Sent to DAB 9/2

"Document Control"

TYPE: ACTION
ORIGINATOR: 02
DOCUMENT NUMBER: 9202364
STATUS I
DIRECTORATE STATUS

****

FROM: OLIVER, Jack: CORNELL UNIVERSITY

TO: DR. D.A. BROMLEY

Karl Erb. Comments? DAB.

DATE OF CORRESPONDENCE: 08/03/92

SUBJECT: HE IS FORWARDING HIS COMMENTS ON THE SCIENCE AND TECHNOLOGY REPORT.

****

DIRECTORATE ASSIGNED: PATRICK WHITE

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

****

SENDER'S DUE DATE:

OSTP DUE DATE: 08/27/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

****

COPIES TO: D. Allan Bromley

****

WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE:

EXT:

REMARKS:

Allan -
This is good science. I would advise to consult the NSF and USGS geologists before replying

OSTP RECEIVED: 08/14/92

DEPT RECEIVED:

FILE: ~~P-PCAST~~ S+T Agenda

CENTRAL FILES:

to Prof Oliver. (This should not have been assigned to Pat White for response).

cc Pat White

Karl

Cornell University

DEPARTMENT OF GEOLOGICAL SCIENCES

SNEE HALL • ITHACA, NEW YORK 14853-1504

TELEPHONE: (607) 255-5267 FAX: (607) 254-4780

August 3, 1992

Dr. D. Allan Bromley
The Assistant to the President
for Science and Technology
The White House
Washington, DC 20500

Dear Dr. Bromley,

Thank you for the copy of the President's Science and Technology Report and Outlook, and for the invitation to provide information that might be useful in future reports of this kind. In response, I would like to draw to your attention one matter that, in my opinion, merits special consideration. It is that the United States should greatly expand its efforts to explore, and develop a comprehensive understanding of, the buried portion of the continental crust.

With the exception of the relatively shallow sedimentary basins that hold petroleum, and some scattered sites that have received special attention for one reason or another, the bulk of the continental crust, although very near to us, is poorly-known and certainly deserves to be called a major frontier. That seems incongruous in this marvelous era in which we make fly-by movies of the surface of Venus, observe the tiniest components of the nucleus of the atom, and seek the outer limits of the universe. In any case, we humans are constrained to live on earth, to draw our essential resources from it, to dispose of our wastes in it, and we are subject to the hazards the earth presents. Surely, in addition to probing esoteric subjects, it is in our best interests to learn as much as we can as soon as we can about the part of the earth that sustains us and that is so close to us that we could walk to it if it were not subterranean.

The continental crust is typically about 40 km thick. Geologically, its surface is reasonably well-known. The upper 5 km of the crust is accessible by excavation in mining style, the upper 10 to 15 km may be probed and sampled by drilling. The entire crust may in principle be explored in considerable detail by a combination of various geological, geochemical and geophysical methods.

The methods for exploration of this part of the earth are already available and proven. In particular, industry has developed the techniques of drilling, and of seismic reflection profiling and seismic subsurface mapping, for exploration of petroleum provinces, and it has already been demonstrated beyond doubt that these techniques are effective on the larger scale of the entire crust. This subject is not, of course, completely ignored at present. Some successful but modest efforts to explore the entire crust are already being made by universities, state and federal surveys and other government agencies, but progress is slow, spotty and sporadic. What is needed is a much more comprehensive effort designed to provide in a modest time frame a thorough understanding of the continent.

To give a more quantitative flavor, one might think, for example, of a seismic reflection survey of a grid spaced at intervals of, say, 100 km and spanning the United States. Such a survey might require the services of ten seismic crews operating for 5 years at a cost of perhaps $3

x 10^6/crew/yr., for a grand 5 year total of \$150 x 10^6. Skilled crews and modern equipment are readily available in the petroleum industry. A deep drilling program to test and calibrate the seismic results and collect deep geological samples might require a comparable sum.

Such a program, when integrated with known surface geology, would provide the basis for understanding the formation and structure of the continental crust. It would also provide basic information to aid in the search for petroleum and mineral resources and to guide us as we make decisions on where to store wastes, how to use fluids of the crust, and how to live with earth hazards.

In earthquake-prone areas, such as California for example, and in conjunction with geological and earthquake-based seismological data, such seismic surveys would provide scientists with a geological understanding of the crust - what is there, how it works, and why earthquakes occur as they do. It is a sign of neglect, or oversight, and almost irresponsibility, that we have not yet collected such readily obtainable information for the entire region of the recent California earthquakes that, in the minds of many seismologists, are forerunners to "the big one" that we all know will, sooner or later, strike that state.

