

Technology Policy

+Introduction

- +Since my colleague Roland Schmitt has assured me that
 - +“Technology policy has now come out of the closet”
 - +and can be spoken about freely, I intend to do so
 - +with the candor of a midwestern engineer.
- +However, let me put my colleagues on the National Science Board
 - +at ease and note that this afternoon I will most assuredly NOT
 - +be wearing my hat as chair of the Board...
- +But rather I will talk from my perspective as president of
 - +the University of Michigan, located square in
 - +the heart of the Rust Belt, where we have been
 - +experiencing first hand the trauma of a transition from
 - +an industrial, domestic economy to what Erich Bloch has called
 - +“a global economy in an age of knowledge.”
- +Indeed, I speak to you today in the wake of the recent news
 - +that General Motors has just announced the elimination
 - +of another 9,000 jobs in our state...including the closing
 - +...right in the backyard of my University...
 - +of perhaps the greatest symbol of American industrial might
 - +the Willow Run assembly plant that a half-century ago
 - +helped win World War II by producing Liberator bombers...
 - +yet today has lost the capacity to compete effectively
 - +in the production of Chevrolets...
- +While people generally look at the midwest as a relic
 - +of America's industrial past, let me suggest that in
 - +many ways, it can also be viewed as America's
 - +future.
- +For it is in the industrial midwest...in Michigan...
 - +that we are being forced to learn through the school of hard knocks,
 - +to fight and scratch our way back
 - +from the economic brink to achieve prosperity
 - +in the brave, new world of the global marketplace.
- +Thus I believe I can speak with personal feeling and experience
 - +as one who is fighting on the front lines to restore our
 - +nation's industrial strength.
- +The Need for a National Technology Policy
 - +And it is from this perspective that I have become
 - +absolutely convinced that without a more coordinated
 - +federal effort in the development and application of
 - +technology, one-by-one our nation's industries
 - +will suffer the same tragic fate that has faced
 - +industries in Michigan.
- +Fortunately, many others have reached the same conclusion.
- +Indeed, the White House, through the strong efforts of
 - +Allan Bromley and his colleagues, has taken the first
 - +important steps toward developing a national
 - +technology policy appropriate for the 1990s.
- +Hence, I don't believe I have to dwell long on the many reasons
 - +for such actions, e.g.,
 - +...the degree to which other nations are passing us by
 - +in investments in civilian R&D...in both relative
 - +and perhaps even absolute terms, as suggested
 - +by the most recent NSF Science Indicators data
 - +...the manner in which our scattered and uncoordinated
 - +national efforts are wasting important assets such as
 - +our research universities, national laboratories,
 - +and industrial laboratories
 - +...the need to develop critical generic technologies such as
 - +...advanced materials
 - +...biotechnology

- +...information technology
- +...and manufacturing and process technologies
- +...the ability to use such a policy to bring national attention
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- +Of course, adopting such a policy for strategic national
 - +investments in technology is nothing new for America.
 - +We have done so before when faced with national challenges
 - +...in the development of modern agriculture in the early 20th Century
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 - +...in biomedical sciences and health care
 - +...in our space program
- +Indeed, I suggest the real question is why it took us so long
 - +to wake up to the needs to embark on a similar course
 - +to address the dominant challenge before
 - +America in the 1990s...our industrial competitiveness.
- +Hence, I will assume that the case for a national technology policy is obvious,
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- +on a sound foundation of research universities
 - +as vital partners in collaboration with government and
 - +the private sector.
- +The Role of the American University
 - +But, of course, turning to the university to address issues
 - +of national need is nothing new for America.
 - +Indeed, perhaps the most unique theme of higher education
 - +in America is that of service...
 - +For the bonds between the university and society are
 - +particularly strong in this country...
 - +Historically our public institutions have been responsible to, shaped by,
 - +and drawn their agendas from the communities that founded them...
 - +In fact, this unique partnership goes back over two centuries,
 - +to the Northwest Ordinance which stated that
 - + "Religion, morality, and knowledge being necessary to good
 - + government and the happiness of mankind, schools and the means
 - + of education shall forever be encouraged."
 - + and laid the foundation for one of America's most wonderful
 - + social inventions...the great land grant universities.
 - +Because they added a commitment to public service
 - +
 - +they created a continuing connection between theory and practice
 - +between public universities and the people they serve.
 - +The result was a powerfully creative engine for progress
 - +uniting students and faculty in a collective discovery
 - +and transfer of useful knowledge and technology.
 - +The American university through oncampus research
 - +and offcampus extension activities was key to
 - +first the agricultural development of America
 - +and then its transition to the industrial age.
 - +WWII provided the incentive for even greater cooperation
 - +as the universities became important partners
 - +in the war effort, achieving scientific breakthroughs
 - +such as nuclear fission and radar.
 - +In this period our university research became "mission oriented"
 - +and we learned valuable lessons

