

From The Lab



BY BOB NEVES



The Metric Mile

The United States, Burma, and Liberia are the only countries in the world that have not adopted the metric system. So, you ask, what does this have to do with me? Quite a bit, actually. You have heard about the global economy, haven't you? Well, all over the globe (except the above mentioned countries), when products are bought and sold, they do so in metric units. When we purchase foreign products, we are paying for the luxury of having our customary English units represented. There are the odd exceptions, like "metric only" units on alcohol which, by the way, seems an odd early choice for U.S. metrification. It appears to me that if the metric system is easy enough to be understood by an intoxicated individual, the rest of us (when we are sober) should have no problem at all.

Unfortunately, the "If it ain't broke" policy has kept the U.S. in general from diving into the Metric Pond (which of course is measured in liters). Politicians have done some major waffling over the last 200 years (yes 200 years, see our metric history below) about the metric system. While politicians typically believe the metric system is inevitable and beneficial, they don't want to be the ones to tell their constituents that they can't use inches, gallons, pounds, pints, or teaspoons anymore. These politicians have been quietly suggesting the metric system to the U.S. public since the days of Thomas Jefferson, and there has been a slow progression by the population toward metrification (kind of like riding a tricycle cross-country).

I am often asked, what's the big deal with the metric system? How can it benefit me? Have you ever tried to figure out how many teaspoons there are in a gallon? How many inches there are in a

mile? Well, you multiply by sixteen, divide by twelve, add the winning lotto numbers and, poof, you have your conversion. The metric system, by contrast, being a decimal based system, easily goes between units by moving the decimal place: 1 kilometer (km) = 1000 meters (m); 1 meter = 100 centimeters (cm); 1 centimeter = 10 millimeters, etc. Try doing that with inches, feet, yards, and miles!

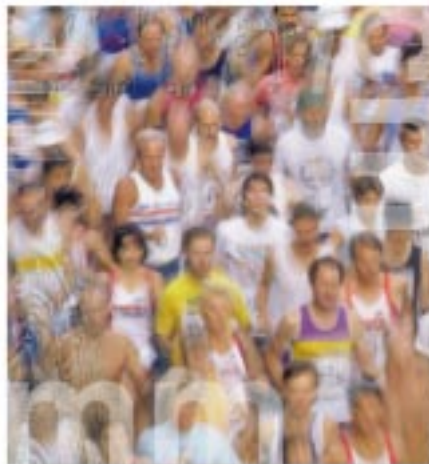
Here are some examples of how the metric system is creeping into our way of life. We buy milk by the gallon, but purchase soft drinks by the liter. Bullets can be bought in inches (.357) or millimeters (9 mm). Medicine is sold by the gram. Pencil lead is sold by the millimeter. The size of car engines used to be given in cubic inches but now is given in liters. Car speedometers now have kilometers per hour on them. Just think, soon those six inches will be fifteen centimeters!

There are some general misconceptions about the metric system that I would like to clear up: You will still have ten fingers and toes with the metric system; The drive to work will still take as long in kilo-

meters; a two-minute abdominal workout will still take two minutes; April will still be the fourth month of the year.

Several industries have moved valiantly ahead with metrication and provide us with those rare instances of commercial metric application. The scientific community has used the metric system for many years, and many high-tech industries like the electronics industry have followed suit. The JEDEC council (the electronics component guys) has stated that all new component outline/pitch descriptions will be given in metric. This means that the components with customary English pitch/spacing (i.e. 0.050 inch) are being phased out in favor of metric pitch/spacing designations. The bottom line here is that OEMs are being forced into buying components in metric, and it won't be long before they begin specifying metric PWBs (another one of their components).

Back in 1984, the IPC decided it should take a stance for our industry in the metric policy arena. A group of wise men was formed, and eventually published IPC-MP-83 in 1985, which was adopted as the IPC's metric policy. This document not only defined basic policy, but went on to give conversion factors and rounding conventions for metric conversions from customary English. Unfortunately, this document has not been widely used for conversions, and should hopefully make a comeback as we rediscover what we did in the early '80s. This policy stated that the IPC should be "metric" by 1990. Well, we all know that date came and went without full metrication, but the IPC has still made progress toward the ultimate goal of "metric only." For the first several years following this policy decision, metric equivalent units were placed in parentheses after



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the customary English units in new or updated documents. In the early 1990s the IPC began switching their documents to make the metric number the primary unit, with the customary English units represented as secondary in parentheses.

