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THE WHITE HOUSE
WASHINGTON

December 18, 1991

Dear Bruce:

I remember with great pleasure the occasion when Joe Weneser, Herman Feshbach and I visited you during your stay at Commerce and we were delighted to find that, among a great many people with whom we talked during those travels, you were the only person whom we felt fully understood what we had in mind.

I am, of course, aware of your continuing efforts to promote precompetitive technologies and have welcomed that support because I really do feel that we have an enormous opportunity that could be tremendously beneficial to the country and, at the same time, an opportunity that we could very easily lose.

I would be happy to talk with the distinguished group that you mentioned in your letter of November 25 and will look forward to hearing from you. My telephone number is 202/456-7116.

You mentioned the need for a civilian-type DARPA and I do have some concerns about such an organization. In my view, the reason that DARPA has been as successful as it has been is in significant measure because it was always extremely clear who the ultimate customer was--the Defense Department. I am concerned that, given the present tendency toward pork activities in the appropriations committees, a civilian DARPA would very quickly be looked on as the happy hunting ground for such activities and I am worried that further departure from a focus on excellence and clear mechanisms for quality evaluation, peer review, and the like will seriously damage our overall science and technology enterprise.

I look on the advanced technology program out of NIST as something of a pilot program and must say that I have been very pleased by the first series of awards and very supportive of an expansion of that program.

In any event, I would look forward to talking with you and your colleagues as would a number of my senior associates, so please do give me a call so that we can arrange to get together.

In the meantime, let me wish you a very merry Christmas, and a happy and healthy 1992.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "D. Allan Bromley".

D. Allan Bromley
The Assistant to the President
for
Science and Technology

Dr. D. Bruce Merrifield
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"Document Control"

TYPE: MEETING REQUEST DOCUMENT NUMBER: 9124979
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: MERRIFIELD, D. Bruce: WHARTON SCHOOL, UNIVERSITY OF
PENNSYLVANIA

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/25/91

SUBJECT: HE REQUESTS TO MEET WITH DR. BROMLEY REGARDING SOME
SORT OF PRO-ACTIVE CIVILIAN TYPE DARPA WHICH IS NOT
MISSION LIMITED, BUT WOULD BE MANAGED AND OPERATED
IN THE PRIVATE SECTOR.

DIRECTORATE STAFF
ASSIGNED: DIRECTOR'S OFFICE ASSIGNED:

ACTION STAFF
REQUIRED: AS APPROPRIATE ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 12/17/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: PHYSICAL SCIENCES
INDUSTRIAL
D. Allan Bromley

WHITE HOUSE TRACKING #: CONTACT PERSON:
REMARKS: PHONE: EXT:

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The Wharton School of the University of Pennsylvania

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November 25, 1991

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Dr. D. Bruce Merrifield
Walter C. Bladstrom
Visiting Executive
Professor of
Entrepreneurial Management

The Honorable D. Allan Bromley
Director
Office of Science and Technology Policy
Old Executive Office Building, Room 176
17th and Pennsylvania Avenue, NW
Washington, DC 20500

Dear Allan:

Since "escaping" from the Commerce Department in 1989, I've been participating with an ad-hoc group (see attached list) to promote "precompetitive, generic, critical technologies" -- such as the High Performance Computing Initiative. In particular, we've been working behind the scenes with people on the Hill to understand the need for some sort of pro-active civilian-type DARPA which is not mission-limited like DARPA, but would be managed and operated in the private sector.

We would much appreciate your thoughts along this line, and General Bernard Schriever, Admiral William Hauser, General Burt Edelson, Jim Fletcher and I would like to meet with you for your guidance. I'll check in with your office, in a few days to see if you may have an opening on your schedule.

If you have questions, the best place to reach me is my Washington office at the American Electronics Association (202/682-9110).