The accumulation of fundamental knowledge on the great subterranean parts of the continents is a logical next step in the history of exploration of our planet. It is a step analogous to the thorough geographical exploration of North America that followed the early forays of Columbus and other explorers, and analogous to the thorough exploration of the sea floor in the post WWII era that brought us the astonishing concept of plate tectonics. Humans have profited enormously from those great eras of exploration of the past. The buried continental crust is the frontier that provides the opportunity for yet another giant step.

Let me close by noting that this letter is rooted in conviction and not self-interest. Although the subject is my specialty, I am nearing retirement age and I do not stand to profit either personally or professionally from a program of accelerated exploration of the continents. I make my point because it is the whole of society that stands to benefit from the proposed effort.

Sincerely yours,

Jack Oliver
Irving Porter Church
Professor of Geology

JO/kav

file

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202552
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

****

FROM: BABCOCK, Horace W.: THE OBSERVATORIES

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/17/92

SUBJECT: HE IS WRITING WITH HIS COMMENTS ON THE SCIENCE AND TECHNOLOGY REPORT.

****

DIRECTORATE ASSIGNED: PHYSICAL SCIENCES

STAFF ASSIGNED:

ACTION REQUIRED: AS APPROPRIATE

STAFF ACTION:

****

SENDER'S DUE DATE:

OSTP DUE DATE: 08/06/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

****

COPIES TO: D. Allan Bromley

****

WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE: EXT:

REMARKS:

OSTP RECEIVED: 07/23/92 DEPT RECEIVED:

FILE: P-PHYSICAL SCIENCES-SPACE

S+T—Reports

CENTRAL FILES:

THE OBSERVATORIES

OF THE CARNEGIE INSTITUTION OF WASHINGTON

17 July 1992

Dr. D. Allan Bromley
The Assistant to the President
for Science and Technology
The White House
Washington, D.C.

Dear Dr. Bromley:

Thank you for sending the President's Science and Technology Report and Outlook.

I believe that you have indeed made the Report comprehensible and informative for a wide audience. On the whole, I give it high marks, but with certain qualifications.

One specific objection that I have is to the support of Space Station Freedom (p. 10). I do not believe that this extremely costly project can be justfied by its potential for accomplishments in science. My opinion coincides closely with that of Dr. Maxine Singer in her testimony before a task force of the Committee on the Budget, U.S. House of Representatives, on April 28, 1992. While I am sure you know of Dr. Singer's testimony, I enclose a sheet that provides excerpts from her comments.

Some references to the peer review system suggest that it functions well. Yet I know from experience that serious errors can result. The peer review system, I think, easily goes awry if reviewers, too often trained in a single discipline, lack the breadth of competence that is implied by the "thematic approach" as mentioned on p. 16 of the Report.

On pages 20 and 21 there is reference to Federal funds for basic research in 1991, with the indication that NSF was responsible for 14 percent, and NASA also for 14 percent. I feel uneasy for lack of better knowledge as to how "basic research" is defined in these instances. My feeling is that NSF is better oriented toward basic science than is NASA. Many of the expansive and far flung operations of the latter are generally perceived as basic science when this is far from the truth.

In my own field of astronomy there is, at last, a rapidly growing interest in the development of adaptive optics. The basic technology was invented some 40 years ago for improving the useable resolving power of astronomical telescopes by compensating atmospheric turbulence. Yet, lacking a multi-disciplinary approach, nearly all astronomers, until quite recently, have failed to recognize its possibilities. Now performance has been demonstrated (notably by Europeans) and adaptive optics clearly has the potential for great advances in

813 SANTA BARBARA STREET — PASADENA — CALIFORNIA 91101-1292

TELEPHONE 818 577 1122 — FAX 818 795 8136

ground-based astronomy. Yet Federal expenditures by NSF for development of adaptive optics in astronomy are recommended, I believe, to total $32M for the current decade. There is a vast lack of balance between this figure and the tremendous expenditures that are going -- and have gone for some 20 years -- into the Hubble Space Telescope and its support. Yet the single most important purpose of each program is the same: to achieve optical resolution close to the diffraction limit by avoiding the distortion of the earth's atmosphere.