- +in how to develop and transfer technology strategically
- +how to work as full partners with government and industry.
- +The importance of this role was recognized in the post-war years
 - +through the seminal report by Vannevar Bush,
 - +“Science, the Endless Frontier”, which in a sense paraphrased the
 - +Northwest Ordinance partnership by noting:
 - +“Since health, well-being, and security are proper concerns
 - +of government, scientific progress is, and must be,
 - +of vital interest to government.”
- +The resulting partnership between the federal government
 - +and the nation’s universities has had extraordinary impact,
 - +...It has made America the world leading source
 - +of fundamental scientific knowledge.
 - +...And it has also produced the well-trained scientists
 - +and engineers capable of applying this new knowledge.
- +Further, this academic research enterprise has played a
 - +critical role in the conduct of more applied, mission-focused
 - +research in a host of areas including health care,
 - +agriculture, national defense, and economic development.
- +Yet as important as these institutions are today in
 - +our everyday lives, it seems increasingly clear that
 - +in the future they will play an even more critical role
 - +as they become the key player in providing the
 - +knowledge resources...knowledge itself, and the
 - +educated citizens capable of applying it wisely...
 - +necessary for our prosperity, security, and
 - +social well-being.
- +As Erich Bloch himself once put it in Congressional testimony:
 - +“The solution of virtually all the problems with
 - +which government is concerned: health,
 - +education, environment, energy, urban development,
 - +international relationships, space, economic
 - +competitiveness, and defense and national security,
 - +all depend on creating new knowledge---and hence
 - +upon the health of America’s research universities”.
- +But here we have both some good news and some bad news.
 - +First the good news...
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 - +The good news here is that America’s system of higher education
 - +is still widely acknowledged to be the strongest and most productive in the world.
 - +A few weeks ago a New York Times editorial
 - +called our nation’s research universities
 - +the “jewel in the crown” of our national economy.
 - +It went on to assert that university research
 - +“is the best investment taxpayers can ever make
 - +in America’s future”.
 - +This was an especially welcome, if all too rare, acknowledgement
 - +since all too often the university today is under attack
 - +from all sides.
- +The Bad News
 - +And that brings me to the bad news...
 - +If the good news is that our universities
 - +are the strongest in the world
 - +the bad news is that the 1990’s
 - +stand a good chance of being
 - +the worst for higher education since the 1930’s.
 - +There is a frightening sense of crisis at many
 - +of our nation’s most distinguished campuses.
 - +To discuss national technology policy realistically
 - +I believe it is imperative that we first understand
 - +that our universities---a vital partner in any national strategy

