READING #16

NOTES ON THE STRATEGIC DEFENSE INITIATIVE

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The Strategic Defense Initiative (SDI) or "Star Wars" as it is called in some circles is a controversial program being carried out by the U. S. Department of Defense as one of the primary interests of President Reagan.

As is well known, high levels in the Soviet government have tried hard to dissuade the U. S. from pursuing this program. So far they have been unsuccessful.

There is considerable reason to believe that the Soviets themselves have been pursuing such a program. Recently the former Secretary of Defense commented on the failure of the Soviets to acknowledge this, and indicated that they were hiding their own activities while complaining about those of the U. S.

Across the United States, a sizeable number of scientists have been criticizing the SDI initiative, and many have urged that universities have nothing to do with it. Articles on this general subject have appeared, for example, in the Chronicle of Higher Education, a weekly newspaper that is widely read by educators and educational administrators.

The SDI program is one that can become very emotional, and it is one about which it is hard to maintain a detached posture. Who can object to trying to protect the American people from incoming nuclear warheads? What kind of person would be against this objective? And what would happen if the Soviets got such a system first and we lacked such a system?

Still there are substantial arguments against the continuation of the SDI program, just as there are for continuing it. These arguments can be looked at only in terms of the current and future merit, but they can also be looked at in terms of the last few decades of the relationship between scientists on the one hand and government on the other.

They can also be looked at strictly in terms of the technological problems that are involved. From this perspective, detailed and substantive arguments have been presented in journals that offer careful explanations of why such a system will not work. Unfortunately, those who promote the SDI initiative have never responded substantively to these arguments.

I am writing this article as a handout for a first-year class at George Mason University. This is a class that is being offered in the PAGE program, with a major goal of promoting "computer literacy". Many definitions have been suggested of what this term means. Too often it is interpreted to mean knowing how to write simple computer programs. Of much greater concern is knowing how to assess computers in society, and how to interpret what they can and cannot do effectively.

In computer hardware, the United States has been and remains a world leader. There is every reason to think that we are well ahead of almost every country in the world in this area, and perhaps of every country. The hardware is high in quality and reliability. One of the primary reasons for this is the outstanding research and development work carried out in the first half of this century at the Bell Telephone Laboratories, which developed the transistor, and which provided very substantial scientific contributions to this country and later to the world. Unfortunately, actions within the past two decades aimed at increasing competition in the communications industry have allowed many competitors to get into this business, and most of them have no record of making any contributions to scientific knowledge. We can only hope that the few large firms now active in the computer industry in the U. S. can find the means to develop the continuing flow of scientific and technological knowledge that for so many years came from the Bell Telephone Laboratories, and which was so freely shared with others.

In computer software, the United States has a history of wasting mammoth amounts of public funds in software development, and nothing that has happened lately is likely to change this. In contrast to the situation in hardware described above, we lack a fundamental science of conceptualization, and our software is being developed by and large by people who do not know underlying science. Moreover, because of the way in which the computer field developed, there was no time to develop a science of software. The pressure for one new product after another caused companies to put their resources into keeping the product line out in front, and to marketing. The kind of controlled monopoly that allowed American Telephone and Telegraph Company to put one cent out of every dollar of revenue into basic research is not present in the computer industry.

The situation in software is in sharp contrast with the situation in other fields. I remember distinctly, for example, the situation in the first half of the 1950's when the issue of whether the U. S. should develop an intercontinental ballistic missile arose. A committee headed by Dr. John von Neumann was appointed to review this question, and made the recommendation to go ahead. Dr. von Neumann was a famous scientist, who already had a very distinguished track record. He was headquartered at the Institute for Advanced Study at Princeton, New Jersey, where he had been a colleague of Albert Einstein and other noted scientists.

At that time and subsequently, scientists played major roles in making decisions about large programs. There were people involved in what was called PSAC, the President's Science Advisory Council, and there was a Science Adviser to the President. These typically were people whose names were well known to engineers and scientists, and who were trusted to make sound recommendations.

Regrettably the influence of scientists has waned substantially. Now the PSAC is silent, and the Science Adviser to the President is often someone who has no significant record in research and innovation, but rather is someone who is content or at least appears content to stay behind the scenes in Washington and, presumably, help fend off scientific criticism of what appear to many to be unwise programs.