Adaptive optics improves the useable resolving power of ground-based telescopes by an impressive factor. Performance has been demonstrated, but full system development will require several more years. R&D is proceeding, but should be accelerated. This technology will reform much of ground-based astronomy. Support by NSF at a level of $3M annually for a decade is definitely inadequate, to say the least.

Although originally invented for astronomy, adaptive optics has been been promoted for classified military uses by DOD for the past decade. Budgets, by all indications, have been comparatively lavish for some of these purposes. Recently there has been an effort to convert in part to astronomical applications. In this there are varying degrees of success, depending upon the laboratories involved. I believe that the Phillips Laboratory at Kirtland AFB near Albuquerque is outstanding.

One could go on to compare progress in astronomy in the United States with that of the seven European countries that operate the European Southern Observatory (ESO) with headquarters near Munich. Many of the current advances are being made by the ESO scientists and engineers, who decided in 1985 that their array of four 8-meter telescopes, to be erected in Chile, will depend upon adaptive optics. Furthermore, ESO is admirably organized and administered, with funding that is reliable and predictable. It has been announced that the American astronomer Dr. Ricardo Giacconi will leave the Space Telescope Science Institute in Baltimore to assume the directorship of the European Southern Observatory at the beginning of 1993.

Thank you for the opportunity to express my comments and reactions to the Report. My response has been delayed a little as I wanted to assure myself that there is a workable solution to a technical problem (tilt anisoplanatism) that has been under discussion in connection with adaptive optics. A brief preprint on multiplexing is enclosed.

Sincerely,

Horace W. Babcock

Horace W. Babcock

Enclosures (2)

Singer testifies on Capitol Hill

On April 28, Maxine Singer gave testimony before a task force of the Committee on the Budget, U.S. House of Representatives. Excerpts from her comments, given as an individual, on planning for the Space Station Freedom are given here:

[On the effects of space on human beings.] I believe that we must surely examine the ethical issues that arise from subjecting humans to what we already know to be a debilitating environment: low gravity and the radiation characteristics of space.

... present and future technological advances will permit us to explore and study space without a human presence. Moreover, extensive data concerning the effects of space on humans and animals have already been acquired by space scientists and astronauts in the United States and the former Soviet Union. Surely these data could now be more carefully analyzed in a joint international project before we again jeopardize the health and safety of Americans.

It would also provide another opportunity to engage scientists in the former Soviet Union in open research for peaceful purposes....

[On spaceborne experiments on cellular processes in normal and diseased cells and organisms.] I do not believe that there is any obvious merit to this activity. It is extremely difficult to imagine how the conditions of space, such as low gravity, could possibly add significantly to our understanding of normal growth, cancer, AIDS, or any other disease of man or other organisms on the planet.

Notice I do not say that it is impossible that we would learn such things, only that it is extremely difficult now to imagine how we would. After all, the sick people in our world are sick for very earthly reasons—infectious bacteria and viruses, abnormal cell growth, malfunctioning immune systems, the process of aging, and poor nutrition. It is also difficult to imagine what special conditions space would provide for answering the questions that we have about the cause, diagnosis, and treatment of human disease....

In terms of the time of trained biomedical scientists and the cost of the experiments, we are many more times likely to achieve significant knowledge sooner here on the planet than in space.

Maxine Singer

[On the problem of inflexibility in planning for space experiments.] Once, in the mid-70's, I spent two years with a colleague determining the sequence of a rather small piece of DNA. It was 172 base pairs long. As you know, the human genome is three billion base pairs.

Well, just as we were finishing up the work and preparing it for publication, the new methods for DNA sequencing came out, and then in the next three weeks we repeated what we had taken two years to do. That kind of situation has recurred frequently in the history of biomedical science in the last several decades, and that is why I think that almost by definition anything that requires very-long-term planning is very likely to be answered or seen as the wrong question by the time you get to do it....

MULTIPLEXING AN ADAPTIVE OPTICAL SYSTEM TO COMPENSATE TILT ANISOPLANATISM

H. W. Babcock
Observatories of the Carnegie Institution of Washington
813 Santa Barbara Street, Pasadena, California 91101

Submitted to Publ. Astron. Soc. Pacific. July 10, 1992

ABSTRACT

Multiplexing of a single adaptive optics system may be the simplest method of solving the problem of tilt anisoplanatism when laser guide stars are used.