- +to improve competitiveness and productivity---
- +are at serious risk on a number of fronts.
- +The signs of stress are everywhere...
- +1. The breakdown of mutual trust leading to
 - +increasingly adversarial relationships between
 - +universities and government, including
 - +Congress, the administration, and federal agencies,
 - +as manifested in recent skirmishes over matters
 - +such as indirect cost reimbursement, scientific misconduct,
 - +and pressures to restrict the flow of technical information...
- +2. The degree to which the skepticism--indeed, hostility--
 - +exhibited by the media and government bodies
 - +has badly eroded public trust and confidence in the university,
 - +as evidenced by the recent deluge of attacks on the academy
 - +...who suggest that
 - +“Most scholarly activity is either the sterile product
 - +of requirements imposed by Philistine administrators
 - +or a form of private pleasure that selfish professors
 - +enjoy at the expense of their students.”
- +3. Forces upon and within the universities which are
 - +pushing toward a rebalancing of missions--
 - +away from research and more toward teaching
 - +and public service...not the least of which are
 - +the rapidly escalating costs of conducting cutting-edge
 - +research.
- +4. The deteriorating morale of academic researchers
 - +driven by the pressures and time-consuming nature of
 - +the need to obtain and manage sponsored research
 - +funding and the disintegration of a "scholarly community"
 - +within the university. Indeed, in a recent NSF workshop,
 - +a young faculty member described the modern university
 - +as “a holding company for research entrepreneurs”...
- +What is going on here?
 - +i) To some degree, we may be seeing evidence of the
 - +increasing estrangement of the American public...
 - +and their elected representatives...from science itself.
 - +The gap between the omnipresent influence of science on
 - +modern society and the scientific literacy of the
 - +body politic widens, the fear of science may be
 - +driving much of this hostility as a way to “control” it,
 - +to keep it in its place.
 - +ii) So too, we may be experiencing the same forces
 - +of populism that rise from time to time to challenge
 - +many other aspects of our society, a widespread
 - +distrust of expertise, excellence, and privilege.
 - +And unfortunately, many scientists...and
 - +universities...have made themselves easy targets
 - +by their arrogance and elitism.
 - +But something else may be happening...
 - +Let me comment on several aspects of the current strains
 - +on the academic research enterprise which may prove
 - +of critical importance to their participation
 - +in a national technology policy.
- +Strains on the Academic Research Enterprise
 - +The Political-Economic Crisis
 - +The most immediate stress is coming from the effects
 - +of a deep and profound political-economic crisis.
 - +For one thing, of course, universities are feeling the effects
 - +of the current recession both nationally and regionally.
 - +But current fiscal woes are not just temporary set-backs
 - +they go much deeper

- +Universities are suffering the consequences
 - +of the structural flaws of national and state economies
 - +--growing imbalance between revenues and expenditures --
 - +that are undermining support for essential institutions
 - +as government struggle to meet short term demands
 - +at the expense of long term needs
 - +...because the electorate has adopted a new credo:
 - +“ Eat dessert first. Life is uncertain.
 - +....and by the way, just sent the bill to the kids later
 - +--say in a decade or two.
- +Education at all levels is feeling the effects of two decades
 - +of political failure to invest in our people and infrastructure
 - +--in our children’s future.
- +The states are in trouble. For the first time in thirty years,
 - +state support for higher education is dropping.
 - +In fact, I suspect there are few areas of the country in
 - +which state support for public higher education will be
 - +even able to keep pace with inflation during the 1990s...
 - +despite the fact that enrollment pressures
 - +are now building rapidly as we bounce back from the
 - +post-war baby boom and bust cycles.
- +Cuts in federally supported financial aid has shattered.
 - +the dream of equal educational access for many students
 - +leaving higher education to scramble to try to make up the difference
 - +while they also are forced to increase tuition
 - +to make up for massive losses in other revenue.
- +So, too, the federal government has embarked upon
 - +a massive effort to shift more of the costs
 - +of federally sponsored research to the universities
 - +through limits on overhead reimbursement rates
 - +even though these rates are less than one-half to one-third
 - +those characterizing other federal contractors
 - +in the public and private sectors.
- +Hence, both public and private institutions are facing
 - +very serious financial difficulties today...
 - +...while you read in the national press about the staggering
 - +budget deficits faced by relatively affluent institutions
 - +like Harvard, Yale, and the University of California,
 - +...let me caution you that the situation is far more serious
 - +in those institutions who do not benefit from
 - +massive endowments or generous state support.
- +Clearly, these financial pressures will impose very real limits
 - +on the universities capacity to participate in
 - +a national technology policy without significant additional
 - +public and private support.
- +The Inability to Comprehend the Modern University**
 - +There is another dilemma here...one perhaps best
 - +illustrated by the old parable of the blind men feeling
 - +different parts of an elephant, and arguing over just
 - +what the beast looks like...
- +The modern research university is complex and multidimensional.
- +People perceive us in vastly different ways,
 - +depending on their vantage point, their
 - +needs, and their expectations...
 - +Students and parents want high quality,
 - +but low cost, education.
 - +Business and industry seek high
 - +quality products...graduates,
 - +research, and services.
 - +Patients of our hospitals seek
 - +high quality and compassionate care

