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My assignment "Washington in Review" gives some license to spend a few moments in the distant past.

Lincoln once said, "I was told that I'm on the way to Hell -- I didn't know that it was only one mile away and under a dome." My friends here know that I've left the government to do something I believe in. Whether I'm going to Hell is not yet clear. But when in a new environment, it's probably normal to dwell on where you've been as well as where you're going. Where I've been with the founder's of this association is someplace that those of you who were not there unfortunately cannot easily revisit. But I think that it's important from time to time to remind you of the legacy that your founder's have left.

In 1984, Ed MacCordy made a masterful presentation which I cannot do justice to today, about the formative years of the association which lead to the passage of Bayh-Dole. But I would like to briefly address what I believe in hindsight were the underlying principles that motivated those extraordinary years.

In 1690, John Locke asserted that constitutional government could only be effective and legitimate if it recognized and preserved

the natural rights of man including the right to life, liberty and property. This was crystalized by his belief that "a man has a right to what he hath mixed his labor with." Locke's proposition is widely understood to be the underpinning of the our constitution. Locke's writings further made clear that he broadly construed property to mean virtually the entire personal sphere of what is a man's own, including his ideas. This principle was specifically manifested in our constitution by the grant of power to the Congress to secure for limited times to authors and inventors the exclusive right to their respective writings and discoveries. Congress' enactment of the patent and copyright laws demonstrated their belief that the right to own intellectual property is a right of man and a necessary element for successful constitutional government and the promise of prosperity envisioned for such governments. Similarly, all state laws protect the right of individuals to maintain trade secrets.

Neither the constitution nor the respective implementing laws guarantee any right to the employers of such authors or inventors. The failure to address the rights of employers is not surprising, since in 1787 writers and inventors were in most part self-employed. But as that fact changed, the common law addressed the relationship between employers and employees by upholding the assignment of a person's ideas as a condition of employment. This evidently was based on the belief that employers and their prospective employers were on an equal footing at the time of hiring and there were no overriding

national issues which need interfere with their freedom to contract. This seemly logical rule of law eliminated any future need on the part of employers to examine whether it was equitable or desirable company or social policy to require the assignment of ideas solely as a condition of being employed. No further consideration was given to the fact that such ideas were not yet made and could not be evaluated to determine their future value to society. It does seem clear, however, that given a possibility of equal footing the law intended that employees would negotiate for a value "in what he hath mixed his labor with." But as time passed, it became clear that employees would not achieve such footing.

It was in the context of this right in employers (including its acceptance and application by the federal government) coupled with the growth of large private and public organizations and the concentration of research funding in these organizations that the rights of authors and inventors faded into obscurity in the 1950's and 60's. Interestingly, at the same time the public perception of these organizations became increasingly critical. It seems appropriate to suggest that as latter day Edison's and Westinghouse's became obscure within these organizations, the public lost its ability to relate to organization's achievements and began focusing on their problems.

Indeed, the Congress later refused to join business (other than small business) to Bayh-Dole because of their near universal

requirement for assignment of ideas of their employees as a condition of employment without additional remuneration.

It was within this environment that the leadership of this association began a long struggle to gain control to ownership of inventions made with public research funding. This undertaking was driven by a clear understanding that successful application of university technology by industry must be a win-win situation aimed at mutual respect in which all participants including industry and the inventor must equitably benefit from the result. From the beginning it was understood that any return from industry licensing must be shared with the inventors that produced it based on predetermined agreement.

Victories in the Executive came in the late 60's at H.E.W., then in the early 70's at NSF, but impending reversal at H.E.W. in 1977 and intransigent bureaucratic resistance made it clear that strong university technology management offices could not be built on the shifting sands of executive policy.

Perseverance of your leadership finally delivered the Bayh-Dole Act of 1980 and through it later a coherent government policy aimed at further decentralizing technology management by permitting all federally-funded creating organizations and their investigators, whether at a university and now at federal laboratories, to own and benefit from the application of their technology.

Well -- principles are fine, but there will always be people that legitimately question whether they work in practice. There are a number of items that lead to the conclusion that the principles embodied in Bayh-Dole are working better than even its advocates expected.

In their last report on Bayh-Dole, the GAO indicated that in addition to increased university invention reporting and licensing, the funding of cooperative arrangements between universities receiving federal R&D funds and industry has grown 74 percent from $227 million in FY 1980 to $482 million in FY 1985 (in constant dollars). Average private funding of universities has risen to between 6 to 8 percent.