Tilt anisoplanatism is a problem encountered in the planning and development of high quality adaptive optics for astronomical use. In particular it may degrade resolution of objects in the visible region of the spectrum as compared to the infrared, and in other situations where suitable natural guide stars are so scarce that laser guide stars must be used.

Pilkington (1987) showed that the problem arises because a real star will appear to wander as a result of outer scale (long spatial wavelength) atmospheric turbulence, and that this is not so for laser guide stars: their apparent positions remain unaffected by turbulence because each laser pulse projected into the atmosphere travels up and down along the same path. Consequently the laser guide star cannot provide information on the apparent wandering of a natural star.

The compensated image of a real star within the isoplanatic patch of a laser guide star may be diffraction-limited on a short time scale of the order of a few

the need for duplication of system components. Multiplexing permits use of a single adaptive optical system with relatively minor additions for switching alternately between two optical inputs. The two inputs that are alternately admitted to the system are isoplanatic fields centered on two laser guide stars that are typically a few arcminutes apart. These fields contain, respectively, the compensated natural tilt-reference star and the compensated astronomical target. Both of these in the short term have resolution close to the diffraction limit, but they are similarly affected by relatively slow wandering that results from any outer-scale (long-wave) turbulence that may be present.

The square wave that controls optical switching can be generated by the system clock that governs pulsing of the laser(s) and readout of the CCDs. There is the option of using a single laser whose beam is optically switched. Switching of the two optical fields at the input (and of the outgoing laser beam as well) can be done with an inclined plane-parallel plate that is given a small incremental tilt by the square wave. As the target will generally be fainter than the tilt reference star, efficiency may be improved by using an asymmetrical square wave for switching.

The natural tilt-reference star and the astronomical target, each in the isoplanatic patch of its respective laser guide star, can both be imaged at the output end of the multiplexed adaptive optics system, with the laser guide stars suppressed by gating. The tilt-reference star is centroided as by a CCD guider, and the centroiding corrections are applied also to the target, resulting in high quality compensation that approaches the Airy limit.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

August 4, 1992

Dear Dr. Babcock:

Thank you for your kind remarks on the President's Science and Technology Report and Outlook.

With respect to your comments concerning the Space Station, neither Dr. Bromley nor I have sought to justify the station on the basis of pure science. We view it as an essential step in the development of our capability for space exploration. If such exploration is planned then we will need the space station.

I resonate with your remarks concerning adaptive optics. This is a very powerful technique and we in OSTP have worked to help transition this technology from the classified into the public sector. I am planning a visit to the Phillips Laboratory later this month to learn more about this intriguing technology.

Again, we appreciate your response to the report as well as your reactions to it.

Sincerely yours,

Karl A. Erb
Associate Director for
Physical Sciences and Engineering

cc: Dr. D.A. Bromley

Dr. Horace W. Babcock
The Observatories of the Carnegie
Institution of Washington
813 Santa Barbara Street
Pasadena, CA 91101-1292

JUL 21 1992 file

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202516
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

****

FROM: BRESLOW, Ronald: COLUMBIA UNIVERSITY

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 07/06/92

SUBJECT: HE IS WRITING WITH HIS COMMENTS IN THE SCIENCE AND TECHNOLOGY REPORT.

****

DIRECTORATE ASSIGNED: PHYSICAL SCIENCES

STAFF ASSIGNED:

ACTION REQUIRED: FOR DAB'S SIGNATURE

STAFF ACTION:

****

SENDER'S DUE DATE:

OSTP DUE DATE: 08/04/92 STAFF DUE DATE

DATE COMPLETED: DATE COMPLETED/DEPT:

****

COPIES TO: D. Allan Bromley

****

WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE: EXT:

REMARKS:

OSTP RECEIVED: 07/21/92 DEPT RECEIVED:

FILE: P-PHYSICAL SCIENCES S+T Report

CENTRAL FILES:

Columbia University
Department of Chemistry
New York, N.Y. 10027-6948

RONALD BRESLOW
S.L. Mitchill Professor of Chemistry

566 Chandler Laboratory
(212) 854-2170

July 6, 1992

Dr. D. Allan Bromley
The White House
Washington D.C.

Dear Allan:

Thanks for sending me the President's Science and Technology Report and Outlook. It is a very nice document, and I hope that it does some good. However, let me make some pariochial remarks.