- +Federal, state, and local government
 - +have complex and varied demands
 - +that both sustain and
 - +constrain us...
- +And the public itself sometimes seems
 - +to have a love-hate relationship
 - +with higher education...
 - +they take pride in our quality,
 - +revel in our athletic accomplishments,
 - +but they also harbor deep
 - +suspicions about our costs, our
 - +integrity, and, even our intellectual
 - +aspirations and commitments.
- +Beyond the classic triad of teaching, research, and service,
 - +society has assigned to the University over the past
 - +several decades an array of other roles:
 - +...improving health care
 - +...national security
 - +...social mobility.
 - +
 - +...big time show biz (intercollegiate athletics).
- +Further, it is now asking to us to assume additional roles such as:
 - +...revitalizing K-12 education.
 - +...improving race relations in America.
 - +...rebuilding our cities.
 - +...securing economic competitiveness.
- +Unfortunately, most folks--and most agencies of
 - +the federal government--can picture the university
 - + "elephant" only in terms of the part they can feel
 - +--for research procurement, student financial aid,
 - +and political correctness.
- +Few in Washington seem to see, understand, or appreciate
 - +the whole enchalada of the university.
- +And no one seems to understand or care that shifting
 - +federal priorities, policies, or support aimed at one objective
 - +or area will inevitably have an impact on other roles
 - +of the university. For example, it is clear that
 - +excessive cost-sharing requirements or inadequate
 - +reimbursement of research overhead costs will
 - +inevitably cause fund shifting from other functions
 - +of the university such as education or public service.
- +Manpower Issues**
 - +Research is an intensely people-dependent activity.
 - +No matter how much funding we have, no matter
 - +how fine our facilities, no matter how effective
 - +our organizations, if we do not have great people
 - +going into these fields, we will not have great research.
 - +For the past decade the National Science Board has been
 - +attempting to assess scientific and technical manpower
 - +needs of our nation. It is our belief that we will indeed
 - +face serious shortages at both the B.S. and Ph.D. levels.
 - +In fact, most universities can tell you that the manpower crisis
 - +is already upon us in many fields--although people in Washington
 - +continue to argue around the fringes, e.g., debating "shortfalls"
 - +versus "shortages," questioning the assumptions
 - +in various manpower projections, while the universities
 - +in corporate America suffer and the clouds continue
 - +to build on the horizon.
 - +Sure, we may get a temporary respite from the shift
 - +of scientists and engineers from the defense effort
 - +into civilian R&D...but this will be short-lived.

