Seeds and Weeds

It's sad to realize that there may very well be a need for a seed vault, a facility that stores thousands of different types of plant seeds so that a species can be reestablished if it becomes extinct in its natural environment. Such a vault now exists. Sitting on a remote Arctic island, the frozen contents of the Svalbard Seed Vault wait silently for the revival that we hope isn't needed.

These seeds are stored to ensure diversity, which is a key element of robustness, the ability to withstand changes in the environment. When all farmers plant the same kind of wheat or the same kind of rice, we know intuitively that we're in trouble. Every system has a weakness, and less diversity means more vulnerability.

Robustness is a central theme in control, but the concept is relevant to virtually every branch of engineering. We know that robustness is attained at the expense of performance. Birds can fly far and fast, but tortoises are better protected. It's tempting to think that shells are more robust than feathers, but these superficial characteristics can be misleading. In fact, any performance/robustness tradeoff depends on how we define each trait—and these attributes can be defined in many different ways.

The human species is extremely robust. We're neither extremely fast nor strong, but we eat a vast range of foods, and we can survive in a wide range of habitats. As a species, we are also diverse, and that accounts for much of our robustness. This robustness makes humans, perhaps, the ultimate "weedy" species—species that manage to invade remote corners of the world and threaten local varieties.

Robustness is strengthened not only by diversity but also by the ability to adapt. In fact, adaptation is possibly the ultimate robustness strategy. While the ability to find a good performance/robustness tradeoff is helpful, a more valuable feature is the ability to develop new robustness and performance traits when the old ones become inadequate.

Since the Svalbard Seed Vault cost a paltry US$9 million to build, I propose a second repository to enhance the chances of the seeds' and thus our own survival. Somewhere in Antarctica might be a good location. After all, traditional robustness wisdom warns against putting all of one's eggs in a single vault.

Dennis S. Bernstein

MARIO SANTILLO

Dennis visiting NASA Langley in Hampton, Virginia.

Digital Object Identifier 10.1109/MCS.2008.927953