With this background, let us mention the criticisms that have been made of the SDI program.

(1) The proposed system is not technically feasible.

(2) The program is a major threat to U. S. economic security.

(3) The program drains away valuable and limited talent from civilian research programs, which might otherwise be deployed to expand our commercial activity here and abroad to compete with growing capabilities offshore.

(4) The program is not managed by scientists or engineers who have proven themselves by performance, and the people who are managing it do not understand the underlying science, and do not know how to manage it.

(5) Many of the technologies that are promoted as components of this system are not even adequately defined, nevertheless they are being promoted as though they were already sufficiently successful to encourage extrapolation.

(6) Because of the battle scenarios envisaged, and the complexity of the SDI system as now conceived, there will not be time for human beings to be involved in the decision to fire, so the decision will have to be turned over to the machines--and that means to the software.

(7) Since the system cannot repel all of the invading missiles, some of the system will be blown up in the early attack phases. And since the system is dispersed with interdependent parts, what is left will somehow have to be able to operate even with some of the original parts missing. But there is no system anywhere near the size and complexity of SDI that ever came even close to doing that.

(8) Even small commercial software does not come with a warranty. The SDI software will be several orders of magnitude larger than that which now does not come with a warranty. The implications of this are that the system will not work.

(9) Present lines of research on software development are not going to solve or come anywhere near solving the problem of getting large software systems to work reliability, even in benign environments.

(10) The majority of the American public are not being told the truth about this system by the government, who believe that it is moral to withhold this and go on spending huge sums that might better be used to reduce the budget deficit and trade deficit.

(11) There is a long history of massive waste in defense system contracting, leading to systems that do not work, and paying for things whose scientific merit could have been recognized initially as negligible. The past record does not support the present claims.

Other complaints have been registered, but the foregoing are representative of the main complaints.

We may note here that many of the complaints have to do with the "system". In light of this, one might suppose that a responsible government would try to identify the top system thinkers who might be available, and would ask them to give an appraisal, or even take part in looking at the design ideas.

This has not happened, partly because the government does not know who they are. One should not think that the government is alone in not knowing about things. Professor Chris Argyris of Harvard University has been studying large organizations for many years. He has published several books explaining why large organizations do such stupid things. Other social scientists have documented "groupthink" and other behavioral characteristics of large organizations that explain why they behave as they do.

Even the government itself, through U. S. Air Force sponsorship at the Rand Corporation over two decades ago, helped pay for a book called INSIDE BUREAUCRACY written by Anthony Downs. This book explained bureaucratic behavior in great detail, and anyone who reads it will be able to see clearly why massive waste can go on in government.

Are there any bright spots in this situation?

First of all, we may take considerable comfort in the idea that the Soviet bureaucracy has the same kinds of inherent limitations as our own. That is why the behaviors of the two governments have been so similar. Our Viet Nam is their Afghanistan, and vice versa. Moreover, their bureaucracy has been all-inclusive. There is no private sector to take initiatives. That is why we have been able to stay ahead of them in so many areas, in spite of the fact that they have very capable scientists. In the absence of initiatives and incentives to apply the science, the Soviets could not compete in international markets.

Any solace we take from this must be tempered by the realization that there is an awakening going on in the Soviet Union and in China, at the same time as competition is growing elsewhere.

Secondly, there is a long history of situations where people predict that something cannot happen, only to find later that it could. Those who defend the SDI can use this as an argument.

One of the people most familiar to American engineers, Lord Kelvin, who made a remark that has been quoted to most engineering graduates in the twentieth century to the effect that if you can't express it in numbers you don't really understand it, also expressed publicly the view that airplanes would not work, and x-rays would prove to be a hoax.

Thirdly, there is no question that some valuable technological development will come out of the SDI initiative. While this argument will be used to defend the program, this argument, though true, is relatively uninteresting. The better way to put the issue is, what is the best way for the federal government to stimulate creative initiatives and to develop good science? If this is the question that is asked, the answer does not come out "to develop SDI". What the government needs most is a much more creative management technology, and development of SDI is much more likely to produce packaged product improvements than it is to produce improved management.