- +But I would argue that the US may indeed experience
 - +such a shortage, and must begin immediately to design
 - +and implement policies that will mitigate its effects
 - +because of the following trends
 - +i) declining number of college-age citizens
 - +ii) declining fraction of students majoring in S&E
 - +iii) no growth in number of citizens obtaining doctoral degrees in S&E
 - +iv) surge of faculty retirements in 1990s
 - +v) a probable growth of industrial jobs requiring the PhD
 - +vi) the appalling failure of K-12 science education
- +Beyond the question of numbers is the question of quality;
 - +we have to face the fact that our best talent--our smartest students
 - +--are simply not attracted to research or academic careers these days.
 - +Instead, they are attracted to careers in law, business, politics
 - +--to wealth, power, and fame--and not to intellectual excitement.
- +As I suggested earlier, it just isn't as much fun to be a faculty member
 - +these days, and our students sense this.
 - +Clearly the faculty of today feel stressed out, overloaded from
 - +the rigors of grantsmanship, paperwork, committee assignments,
 - +review panels, oversight strains--with precious little time left over
 - +for teaching and research, much less thinking.
- +We need to address these manpower challenges
 - +or we can forget about the rest of the agenda.
- +Paradigm Shifts**
 - +Let me suggest that beyond the financial pressures,
 - +and manpower concerns, and the difficulties in
 - +comprehending and balancing the many missions
 - +of the university, there is yet another important theme
 - +that we must consider, and that that is change itself...
- +Today we find ourselves in the midst of two
 - +simultaneous paradigm shifts...
 - +i) in the nature of the government-university
 - +research partnership
 - +ii) and in the character of the university itself.
- +These shifts are driven by the extraordinary nature and
 - +pace of change in the world today.
- +Let me consider each, in turn...
- +The Transition from Partnership to Procurement
 - +The basic structure of the academic research enterprise
 - +of the past half century was set out in the
 - +seminal study chaired by Vannevar Bush
 - +shortly after the end of WWII:
 - +“Science, the Endless Frontier”.
- +The central theme of the document was that the nation's
 - +health, economy, and military security constantly
 - +required the deployment of new scientific knowledge;
 - +that the federal government was obligated to ensure basic
 - +scientific progress and the production of trained personnel
 - +in the national interest.
- +It insisted upon the principle of federal patronage for
 - +the advancement of knowledge. It stressed a corollary
 - +principle--that the government had to preserve
 - +“freedom of inquiry”, to recognize that scientific
 - +progress results from the “free play of free intellects,
 - +working on subjects of their own choice, in the manner
 - +dictated by their curiosity for explanation of the
 - +unknown”.
- +Since--at least in the past--the government recognized that
 - +it did not have the capacity to manage effectively either
 - +the research itself or the universities, the relationship
 - +was essentially a partnership, in which the government

- +provided relatively unrestricted grants to support a
- +part of the research on campus, with the hope that
- +“wonderful things would happen” ...and they did.
- +Unfortunately, in recent years the basic principles of
- +this extraordinarily productive research partnership
- +have begun to unravel.
- +So much so that today this relationship is rapidly changing
- +from a partnership to a procurement process.
- +That is, the government is increasingly shifting from
- +being a partner with the university...a patron of basic research
- +to becoming a procurer of research, just like other
- +goods and services; while the university is
- +shifting to the status of a contractor, similar to that of
- +other government contractors in the private sector.
- +In a sense, today a grant has become increasingly viewed as a contract,
- +subject to all of the regulation, oversight, and accountability
- +of other federal contracts.
- +This view has unleashed on the research university
- +an army of government staff, accountants, and lawyers
- +all claiming as their mission that of making certain that
- +the university meets every detail of its
- +agreement with the government.
- +To be sure, we must all be concerned
- +about the proper expenditure of public funds.
- +But we also must be concerned about restoring the
- +mutual trust and confidence of partnership
- +and move away from the adversarial contractor/procurer
- +relationship that we find today.
- +But even this may be a transitional stage,
- +since in recent months there have been signs that
- +the paradigm is continuing to shift still further
- +to the same cost-control--or more correctly,
- +federal cost-shifting--patterns characterizing
- +health care. Gad, can you imagine a system of
- +DRG cost-reimbursement rules for basic research?
- +Surely the most ominous warning signs for academic research
- +is the erosion, even breakdown, in the extraordinarily productive
- +fifty-year partnership uniting government and universities.
- +Scientists and universities are wondering if they can depend
- +on the stable and solid relationship they had come to trust
- +and that has paid such enormous dividends
- +in initiative, innovation and creativity.
- +Truly perverse that the relationship that
- +has been in large measure responsible
- +for our long undisputed technological superiority
- +should be threatened at very moment
- +when it has become most critical for our future.
- +The Changing Paradigm of the Research University
- +But there is an even more profound transformation occurring:
- +that involving the paradigm of the research university itself.
- +The triad mission of the university as we know it today
- +--teaching, research, and service--was shaped
- +by the needs of an America of the past.
- +Today our nation and our world are changing at an
- +ever-accelerating pace. Hence, it seems appropriate
- +to question whether our present concept of
- +the research university, developed largely
- +to serve a homogeneous, domestic, industrial society
- +of the twentieth century, must also evolve rapidly
- +if we are to serve the highly pluralistic,
- +knowledge-intensive world nation that will be