The University of Minnesota study of "University Patent, Issued in 1987" available from Diane Plunkett today, verifies that invention reporting has dramatically increased. Over 900 patents issued to universities in 1987. That is four times the 230 patents that issued in 1976!

Nineteen seventy-six was the last year in which the Department of Commerce collected statistics on patents issued to federally funded research performers. In that year, the total number of patents issued for all federally funded research performers regardless of their ownership was approximately 1800 and was headed down on the basis of the trend set by the prior five

years. There is no evidence that for performers other than the universities that the statistics reversed after 1976. In fact, a report by the patent office last week suggests that they still may be heading down.

But presuming that since 1976 they remained flat for other performers, the total number of patents issued in 1987 for all federally-funded performers would be approximately 2500 including the 900 attributed to universities. That makes the university portion 36 percent of the total. That means that university research with approximately 10 percent of the federal R&D budget is producing over a third of the resulting patents. Even more fantastic is the fact that unlike the other performers this is being done at virtually no cost to the taxpayer. Further, the fact that the patents are being paid for by the universities or its licensees also suggests that they are patents that were filed after careful consideration. Can there be much question that the incentives of Bayh-Dole have worked?

While we can be genuinely encouraged by these statistics, the report from the Patent Office is not bright. Of the 90,000 patents issued by the PTO in 1987, 47 percent went to foreign nationals, from 45 percent in 1986. This marks a continuation of a trend that has seen the overseas share of American patents double over the past 20 years while the number of patents going to American nationals has remained static. Patents received by U.S. citizens have been steadily falling from a high of over

50,000 in 1972 to below 40,000 in 1985. At the same time scientific papers published by industrial employees slipped from 12,200 in 1973 to 10,400 in 1980. Yet R&D budgets grew 80 percent to about $52 billion from 1975 to 1985. With increasing expenditures and decreasing output, the OTA concludes that American R&D is exhibiting all the classic signs of declining productivity.

But in the midst of this industrial gloom a glimmer of hope comes from the current trend to restructure corporate America. One of the principal lessons of restructuring, just about everyone agrees, is that an experienced operating manager given the right guidance, liberal incentives, and enough freedom, can almost invariably do a better job generating value from a business than someone from corporate headquarters. So the lessons of decentralizing are also being undertaken by business. If these liberal incentives lead to better policies on remunerating their employed inventors, Bayh-Dole suggests their statistics on patents will surely improve. I think start-up companies already understand the need to take care of their inventors.

Notwithstanding, Washington still has a significant number of people hoping to manage the next big science project. Each project is supported as the answer to our competitiveness problem. "Mr. President, fund this one and we promise you that the by-products that will result will vault us ahead of foreign competition in any area of technology touched by the project."

But the past has shown that those that gain control of the funding, demand control of resulting technology on grounds that inability to direct the actions of the creator will impact on the funder's targeted result.

But this association has learned that it is possible and probably imperative to address both the directed and the serendipitous results of science. Indeed, the serendipitious result could be the initial step to a technology of greater importance to society than the directed or funded result. The most common problem of large research programs has been the lack of management understanding at the funding level on how to manage serendipitious results. Bayh-Dole responds directly to that problem. In fact, the state of the art in technology management has advanced to the point where it is legitimate to challenge the funding of science projects that will not be managed by agencies under Bayh-Dole principles. The most immediate projects that come to mind is the super conducting-super collider and mapping the human genome, both of which are advocated by the Department of Energy.

If I have not made my point, I believe this last story demonstrates it. A few weeks ago a friend called at the request of his son who is a computer scientist at one of the major universities here today. My friend's son wanted me to know that with the assistance of his university he had just concluded the licensing of a software program he designed for a significant

return and on the basis of this he has decided to reject a job offer from a major company. He felt that the opportunity to pursue his own research to completion and still share in the value created was something that could not be met by the offer.

Louis Pasteur probably said it best:

> "There is no greater charm for the investigator than to make new discoveries, but his pleasure is heightened when he sees that they have a direct application to practical life."

It seems to me that when all our creative people are treated with respect through sharing with them the return on what they have created, we will have switched on a power that no foreign competitor can equal. But in the meantime, John Locke clearly lives here.

I thank you for your indulgence both today and in the past.