Sincerely,

DBM:efs

Attachments

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U. S. INDUSTRIAL COMPETITIVENESS
FUNDING OF HIGH-RISK LONGER-TERM INVESTMENTS
IN NEXT-GENERATION "CRITICAL TECHNOLOGIES"

Rationale

U. S. industrial competitiveness in a hyper-competitive global marketplace increasingly will depend upon accelerated conversion of basic research discoveries (where the U. S. has a commanding lead), into generic technologies which are advanced to the point where industrial firms can further develop them and commercialize leading edge products, processes and services. The \$24 billion of annual basic research investments now being made in the U. S. are 10 times greater than any other nation has the in-place capability to duplicate --- resulting in most of the Nobel Prizes and most of the scientific break-throughs for U. S. laboratories.

However, these seminal discoveries are far from commercialization. Most of the eventual cost and risk of development is still ahead, and often beyond the capacity of most companies to undertake alone. Barriers to this technology-transfer and the further development process, so urgently needed, include bureaucratic regulations, a lack of industrial experience in university and Government lab personnel responsible for transfer, and above all, a lack of availability of risk capital at justifiable costs, for early stage investments, where ultimate commercial potentials are still nebulous.

Current Sources of Funding

The Federal Government currently funds about \$70 billion in R&D, of which about 80% is contracted out to private sector laboratories. However, this work largely is mission-restricted, and may or may not have industrial (dual-use) potential.

For mission-restricted work, the Government is the built-in customer and the technology transfer process, therefore, is built-in. However, for industrial uses the transfer of technology process is weak to non-existent, even though the authorization through the Technology Transfer Acts and through specific Presidential directives¹ has been in place for many years! Also, except for DARPA, the Government funding process has been through grants and procurement contracts, and tends to be reactive rather than pro-active in seeking out next-generation possibilities --- a critical deficiency!

The Advanced Technology Program (ATP) at Commerce is a recent departure, in that it is not mission-restricted, and the Government is not the primary customer. Also, it requires shared funding with industry, but funding still is very limited, relative to demand, and the process still is reactive rather than pro-active. Finally, the ATP program does not have authorization to fund

¹ See attached table of authorizations and directives.

research in universities or Government labs, where much of the nation's best technical talent is located, and where the seminal discoveries are being made that need risk capital to begin the transfer process.

DARPA is a unique Government agency which has annual funding of about \$1.3 billion, and is an exception in that it is pro-active. DARPA has no labs of its own, and therefore contracts out all funds to the best sources of talent and capabilities --- wherever they may be in large or small organizations, Federal laboratories, universities, corporations, or consortia. Nevertheless, it still is mission-restricted to military needs, and only recently has had limited authorization to be involved in collaborative R&D arrangements.

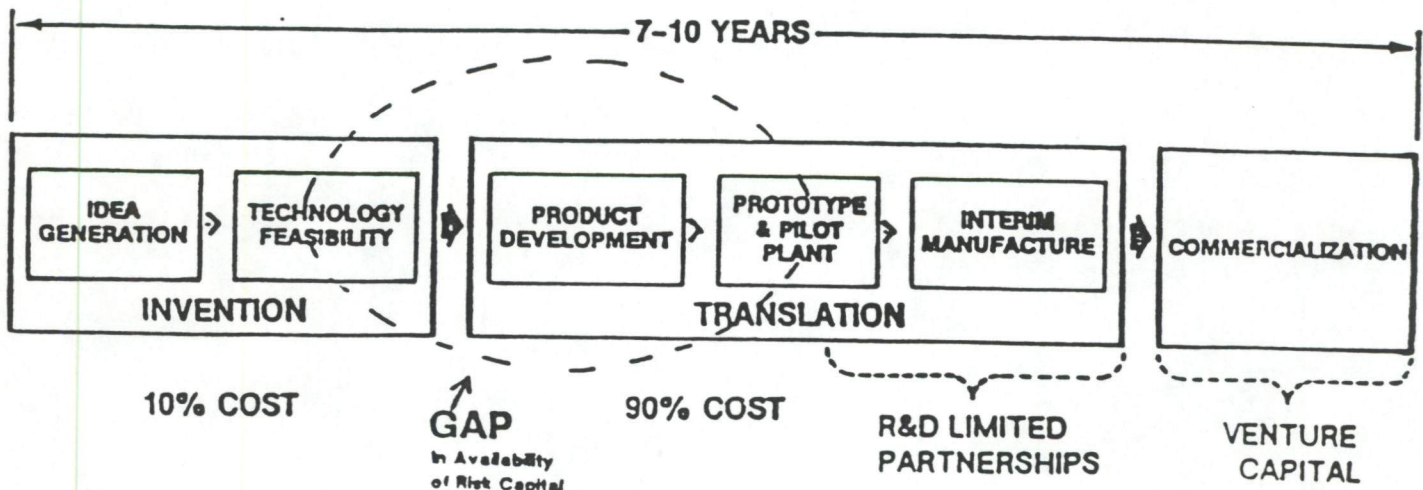
DARPA, however, has been remarkably successful in its operation, particularly in generating generic technologies which have had enormous industrial value --- computing, telecommunications, electronics, and advanced materials. DARPA has had highly competent personnel on its staff who operate with great flexibility. It has been very aggressive in searching out innovative ideas, talented people, and capable organizations --- and has been able to fund these at appropriate levels. It has been able to short-circuit the bureaucratic process to start promising new projects quickly, and then terminate those that appear less attractive. This combination of power, talent and flexibility is lacking in all other Government research organizations (DOD, NASA, DOE, NSF, etc.). There is no civilian equivalent.