- +the United States of the twenty-first century.
- +Given the pace and magnitude of change today,
 - +perhaps the decade ahead is
 - +a time for "reinventing" the American university.
- +But will a gradual evolution of our traditional paradigm be sufficient?
 - +Or will the challenges ahead force a more dramatic,
 - +indeed revolutionary, shift in the paradigm of
 - +the contemporary research university?
- +I'm not sure how rapid these changes will occur,
 - +but I can tell you that much of the energy on our campuses
 - +today is really part of a process to discover the nature
 - +of the University of the 21st Century...an institution
 - +that will almost certainly be as different from what we
 - +know today as the modern research university is from
 - +that of the 19th Century...
- +A World Transformed
 - +Of course these paradigm shifts are being driven
 - +by the extraordinary pace of change in our society...
- +We are living in the most extraordinary of times
 - +...the collapse of communism
 - +...the end of the cold war
 - +...the impact of technologies ranging from
 - +computers and telecommunication to
 - +biotechnology
 - +...a redefinition of the world economic order
 - +...and, of course, mankind pushing against
 - +the very limits of the planet
- +Indeed, many believe that we are going through a
 - +period of change in our civilization just as profound
 - +as that which occurred in earlier times such
 - +as the Renaissance or the Industrial Revolution
 - +...except that while these earlier transformations
 - +took centuries to occur...
 - +the transformations characterizing our times will
 - +occur in a decade or less!
- +I used to portray the 1990s as the countdown toward
 - +a new millenium, as we find ourselves swept toward
 - +a new century by these incredible
 - +forces of change.
- +But the events of the past year suggest that the
 - +21st Century is already upon us...a decade early.
- +But are we ready for it?
 - +Are we prepared to face a world whose economy,
 - +culture, polity, is driven by the explosion of
 - +knowledge itself?
- +Is It Time to Break the Mold?
 - +This time of great change, of shifting paradigms,
 - +provide the context in which we must consider
 - +the changing nature of the academic research
 - +enterprise itself.
- +We must take great care not to simply extrapolate
 - +the past, and instead examine the full range
 - +of possibilities of the future.
- +But here we face a particular dilemma:
 - +Both the pace and nature of the changes occurring
 - +in our world today have become so rapid and so profound
 - +that our present social structures--in government, education,
 - +the private sector--are having increasing difficulty in even sensing
 - +the changes (although they certainly feel their consequences),
 - +much less understanding them sufficiently to allow institutions
 - +to respond and adapt.