There is a danger that fascination with the new may lead to a lack of emphasis on that which is old and established, but still important. My field of chemistry suffers to some extent from that problem. It is a very old field, although what is being done in it now is quite new and exciting. Chemistry plays a central role in some of our most important industries, specifically but not exclusively the chemical industry and the pharmaceutical industry. There is still a great demand for trained chemists by the American companies involved in these areas, companies which also account for significant trade surpluses for the U. S. It is a field of science in which the U. S. is still a leader.

Maybe none of this needs to be said. However, our scientific and industrial strength in these areas critically depends on there being adequate support for research and training in chemistry. I hope that the natural tendency to look for the most recent trendy areas of science will not lead to neglect of fields, such as chemistry, whose newest aspects are quite revolutionary even though their history is extensive.

With best regards,

Sincerely,

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

August 4, 1992

Dear Dr. Breslow:

Thank you for your remarks concerning the President's Science and Technology Report and Outlook.

Your concern that fundamental research in established branches of science might be neglected in the quest for new areas for concentration is a serious one, and we in OSTP are committed to ensuring that these areas receive adequate support. Incidentally, I expect that chemistry research will benefit to some extent from the proposed initiative in advanced materials R&D.

Sincerely,

Karl A. Erb
Associate Director for
Physical Sciences and Engineering

cc: Dr. D.A. Bromley

Dr. Ronald Breslow
Department of Chemistry
Columbia University
New York, NY 10027-6948

file

JUL 20 1992

"Document Control"

TYPE: Action Item DOCUMENT NUMBER: 9202257
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

****

FROM: SOMORJAI, Gabor: UNIVERSITY OF CALIFORNIA

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 06/16/92

SUBJECT: HE IS WRITING REGARDING THE ANNUAL S7T REPORT AND ITS NEGLECT OF THE FIELD OF SURFACE MATERIALS.

****

DIRECTORATE ASSIGNED: PHYSICAL SCIENCES

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

****

SENDER'S DUE DATE:

OSTP DUE DATE: 07/24/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

****

COPIES TO: D. Allan Bromley

****

WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE: EXT:

REMARKS: REASSIGNED TO PHYSICAL SCIENCES PER DR. WONG.

OSTP RECEIVED: 06/23/92 DEPT RECEIVED:

FILE: ~~INDUSTRIAL~~ S+T Rpt A

CENTRAL FILES:

225 1

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

PROFESSOR GABOR A. SOMORJAI
DEPARTMENT OF CHEMISTRY
TELEPHONE: (510) 642-4053
FACSIMILES: (510) 643-9668
(510) 642-8369

BERKELEY, CALIFORNIA 94720
TELEX: TWX 910-366-7114
UC BERK BERK
OR
TWX 910-366-7337
UC LIB BERK

June 16, 1992

Dr. Allan Bromley
The Assistant to the President for Science and Technology
Executive Office of the President
Office of Science and Technology Policy
The White House
Washington, D.C. 20500

Dear Dr. Bromley:

Thank you for sending me the President's Science and Technology Report and Outlook. It is a beautiful document and I would like to express my appreciation for your willingness and success in representing science and technology in the White House. I appreciate it very much.

There is one major area I believe that is woefully missing from the report, and this is the field of surface materials that include heterogeneous catalysts. This area creates an enormous positive balance of payments for the United States, second only to aircraft manufacture and sales. This is the mainstay of the chemical and petroleum industries, and provides jobs to over 2 million people. I believe that government support of this all-important area of the application of surface materials is absolutely essential if we are to maintain our industrial competitiveness. I am enclosing a recent National Research Council report that I participated in writing that explains the importance of Catalysis for the future of the United States. I trust that you will not hesitate to get in touch with me if you think that I can be of any assistance to you.

With warm regards.

Sincerely yours,

Gabor A. Somorjai

GAS:dt

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

August 4, 1992

Dear Dr. Somorjai:

Thank you for your remarks concerning the President's Science and Technology Report and Outlook.

You will appreciate that a publication such as this cannot begin to mention the important areas of science and technology receiving attention in the Federal government's R&D portfolio. Surface materials and catalysis are indeed of fundamental importance: research in this area is being funded by both the Department of Energy and by the National Science Foundation.

Your concern that mainstay research might be neglected in the quest for new areas for concentration is a serious one, and we in OSTP are committed to ensuring that these areas receive the support they require.

Sincerely yours,

Karl A. Erb
Associate Director for
Physical Sciences and Engineering

cc: Dr. D.A. Bromley

Dr. Gabor A. Somorjai
Department of Chemistry
University of California, Berkeley
Berkeley, CA 94720