

Originally Processed With FOIA(s):
2005-0336-F

FOIA Number:
2005-0336-F

FOIA MARKER

**This is not a textual record. This is used as an
administrative marker by the George Bush Presidential
Library Staff.**

Record Group/Collection: George H.W. Bush Presidential Records
Collection/Office of Origin: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files

OA/ID Number: 62042
Folder ID Number: 62042-002

Folder Title:
Physical Sciences: General (1) [2 of 7] [1992]

Stack:

Row:

Section:

Shelf:

Position:

0

0

0

0

"Document Control"

TYPE: ACTION

DOCUMENT NUMBER: 9203548

ORIGINATOR: 02

STATUS I

DIRECTORATE STATUS

FROM: MASSEY, Walter: NATIONAL SCIENCE FOUNDATION

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/20/92

SUBJECT: HE IS WRITING REGARDING THE NSF BUDGET FOR FY1993.

DIRECTORATE

STAFF

ASSIGNED: DIRECTOR'S OFFICE

ASSIGNED:

ACTION

STAFF

REQUIRED: AS NECESSARY

ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE: 12/18/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

COPIES TO: PHYSICAL SCIENCES
FCCSET

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

PHONE:

EXT:

Handwritten: closed out 12-11



OSTP RECEIVED: 12/07/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:

3548

NATIONAL SCIENCE FOUNDATION

1800 G STREET, N.W.
WASHINGTON, D.C. 20550



OFFICE OF THE
DIRECTOR

November 20, 1992

Honorable D. Allan Bromley
Assistant to the President
for Science and Technology
Office of Science and Technology Policy
Washington, D.C. 20500

Dear Allan:

I appreciate the opportunity to discuss the NSF's FY 1993 budget. My biggest concern is the \$352.5 million reduction we have to make from the request in the Research and Related Activities. Compared to FY 1992, the appropriation of \$1.859 billion represents a \$13 million reduction below last year. In addition, the Congress has directed NSF to fund a number of major research equipment projects -- such as LIGO -- at specific levels. This will result in significant reductions in individual project support. For example, physics and astronomy have each been reduced by more than 10% below their FY 1992 levels.

I have maintained the FCCSET initiatives at the highest levels possible. Nevertheless, most of them are significantly below the original request. Advanced materials is funded at 75% of its requested increase as is manufacturing and biotechnology; support for global change research, for which we had requested a 49% increase, will increase by only 10%; high performance computing will receive about half of its requested increase. The only bright spot is math and science education which is funded at \$526.7 million.

In addition, the budget reductions have hit a variety of other areas: we must find additional funds for the Small Business Innovation Research Program since the statutory setaside increased from 1.25% to 1.50%; support for individual investigators will actually decline by 3% from last year's level; 30-40% reductions from the FY 1992 level will be required in non-FCCSET engineering research programs; in computer and information science and engineering, to adequately support networking, we level funded all the other subactivities in the directorate; and research in social, behavioral and economic science is down about 8% from the FY 1992 level.

In addition, our FY 1993 appropriation for Salaries and Expenses is not sufficient to adequately support our staffing needs. At \$111 million, this is only 1.8% above last year's level. After we severely restrict all discretionary administrative expenses, we

still may have to furlough staff later in the fiscal year. With the increasing program responsibilities accruing to the Foundation, staff support must be our highest priority in this account.

I would strongly support your efforts for the development of a supplemental budget request which would address the problems I have outlined in this letter.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Walter', with a stylized flourish extending from the end.

Walter E. Massey
Director

cc: Dr. Paul Gilman, OMB

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9203523
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: KAHANA, Sid: BROOKHAVEN NATIONAL LABORATORY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/19/92

SUBJECT: HE IS FORWARDING INFORMATION REGARDING RHIC AND ASKS
IF DR. BROMLEY'S SUCCESSOR WILL BE ABLE TO KEEP
SCIENCE AT A HIGH VISIBLE LEVEL.

DIRECTORATE STAFF
ASSIGNED: D. Allan Bromley ASSIGNED:

ACTION STAFF
REQUIRED: AS/IF NECESSARY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 12/16/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: PHYSICAL SCIENCES

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

OSTP RECEIVED: 12/02/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:

THE WHITE HOUSE
WASHINGTON

December 15, 1992

Dear Sid:

Many thanks for your kind note of November 19.