Possible Solutions to the Need for a Civilian "ARPA"

A civilian "ARPA" modeled on DARPA but without mission-restrictions and with a strong market focus, could provide the missing pro-active initiative needed to more effectively exploit the dominant U. S. advantage in basic research. The fundamental understanding here (Exhibit I) is that once a

EXHIBIT I

INNOVATION PIPELINE



basic discovery is made (Boxes I and II), about 90% of the cost, time and risk still lies ahead in translating that discovery (Boxes III, IV and V) into something useful (Box VI). Moreover, currently the high-risk early-stage seed funding (the bridge between Boxes II and III) has simply not been available.

This is the gap that DARPA bridges so effectively, and is missing for non-military opportunities. A pro-active market-focused industry-managed and led "ARPA" could take a number of different forms (Exhibit II):

EXHIBIT II

FUNDING MODELS FOR CRITICAL TECHNOLOGY

DEVELOPMENT

<u>Organizational Form</u>	<u>Funding Source</u>	<u>Staff Factors</u>	<u>Labs Owned</u>	<u>Degree of Independence</u>	<u>Program Initiative</u>
• Govt. Agency	Budget Appropriation	Civil Service	Problem?	Limited Flexibility	Reactive
• Govt. Corp.	Endowment Plus Funding	Small Independ.	None	Somewhat Limited	Reactive
• Private Sector	Self-Funding	Small Independ.	None	Very Good	Pro-Active

All three models above are feasible, but each has advantages and disadvantages: A Government Agency might be established under the Technology Administration at Commerce or in DOE, funded by Congress, and staffed by civil service personnel, employing Government contracting procedures --- the sum total of which would effectively limit the pro-active flexibility desired. Politically, however, it may be necessary to build on existing capabilities rather than create something new. DARPA operates under somewhat similar restrictions, to those above, except that it has the advantage of having a built-in customer, with massive funding, operating against clearly defined requirements (any dual-use opportunities are a side-benefit).

A Government Corporation might operate as a Federally funded R&D center (FFRDC), which would be established with an endowment. The operating latitudes would include ability to fund R&D work in both Government and private sector labs. The Government would retain a good deal of control through ownership, but the corporation would operate outside the civil service framework, and therefore could command a level of management competence and flexibility much greater than that in a Government agency. Industrial interests and market focus might be integrated in some degree through industrial participants on an advisory board.

A Private Sector organization might take the form of a corporation or Limited Partnership, which could have maximum flexibility and access to the highest level of technical competence. The Government would lose a measure of control to private interests, but it still might retain considerable influence by inserting policy guidance in its charter, or by acting as a private investor or customer in the enterprise. However, the organization might not always work in ways consistent with the views of Government agencies, even becoming competitive with Government programs, or with industrial firms as well. As a private sector organization, it could become self-funding through royalties, or by taking equity positions in successful developments. If established as a Limited Partnership, it would provide incentives for investment by companies, by pension funds, by venture capital funds or by syndicated groups of individual investors.

