

LETTER FROM BRUSSELS



Getting together on units

One thousand delegates agree: Most of the world today is going standard

by John Lambert

The age-old battle to obtain a world-wide standardized system of units of measurement is ever so slowly being won.

The more than 1,000 delegates to a recent international conference here in Belgium spent two days exchanging information on the progress and problems involved in acceptance of SI units. The outlook, with some exceptions, seems to be for a relatively smooth course ahead.

SI (for *système internationale*) is the name given the units that are to be used throughout industry and science to clear the jungle of diverse nomenclature that has obscured understanding ever since people first started measuring things. It takes as a starting point the metric system, which has been used on the Continent for well over a century, and simplifies it by settling on only one unit for each of six basic quantities. All other units are derived from these.

Even for nonmetric countries, SI won't mean a total break with the past; of the six base units, three—the second, the ampere and the candela—are already in universal use. For the metric countries the system needs even less change; they've been using meters and kilograms for a long time now, and the switch to the new system requires little more than tidying up the oddities and confusions which the original metric system had. These were caused by the existence of an absolute system of units, which were too small to be used outside special fields like relativity theory, and a practical system, which was made practical only by sticking in numerical conversion factors to make the units come out right.

Almost all the delegates agreed that the change they had found most difficult to sell to engineers in their own country was in the unit of force. The poundal, the pound-force, the dyne and the kilogram force are all swept away; in their place comes the newton. Mechanical engineers are particularly unhappy about this, but the payoff in simplicity and consistency is so great that all the metric countries have decided to abolish the old units of force within the next 10 years. The United Kingdom is going to move straight from its foot-pound-second system to SI without bothering with the old metric system.

As a Belgian delegate pointed out, electrical engineers long ago discarded the unrationalized system of units, and the British and Irish delegates didn't show much enthusiasm for picking up other people's castoffs.

The savings in time and effort that can be achieved was shown in a series of sample calculations.

A typical one involved determining how much heat energy is given off by the fission of a given amount of material in a nuclear pile.

Everyone knows Einstein's equation, $e = mc^2$: The energy from disintegration of material is equal to the mass converted times the square of the speed of light. But in British units, the speed of light is 186,000 miles per second, which has to be multiplied by 5,280 to get it into feet; and that answer has to be divided by 32.2, the gravitational constant, and divided again by 778 to get a heat measurement in British thermal units.

Somehow $e = \frac{5,280 mc^2}{32.2 \times 778}$ doesn't look right.

In the ordinary metric system the situation isn't much better. Here division by the gravitational constant (9.81 this time) is needed, followed by multiplying by 2.34×10^{-3} to get an answer in kilocalories.

In SI units, one must take the speed of light, 3×10^8 meters per second, square it, multiply by the mass in kilograms and there's the answer in joules. And that really is the answer, because the calorie is no more. After all, heat is a form of energy and there's no particular reason why it should have a particular unit all to itself.

As for the power of the reactor, SI has done away with horsepower and thermal units per hour. Now all measurements of power are in watts and multiples of a watt.

There is still some resistance from those who feel that watts should be restricted to electricity. But chances are that the reactor is used to drive a generator, so it makes sense to have one unit everywhere. The electricity people are responsible for one oddity, though, the kilowatt-hour. The hour is a very nonmetric unit. Holland's Dr. J. R. Tinbergen suggested that they do away with the hour, but it was announced that, by courtesy of the International Weights and Measures Committee, the hour is here to stay.

The United States is moving sluggishly toward adoption of the metric system (SN: 1/25, p. 91); several other countries use part English, part SI. But for most of the world's nations, said a French delegate, "All the big problems have been solved; it's just a question of deciding whether you use a dot or a comma for the decimal point."