

prevailed, and to the attenuation of many of the basic incentives for private investment.

The consequences could be disastrous if these trends were to continue much longer. Already, our lead in many fields has diminished perceptibly and in other fields is gone altogether. This comes at a time when the Soviet Union understands very well the significance of science and technology for the future and has mounted an unprecedented national effort which is still growing steadily. They understand the power of technology in altering the strategic balance, both militarily and economically; and...particularly...the power of possible revolutionary developments now, a number of which will involve the subject matter of this conference. There is also the possibility of technological surprise, particularly by societies which, unlike us, operate largely in secret.

In order to reverse these disturbing trends it is necessary to set in motion a national commitment to retain our leadership over the long haul. This will require a long range investment program. The program should have a planned and real growth, but, above all, it needs continuity. It cannot build and sustain needed momentum if it turned on and off on an annual basis and if we chop R and D programs up in the name of improved management too often....

All DoD-sponsored research in universities is in the technology base as well as most DoD sponsored work in pulsed power. In Fiscal Year 1977, the technology base amounts to roughly \$1.8 billion out of a total program of \$10.6 billion. Prior to this, it had eroded in real value by about 50 per cent over the last decade because of inflation. Two years ago we initiated a policy of 10 per cent annual growth in research above inflation and, similarly, an annual real growth of 5 per cent for exploratory development...

Of course, increased funding alone is not enough...We must have excellent people to make it worthwhile...

I will be presenting to Congress shortly the outline of a plan for accomplishing this objective. I have discussed the proposed program with the President's Science and Technology Advisor and it has his full support. Although it would be premature to discuss the details, I can say that the plan will involve block funding of universities for multi-year periods for the support of research in broad areas of interest to DoD. It will emphasize support for young post-doctoral students and faculty and will be centered around the leadership of outstanding individuals.

Pulsed Power Comments

Now let me comment briefly on several aspects of pulsed power, the subject of this symposium.

Certainly one major and demanding area of application for pulsed power is the field of high energy lasers (HELs).

Over the past decade, the development of high energy lasers has been actively pursued within the DoD. This is an example of a new area of R and D which is potentially high payoff, but is also high risk. The DoD is trying to find out if HELs will be useful weapons. The results are still unclear. We have structured our programs to be prepared to assess the weapons potentials by the end of this decade.

However, the DoD push into HEL technology is already having useful spinoffs. High power pulsed laser concepts developed by DoD have led ERDA to explore intensively the possibilities for laser fusion. Many of the isotope separation schemes now being explored in this country sprung from researchers pushing the frontiers of HEL technology. On a more applied level, industry has attempted to utilize HELs in manufacturing processes such as welding, cutting and heat treating. Progress in this area has been slower than anticipated by laser enthusiasts — of which I am one — but I have faith that it will come.

If I may, I'd like to indulge in a little speculation involving another possible application of lasers to energy research. High energy carbon monoxide lasers have demonstrated that they can convert pulsed electricity into laser light with very high efficiency — up to about 70 per cent. We have also shown that, at least at low power, laser light can be converted efficiently into electricity. The conversion of electricity into laser energy and vice versa can be made conceptually close to 100 per cent efficient. There is no limiting Carnot efficiency associated with this process. If we could find an attractive, efficient way to convert large amounts of laser energy into electricity, we could develop a new way to transmit energy over long distances. This may be very important in space, for either interspace energy transmission or space to ground transmission of energy.

Let me touch on another area of interest to both the DoD and the pulsed power community. That is the laboratory simulation of radiation from a nuclear detonation...In 1961 members of a Defense advisory group made the prognosis that the output and energy storage of then available pulsed power sources could be increased by at most a factor of ten by technology advancements over a ten year period. But during the course of the next decade, energy stores were increased by *three* orders of magnitude and radiation outputs over large volumes were increased about 10 million times over.

...It is not clear that it is possible to keep on enlarging pulsed power simulators much longer...Most of our problems are at and near the front end of our machines where the final energy convergence and conversion takes place. It is here where we have to discover different methods of energy convergence, extraction, conversion, or perhaps even multiplication in order to markedly increase our efficiencies....

Rumsfeld, Clements, And Currie Receive Laurels From Aviation Week Magazine

Dec. 15 — In its Dec. 13 editorial, *Aviation Week and Space Technology* magazine presented "Laurels For 1976" to individuals which *Aviation Week* "thinks made significant contributions to the aerospace world during 1976." Noteworthy recipients were "Donald Rumsfeld, Secretary of Defense; William P. Clements, Jr., Deputy Secretary of Defense; and Dr. Malcolm R. Currie, Director of Defense Research and Engineering, for providing the Pentagon with the strongest and most perceptive civilian leadership of this nation's defense program in recent years."