- +Let me go further. I worry that our present institutions,
 - +such as universities and government agencies, which have
 - +been the traditional structures for intellectual pursuits such
 - +as research, may turn out to be as obsolete and irrelevant
 - +to our future as the American corporation of the 1950s.
- +I believe we need to explore new social structures capable
 - +of sensing and understanding change, and capable
 - +as well of engaging in the strategic processes necessary
 - +to adapt or control change.
- +An Example
 - +Let me give you an example of what I mean...
 - +Since the business of the academic research enterprise
 - +is knowledge, let me suggest that the impact of
 - +the extraordinary advances in information technology
 - +could have--likely will have--profound implications.
 - +Technologies such as computers, networks, HDTV,
 - +ubiquitous computing, knowbots, and other
 - +technologies may well invalidate most of the
 - +current assumptions in thinking about the future
 - +nature of the research enterprise.
 - +Will the "university of 21st Century" be localized
 - +in space and time, or will it be a "meta-structure"
 - +involving people throughout their lives, wherever
 - +they may be on this planet--or beyond?
 - +Is the concept of the specialist really necessary
 - +--or even relevant--in a future in which the most interesting
 - +and significant problems will require "big think" rather
 - +than "small think," where intelligent software agents
 - +can roam far and wide through robust networks
 - +containing the knowledge of the world and instantly
 - +and effortlessly extract whatever a person wishes to know.
 - +Will lifestyles in the academy (and elsewhere) become
 - +increasingly nomadic, with people living and traveling
 - +where they wish, taking their work and
 - +their social relationships with them?
 - +In the spirit of these questions, perhaps we should pay far more attention
 - +to evolving new structures such as "collaboratories" rather
 - +than old-fashioned structures such as research universities,
 - +federal research laboratories, research projects, centers, and institutes.
 - +There is a possible implication here. If information technology will indeed
 - +allow--perhaps even require--new paradigms for research organizations,
 - +should we not place a far higher priority on linking together
 - +our scientists and engineers, not to mention linking them
 - +with the rest of the world? This would seem to be
 - +a modest investment compared to other megaprojects
 - +such as the SSC and the Human Genome Project.
 - +Further, without investigating the impact of such
 - +technology-based infrastructure first, we may find ourselves
 - +making massive investments in research structures of the past.
- +Some Final Caveats
 - +Before concluding, let me offer a few more general caveats
 - +as we move forward with the debate on
 - +a national technology policy.
 - +For example, a policy should not take on or promise too much,
 - +it should start small and demonstrate effectiveness rather
 - +than risking a boomerang effect if can't deliver.
 - +I worry about the consequences if we justify a national technology policy
 - +purely in terms of national competitiveness.
 - +If we try to motivate by appeals to protectionist sentiments,
 - +scapegoating, and self interest we will be making
 - +a profound mistake. Not only are these

- +antithetical to the values and methods of science and academia
- +but they also create backlash since they are not worthy of our best values
- +and will not inspire us to achieve common purpose and goals.
- +Instead, let us set our sights higher.
- +A national technology policy should inspire our people
 - +to share a positive vision of our future through
 - +advancing knowledge and using its products to serve mankind.
- +Any technology policy should, like the Vannevar Bush report,
 - +take a long term strategic view
 - +and it should recognize the central role of our universities.
- +It should strive to be responsive to bottom up demand
 - +from industry and society more broadly
 - +rather than focus on top down policy making.
- +Concluding Remarks
 - +The world and the structure of academic research
 - +have changed a greatly since Vannevar Bush wrote his report.
 - +But the major principles he advanced merit reaffirmation.
 - +Now more than ever before the national interest
 - +calls for an investment in human and intellectual capital.
 - +As Bush so clearly said, the government university partnership
 - +isn't simply about the procurement of research results.
 - +It is also that nurturing and maintaining the human strengths
 - +of a great technological nation and sowing the seeds of innovation
 - +that will ultimately bear fruit in new products and processes
 - +to fuel our economy and improve our quality of life.
 - +The American public, its government, its universities
 - +should not surrender the long-term advantage
 - +of this research partnership because of
 - +a short-term loss of direction or confidence.
 - +At a time when many of society's other institutions
 - +do not seem to be working well, the research university
 - +is a true success story.
 - +We simply must get that message across to the American public.
 - +We must rearticulate and revitalize the remarkably successful partnership
 - +that has existed between our government, our society,
 - +and our research universities over the past four decades.
 - +Yes, the world--and the structure of R&D--have changed a great
 - +deal since Bush wrote his report, but the major
 - +principles he advanced in it merit reaffirmation. The
 - +long-term national interest still calls for
 - +investment in human and intellectual capital that are
 - +essential, ultimately, to national power and prosperity in the modern
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