Although the Clinton-Gore team has not appointed my successor I have been lobbying for an early appointment and have been pleased by the quality of the people who are at least under discussion. Any of them would, I think, do an outstanding job and would try to maintain science and technology high on the Administration's radar screen.

We have just begun the transition activity but I hope that some of the new institutional structure that we have put in place over the last several years will be continued into the future.

I much appreciate the information and pictures having to do with RHIC and, of course, do very much maintain my interest in that project.

I have decided, at least for the immediate future because I still have a house in New Haven and an endowed chair at Yale, that I will return to New Haven about mid-January and spend a relaxed few months considering some of the options. In the meantime let me congratulate you on your new ion-simulations. The real question now is to find an unambiguous signature for the QCD plasma once formed but it would be extremely exciting if one were able to actually detect such a plasma at AGS energies.

I am sure that our paths will cross in the not too distant future so in the meantime again my thanks and all best wishes for a happy holiday and the very best of new years.

Sincerely yours,



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

Dr. Sid Kahana
Department of Physics
Brookhaven National Laboratory
Upton, Long Island, New York 11973



RECEIVED

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.

92 DEC 2 P4:44

Upton, Long Island, New York 11973

Department of Physics

OSTP
MAIL ROOM(516) 282-
FTS 666-3738

19 November 1992

The Honorable D. Alan Bromley
Assistant to the President
for Science and Technology
Old Executive Office Building
17th and Pennsylvania N.W
Washington, D.C. 20506

Dear Alan,

Perhaps its now safe to write to you since I cannot possibly be seeking your influence. I have however noticed how impressive your performance has been and how high you have elevated this important position. Will your successor, if any, be able to keep science at such a visible level? In view of your interest in and help on RHIC, I thought you might be interested in the enclosed papers and especially the pretty transparencies for ion-ion simulations. In particular, it would now seem that even at the AGS Au+Au collisions will achieve sufficiently high baryon densities for sufficiently long times to reach regions where one expects QCD plasma.

With best regards,

Sid

Sid Kahana

SK:ih

ANTIPROTON PRODUCTION FROM HEAVY ION COLLISIONS AT 14.6 GeV/c

S.H. Kahana*, Y. Pang, T. Schlagel and C.B. Dover

Department of Physics
Brookhaven National Laboratory, Upton, NY 11973

ABSTRACT

Antiproton production from heavy ion collisions involves a strong competition between creation and annihilation mechanisms. Due to the high threshold energy, antiprotons mostly arise from the highest energy baryon-baryon collisions. We have identified a three-body screening mechanism which strongly reduces the subsequent absorption of antiprotons in the medium. We have used the relativistic cascade code ARC to study this effect, and find that it is essential to obtaining good agreement with recent $\bar{p}$ production data from Brookhaven experiment E802.

* This work was supported in part by an Alexander von Humboldt Foundation Senior Fellowship.

This manuscript has been authored under contract number DE-AC02-76CH00016 with the U.S. Department of Energy. Accordingly, the U.S. Government retains a non-exclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes.

To appear in PRL.

FORWARD PROTONS AND NUCLEAR TRANSPARENCY IN RELATIVISTIC HEAVY-ION INTERACTIONS

T.J. Schlagel, S.H. Kahana*, and Y. Pang

Department of Physics
Brookhaven National Laboratory, Upton, NY 11973

ABSTRACT

The relativistic cascade code ARC is applied to data from the experiment E814 covering projectile rapidities in Si+Pb collisions at 14.6 GeV/c per nucleon. The result is a quantitative theoretical description of the experimental rapidity spectrum covering both target (E802, Si+Au) and projectile rapidities, as well as of the level and transverse energy dependence of "punch through" protons. This plus additional detailed comparisons of transverse mass distributions strongly suggest the cascade approach can be highly useful for understanding energetic ion collisions.

* This work was supported in part by an Alexander von Humboldt Foundation Senior Fellowship.

This manuscript has been authored under contract number DE-AC02-76CH00016 with the U.S. Department of Energy. Accordingly, the U.S. Government retains a non-exclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes.