In 1997, the IPC's Technical Activities Executive Council (TAEC), of which I am a member, met to discuss the final implementation of the IPC's metric policy. It was decided (after a lot of discussion about parental heritage and wanton bloodshed) that IPC documents would go fully metric in 1998. This meant that all IPC documents, which were revised or published after January 1, 1998, would have no customary English values in them at all. Needless to say, this was a controversial decision, and each committee working on a revision and/or new document was faced with the fact that their document would be a "metric only" document. This rattled our friends in the copper foil committee so much that they scuttled an amendment to improve their document, IPC-MF-150, just so they could keep the English way of measuring things. This was done despite the fact that they sell their products in metric units outside North America.

Other committees decided not to be quite so extreme, but put up a lot of fuss and fighting. IPC-4101 (laminated materials) was one of the first documents to be published "metric only," and a thorough look at the document shows that, although the conversions were not always the best, the document turned out to be quite usable, and should cause little practical grief. Other documents on the "metric only" horizon include IPC-6012A (rigid boards), IPC-6013 (flex boards), IPC-A-600F (PWB Acceptability) and all of the High Density Interconnect (HDI) specifications. There are many others in the "specification pipeline" that will be affected, and I believe that within the next few years almost all of the IPC specifications will be "metric only."

As an industry, we are typically metric illiterate. This is not to say that we are incapable; our industry has a strong history of adaptability and conformity. Unfortunately, we speak of almost everything in "mils," "thousandths," and "inches" (me included). It is going to be quite a change to begin speaking in "micrometers," "millimeters," and "centimeters." How is this all going to work, you ask? Education of what the metric

system is and why it is beneficial is the only answer. The IPC has available a metric poster which shows standard recognizable items (sports gear, office supplies, etc.) along with the appropriate metric association. Other things like this are, or will be, available over the next year or so. The National Institute of Standards Technology (NIST) has several tools (rulers, pictures, etc.) that deal with the metric system and are available to the general public. If you think the electronics industry is going to have problems with the metric system, think of the poor people in the cooking industry, where teaspoons, cups, ounces, pints, and tablespoons abound. Can you imagine "Julia's" cooking show with milliliters and grams?!

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So you think all this metric stuff is new? Here is a brief synopsis of the U.S. government's flirtation with the metric system:

1790—Thomas Jefferson proposed a decimal-based measurement system for the U.S.

1800—U.S. Coast Guard & Geodetic Survey used meter & kilogram standards brought from France for map making.

1866—Congress authorized the use of the metric system (made it legal) and gave each state a set of metric standards.

1875—The U.S., along with sixteen other nations, signs the "Treaty of the Meter," establishing an International Bureau of Metric Standards and Weights.

1893—The metric standard was adopted as the fundamental standard for length and mass in the U.S. Our "customary" units (i.e. foot, pound, quart, etc.) have been defined in relationship to the meter & kilogram ever since.

1960—The "Treaty of the Meter" nations met and approved a modernized version of the metric system called "The International System of Units (SI)."

1964—The National Bureau of Standards (NBS) made the metric (SI) system its "standard."

1965—The British were forced to become metric as a condition of European Community membership (nothing to do with the U.S., but if the Brits can do it . . .).

1968—The U.S. Congress authorized a three-year study of metric in the U.S. The committee recommended a ten-year plan for metrication.

1970—Our Canadian neighbors "go metric" (see my comment on the British in 1965).

1975—Congress passes the "Metric Conversion Act." While not forcing metric conversion (no ten-year plan as recommended), it established the "U.S. Metric Board" to carry out planning, coordination, and public education about the benefits of the metric system.

1979—The Bureau of Alcohol, Tobacco, and Firearms (ATF) mandated that wine producers and importers switch to metric units. They required distilled spirit (hard liquor) producers to do the same in 1980.

1982—Due to the U.S. Metric Board's "apparent ineffectiveness," it was disbanded by President Reagan.

1988—Congress passes the "Omnibus Trade & Competitiveness Act" which designated the metric system as the "preferred" system for commerce in the U.S. It also required all Federal agencies to use the metric system in their procurement and business activities by the end of fiscal year 1992 (as long as it was economically feasible . . . attorneys!).

1991—Presidential Order 12770 (George Bush) "Metric usage in Federal Programs" which further reinforced the "Metric Conversion Act" and "Omnibus Trade & Competitiveness Act."

1994—The "Fair Packaging and Labeling Act" was amended by the FDA to require the use of dual units (inch-pound and metric) on all consumer products.

1995—Congress passed the "Transportation Equity Act for the 21st Century," which provides for metrication of highway signs by September 30, 2000. This act was later amended to strike the date of September 30, 2000, from the act (took out the teeth).

1996—Congress passed "The Savings in Construction Act," which gave certain elements in the construction industry the ability to not use metric in certain instances (a step backwards!).

1998—The IPC mandates "metric only" in its new documents.