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These are fundamental processes which are involved in laser annealing by the pulse (liquid epitaxy) technique, as well as in laser damage of semiconductor devices.

The redistribution of impurities following pulse melting may have a detrimental effect on a device (as in laser damage), or it may produce a parasitic but tolerable effect (as in pulse annealing of solar cells). It should be pointed out, however, that this effect also offers another means of controlling and modifying impurity distributions,[3,4] and thus it enhances the potential versatility of laser processing techniques for semiconductors.

References

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7/14/78

Physicist as engineer

The February issue contained two letters which I found particularly interesting. John Fanchi's letter (page 15) concerning vocations vs. avocations and Robert Johnson's letter (page 15) concerning engineering physics both offer excellent alternatives to unemployment for physicists.

I obtained an MS in physics in 1975 and since that time I have been employed as an engineer. My experience has been that an education in physics offers an excellent background for engineering work. The basic understanding of the laws of nature as well as the training that is obtained in logic are both of primary importance in the engineering field. The state boards of registration accept my educational background as suitable for licensing as an engineer and I am eligible this year to take the professional engineer's exam.

I was able to get a job in engineering as a result of some prior experience in the field and an associate degree in engineering from a community college. I did have some difficulty in convincing prospective employers of my ability to perform as an engineer, even though they all agreed that the basic fundamentals of engineering are all founded in physics.

During the time I have spent in engineering, I have not felt handicapped in the slightest by having degrees in physics as opposed to engineering. In some ways, in fact, I have felt ahead of the game.

Programs, such as that outlined at the University of Virginia by Johnson, offer excellent preparation for physics students entering the job market. It is possible at other institutions for students to elect courses in engineering.

All undergraduate physics students should be constantly aware of the fact that they will be seeking employment at some point and they should prepare for this. Some engineering courses as electives will help make a student more employable. Furthermore, engineering or a related technical field is a much better profession than chronic unemployment.

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2/20/79

English versus metric

As one who has been a practical builder and experimenter all my life, and has been thoughtful about it,[1] I am distressed to see editorials such as that by Harold Davis (February, page 104), which encourages US conversion to the metric system of measurement, without giving any better reasons than that everyone else is doing it, or that people who know about it like it. There has been growing, if unorganized doubt about the practical utility of the metric system. There seem to be four reasons for adopting the metric system:

- The units can be recovered if they are lost because they are based on the circumference of the Earth.
- Metric arithmetic is easy because units are related by integral multiples of ten.
- The European Common Market uses the metric system.
- The English system is messy.

The first reason is weak because other units might be based on the circumference of the Earth, and therefore be recoverable if lost. Other units might be arranged that would share the second advantage mentioned above. The third reason is purely economic and may explain why US industry has been more hospitable to metrication than the general public. But it is not the reason that responsible scientists will want to promote.

Many of my friends, responsible scientists, display some of their most irrational behavior in defending the metric system; and they direct their statements toward the fourth reason in my list, the messiness of English units. Surely the badness of one system is no argument in favor of some other. Further, English units may not be so bad as some critics make them out to be.

The standard foot unit emerged in England as the standard of length from a field of competition which included not only the rod and yard, but also the highly portable cubit, the distance from the elbow to the tip of the outstretched fingers. That the less portable foot would

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have won out over the cubit suggests that the foot had some highly desirable qualities to recommend it. I suggest that these qualities were related to measurements of things that are about human size—measurements which will remain important to humans for the rest of time.

Compare, for example, estimates of human heights in English and metric units: Adult humans can be anywhere from about four to about seven feet in height. When the statement is converted to metric units, the result (about 1.2 to about 2.1 meters) is worse than unfamiliar. The gratuitous use of decimal fractions gives to the estimates an appearance of detailed accuracy that is not present or intended, but is inescapably implicit in the numbers. Feet, in contrast, give a truer reflection of the intent of the estimate; and they give it in terms that require no quick mental arithmetic to understand: small whole numbers.

If we really want to do posterity a service we must develop a system of units that will serve people's needs and make people comfortable. While I have been happy to measure protozoa in microns, machine parts in thousandths of inches, people in feet, and radio waves in meters—if we must have a single unit, let us base it on the unit that really will never change: the nautical mile. For example we might define the new foot as being 1/6,000 part of a nautical mile. Celsius degrees, like meters, should be carefully reconsidered because, like meters, they are too "big" for the values they must measure—mostly temperatures from a little below freezing to a little above human body temperature.

I hope that scientists will not cling to metric units for the same reason that other people cling to English units (familiarity), but that members of the AIP will favor what responsible scientists ought to favor: A gathering of all relevant information, public discussion of issues, anticipation of problems; and recommendations based on specific and exhaustive reasoning.

Reference

1. William L. Abler, *Shop Tactics*, Running Press, Philadelphia (1976).

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Our editorial pointed out that the entire world, not just the Common Market, is going metric (with the exception of Brunei, Burma, Liberia and Yemen).

The Editor

Correction

January 1978, page 120—the 8th General Assembly referred to is that of the International Council of Scientific Unions and not the United Nations. □