"Document Control"

TYPE: INFORMATION

DOCUMENT NUMBER: 9203609

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: GLASS, Alexander: LAWRENCE LIVERMORE NATIONAL LABORATORY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/12/92

SUBJECT: HE IS WRITING TO INFORM DR. BROMLEY THAT HE IS NO
LONGER GOING TO SERVE AS THE HOME TEAM LEADER FOR
THE ITER PROJECT.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
PHYSICAL SCIENCES

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

OSTP RECEIVED: 12/07/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:



3609
Lawrence Livermore National Laboratory

November 12, 1992

Dr. D. Allan Bromley
Scientific Advisor to the President
Old Executive Office Building
Room 358
Washington, DC 20515

Dear Allan:

I am writing to let you know that I shall no longer serve as U.S. Home Team Leader for the International Thermonuclear Experimental Reactor (ITER) project. Effective November 3, the U.S. Home Team Leader is Dr. Charles Baker of the Oak Ridge National Laboratory (ORNL). Dr. Baker had previously served as Technology Manager for the U.S. Home Team, and has spent much of his professional career in magnetic fusion research, both at ORNL and at the Argonne National Laboratory.

During the past two years, I have served as Home Team Leader, while also serving as Laboratory Associate Director for Programs at the Lawrence Livermore National Laboratory (LLNL). Although serving in both functions placed a heavy burden on my time, I received strong and effective support from both the Home Team organization and my staff at LLNL. However, as the ITER project enters into a more active phase with the start of the Engineering Design Activities, Dr. Anne Davies, the Director of the Office of Fusion Research, felt that closer technical contact with the Project Director would be required, and that the Home Team Leader would need to devote full time to his duties.

I hope to remain associated with the ITER project, possibly as a member of one of the Advisory Committees. Other than that, I shall not have any formal association with the fusion program. However, in my position at LLNL, I shall do whatever I can to support the continued development of both inertial and magnetic fusion energy technology.

I want to express my strong support for Dr. Baker. He has served for two years as the Technology Manager for the ITER project, and has played a major role in setting up the Home Team organization. He also brings to his new position the benefit of long years of experience in fusion energy research.

It has been a pleasure for me to work with you on fusion program activities. I look forward to our continued association on ITER and other projects.

Yours sincerely,

Alexander J. Glass
Laboratory Associate Director
for Programs

AJG92-252:mcr



Recycled

"Document Control"

TYPE: INFORMATION

DOCUMENT NUMBER: 9203385

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: DEMARS, B.: NAVAL REACTORS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/10/92

SUBJECT: HAVING JUST RETURNED FROM POST-REFUELING OVERHAUL
SEA TRIALS HE IS PLEASED TO REPORT THAT THE
PROPULSION PLANT PERFORMED FLAWLESSLY.

DIRECTORATE

STAFF

ASSIGNED:

ASSIGNED:

ACTION
REQUIRED:

STAFF
ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE:

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
PHYSICAL SCIENCES
INDUSTRIAL

WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE:

EXT:

REMARKS:

OSTP RECEIVED: 11/13/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01a. Letter	To: Allan Bromley From: B. DeMars Re: Sea trials of NR-1 (1 pp.)	11/10/92	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01b. Letter	To: Bruce DeMars From: Allan Bromley Re: Response to 11/10/92 letter (1 pp.)	11/24/92	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

"Document Control"

DEC 2 1992

TYPE: ACTION
ORIGINATOR: 02

DOCUMENT NUMBER: 9203495
DIRECTORATE STATUS

FROM: CRONIN, James J.: MURRAY UNITED DEVELOPMENT CORPORATION

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/10/92

SUBJECT: HE IS ASKING FOR INTRODUCTIONS FROM OSTP TO PARTIES
INTERESTED IN HIS COMPANY.

