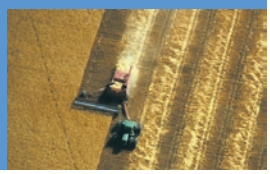


Lyle's Law of Rocketry

Like most young men of my generation, I spent a few years in military service—in my case, the Navy. I came into the Navy just as it was preparing to deploy surface-to-air missiles in the fleet, and I was fortunate to be trained as one of the first guided missilemen, a rating later changed to missile technician. After basic training and some nine months in a technical school, I was sent to the *USS Norton Sound* that was doing the final sea tests of the Terrier missile.

We rarely went far from our home port, but almost every week we would put to sea for a day or two and fire missiles at remotely controlled target aircraft. My duties involved pre-launch testing and loading the missile on the launcher located on the fantail. During the launch, I was able to stand on one of the side decks and watch the flight of the missile. It left the launcher with a tremendous roar as the booster took it from zero to mach 3 in just a minute or so. At the end of the boost phase, the missile and booster separated, and a sustainer rocket ignited to maintain the missile's speed as it went about its business of intercepting the target.

"Everybody needs a booster."

The performance of the Terrier was incredible—we rarely missed. The airframe, the guidance system, the power system, and the sustainer rocket: all were very sophisticated for the time—more than 50 years ago—and they worked beautifully. It has occurred to me, however, that this advanced system could not have done its job had it not been for the work of the booster. This simple but very powerful rocket didn't last long, but it got things up to speed and enabled everything that happened later. Further reflection suggested there is a close parallel of this situation to the human condition, and out of this comes Lyle's Law of Rocketry—***Everybody needs a booster***.

The purpose of a booster rocket is to overcome the inertia of the rocket being boosted and change its state of motion. It does this by converting chemical energy into mechanical energy and transferring that energy to the *boostee*. Some of this will be kinetic energy manifested in increased speed. Some will be potential energy associated with the greater altitude achieved. And some will be dissipated as heat, overcoming the friction that impedes the flight of the rocket. The human booster/*boostee* relation is much the same.

We often speak of human *energy*. Since this isn't energy in the strict physical sense, I prefer to use the term *effort*. But the result is the same; as one person expends some effort to boost another, the *boostee* is pushed to rise to greater heights—i.e., have greater potential—and also move toward a goal with greater speed. A good boost can also help to overcome the friction of the events and circumstances that hold us back. Inertia—not the physics kind, but the human variety—is overcome.

A boost may consist of some real assistance such as helping to solve a problem or providing a bit of cash or shoveling a sidewalk, but it is often no more than an encouraging word to let someone know you think she can succeed. Or, as appropriate, a scolding and an admonition to change some counterproductive practices.

The Law of Rocketry was inspired by a visit to a campus with which I have been associated for the last 25 years or so. Part of that university's mission is to take students who may not be well prepared academically or whose motivation may be weak or whose life expectations are not very high and turn them into college graduates. They don't always succeed, but they succeed more often than they fail—and much of that success is due to the campus boosters. And it seems that everyone there is a booster: the president, the deans, the faculty, the students, and even the alumni. Everyone is encouraging the floundering student. Sometimes it is a pat on the back. Sometimes it is a kick in a lower region. But the boost is always there. It is a community of boosters. Little Canaveral.

Perhaps the Law of Rocketry is a bit sweeping. Perhaps not everyone needs a booster. There may be self-made people who have done everything on their own and have never needed a helping hand or an encouraging word from anyone. If so, I congratulate them. For lesser mortals, however—such as yours truly—an occasional boost is essential.

As with any metaphor, of course, the analogy between the booster rocket and the booster person is not perfect. The rocket emits a horrendous roar—much louder than can be imagined by someone who has never heard one launched—and produces a tremendous push for a short period of time. And it can do it only once. In contrast, human boosters are most effective when their work is quiet and little noticed by casual bystanders. They are also adaptive; they don't need to give a huge boost all the time but can adapt the length and strength of their push to the time and the circumstances. And they aren't single use devices; they can keep giving boost after boost after boost.

Boosting is not the same as mentoring. A mentor helps you know what to do. A booster helps you believe you can do it. I suspect I am not alone when I say that one of my greatest boosters was my mother. Her education was received in a one-room country school during a series of "terms" that fit between seasons of planting and harvest. It ended at what she estimated as about the sixth-grade level. She knew nothing about higher education, but it was her urging and her support that gave me the final impetus to leave that little Iowa town and go to the university.

Perhaps the most important boosting comes from teachers to their students and from managers to the people who report to them. However, this process is complicated because the booster eventually has to sit in judgment over the *boostee*. It is difficult to say "You can do it; you can do it" and then later, hand out a *D* grade or a poor performance review. Nonetheless, it must be done—and done in such a way that lack of success is seen as a temporary condition.

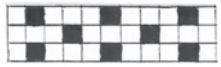
How best to boost? In the end, boosting is an attitude, not a technique. Once you understand that someone else's success does not diminish you, all you need to do is follow your best instincts. Go boost.

—**Lyle D. Feisel,** Ph.D., P.E., *Iowa Alpha '61*

BRAIN TICKLERS

(Continued from page 51.)

5 Fill in the following cross-number puzzle with 13 different three-digit perfect squares. No leading zeros. Read top-to-bottom and left-to-right as in a crossword puzzle.



—**Richard I. Hess,** *CA B '62*

Bonus. If 12 one-ohm resistors are soldered together to form a cube, with each resistor being the edge of the cube, then the equivalent resistance of the network between two corners at the ends of a body diagonal is 5/6 ohm.

It is also possible to solder 32 one-ohm resistors together in the network equivalent of a four-dimensional hypercube. The vertices of a four-dimensional hypercube can be designated using the coordinates (w,x,y,z) where each variable has a value of 0 or 1. Then adjacent vertices are those in which only one variable has a different value; for instance, (0,1,0,1) and (0,1,1,1) are adjacent vertices. One can show that the equivalent resistance of the four-dimensional hypercube between a body diagonal, say (0,0,0,0) and (1,1,1,1), is 2/3 ohm.

Now, consider 192 resistors soldered together to form the network equivalent of a six-dimensional hypercube. What is the equivalent resistance between corners at the ends of a six-dimensional body diagonal?

—**John L. Bradshaw,** *PA A '82*

Computer Bonus. Thirty-six is the smallest number, greater than one, that is both a triangular number and a perfect square. What are the next four numbers that are both triangular and a perfect square? Triangular numbers are numbers of the form n(n + 1)/2, the first few being 1, 3, 6, 10, and 15.

—*The Colossal Book of Mathematics* by Martin Gardner

Postal mail your answers to any or all of the Winter Brain Ticklers to Jim Froula, Tau Beta Pi, P.O. Box 2697, Knoxville, TN 37901-2697, or email to *BrainTicklers@tbp.org* only as plain text. The cutoff date for entries to the Winter column is the appearance of the Spring BENT in late March. The method of solution is not necessary.

We welcome any interesting problems that might be suitable for the column. The Computer Bonus is not graded. Jim will forward your entries to the judges who are **H.G. McIlvried III,** *PA Γ'53;* **F. J. Tydeman,** *CA Δ'73;* **J.L. Bradshaw,** *PA A '82;* and the columnist for this issue, **D. A. Dechman,** *TX A '57.*