If modeled after COMSAT, the organization would be Government-chartered, but privately funded and staffed. The Government would have the opportunity, and might agree at the beginning, to invest in the corporation, or be a supplier to or a customer of the corporation. Staff competence and pro-active flexibility would be assured.

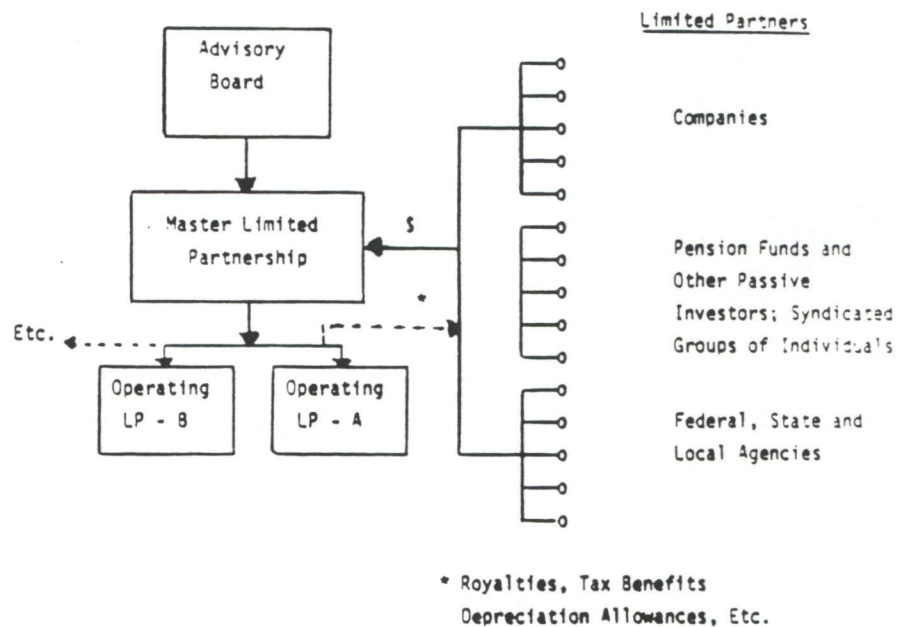
The Limited Partnership organizational model is of particular interest for a private sector

operation of this sort (Exhibit III). In this model, the limited partners (far right) can include companies as well as Government agencies and passive investors such as pension funds. Limited partners are insulated from liability and antitrust concerns by this organization (properly structured), which has been much used, and is well documented. Profits from successful developments flow back to the limited partners (without double taxation as in a normal corporation)

but proportional to their initial investment. This allows disproportionate investments to be made from any source. Also, depreciation allowances, and any other tax benefits automatically flow back to the limited partners. The master partnership retains the pro-active flexibility to seek out leading edge investment opportunities which are set up as sub-limited partnerships and can have additional limited partners if desired.

EXHIBIT III

Limited Partnership Management Model



Eventually, a successful development can be spun off to the limited partners, can go public as a new company (providing liquidity for the investors), or can be operated as a "cash cow" for further investments.

Summary

The U.S. retains a commanding lead in basic research which will continue to result in Nobel Prizes and most of the next-generation seminal discoveries. However, these discoveries often have remained latent in university and Government laboratories, because of bureaucratic impediments, lack of experience in the technology transfer process, and most importantly, the lack of low cost risk capital.

The remarkable success that DARPA has experienced for military needs over the last 30 years, could be replicated in the civilian sector by a similarly constituted pro-active organization, whose mission would be one of catalyzing the process needed to exploit the U.S. advantage in basic science. This advantage is not questioned, but the follow-through has been limited, providing opportunities for other nations to cherry-pick the best discoveries for subsidized development.

Several types of feasible organizations are outlined above which might provide the needed capabilities. However, more important than the form of organization, is the clear recognition of the problem, and the elements that constitute the problem. U.S. industrial competitiveness increasingly will be dependant upon solutions to this problem.