DIRECTORATE
ASSIGNED: PHYSICAL SCIENCES

STAFF
ASSIGNED:

ACTION
REQUIRED: AS/IF NECESSARY

STAFF
ACTION:

*circulate enclosures to Schroeder
Bass
Andrews*

SENDER'S DUE DATE:
OSTP DUE DATE: 12/10/92
DATE COMPLETED:

STAFF DUE DATE
DATE COMPLETED/DEPT: 12/3/92

COPIES TO: D. Allan Bromley

WHITE HOUSE TRACKING #:

CONTACT PERSON:
PHONE:

EXT:

REMARKS: *Dear Mr Cronin*

*Thank you for bringing the Murray Rotorcam
engine to our attention. Dr Bromley and I wish
you well as you continue your prototype
tests, and we hope (the tests show that) you have ~~another~~ another winner*

OSTP RECEIVED: 11/30/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES: *on your hands.*

*Sincerely
KFE*



THE WHITE HOUSE
WASHINGTON

December 10, 1992

Dear Mr. Cronin:

I am responding to your letter of November 10 in which you requested introductions to parties who might be interested in the activities of your corporation. I regret that it would be inappropriate for this office to undertake such introductions but would suggest that you contact Dr. Robert Simon in the Office of Energy Research, Department of Energy, and Dr. Robert White, the Under Secretary for Technology, Department of Commerce, both of whom have the appropriate mechanisms for making the connections that you have in mind.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "D. Allan Bromley". The signature is fluid and cursive, with the first name "D. Allan" and last name "Bromley" clearly distinguishable.

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

Mr. James J. Cronin
Murray United Development Corporation
10 Orben Drive
Landing, New Jersey 07850

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

December 3, 1992

Dear Mr. Cronin:

Thank you for bringing the Murray Rotorcam engine to our attention. Dr. Bromley and I wish you well as you continue your prototype tests, and we hope the tests show that you have another winner on your hands.

Sincerely,

A handwritten signature in dark ink, appearing to read "Karl A. Erb", with a long horizontal flourish extending to the right.

Karl A. Erb
Associate Director
for Physical Sciences and Engineering

Mr. James J. Cronin
Treasurer
Murray United Development Corporation
10 Orben Drive
Landing, NJ 07850

MURRAY UNITED DEVELOPMENT CORPORATION

10 Orben Drive • Landing, N. J. 07850

(201-770-3201)

November 10, 1992

The Honorable D. Allan Bromley
Assistant to the President for
Science & Technology
Old Executive Building
17th & Pennsylvania Avenue, NW
Washington, D.C. 20500

Dear Dr. Bromley,

Murray United is successfully testing the prototyped principles of a new internal combustion engine, the Rotorcam Engine (RE). Developed by its founder, Jerome L. Murray, the Rotorcam addresses many of the engineering and societal issues confronting the design of internal combustion engines.

Originally conceived to reduce emissions, the design's flexibility has assumed a number of other characteristics that now rival the original design goal. Paramount to emission abatement are multiplicity of fuel sources, operational simplicity, component reduction, exceptionally high power-to-weight ratio and scalability. These salient aspects qualify the RE as a very unique innovation.

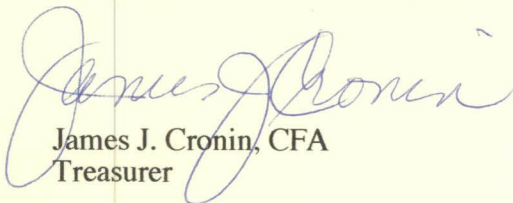
Indeed to make the assertion that the RE simultaneously transcends the technical performance hurdles across the broad spectrum of industrial and transportation applications is a bold statement. Nevertheless, the first prototype is generating test cell data that clearly points in that direction. We believe we are breaching previous world class performance benchmarks for torque.

We have our work cut out for us in the days ahead. However, the dramatic readings we are recording argue in our favor that we have not only proven the scientific hypothesis imbedded in the original drawings but have unveiled a true technological breakthrough in engine construction. Such invention will represent the turning point for domestic manufacturing and return Americans to working with their hands again.

Our note to you was composed with the forethought that every major technological introduction required the serendipitous interplay of complimentary technological forces and effective endorsement of influential members of the Fourth Estate, Industry and, of course, Government. Introductions by your office to interested parties would be most beneficial to our company.

Enclosed are materials that will highlight our corporate background. What is not clear is the definite potential for the company to assume a stature equivalent to that of its founder. Such metamorphosis is currently in progress.

Sincerely,

MURRAY UNITED DEVELOPMENT CORPORATION

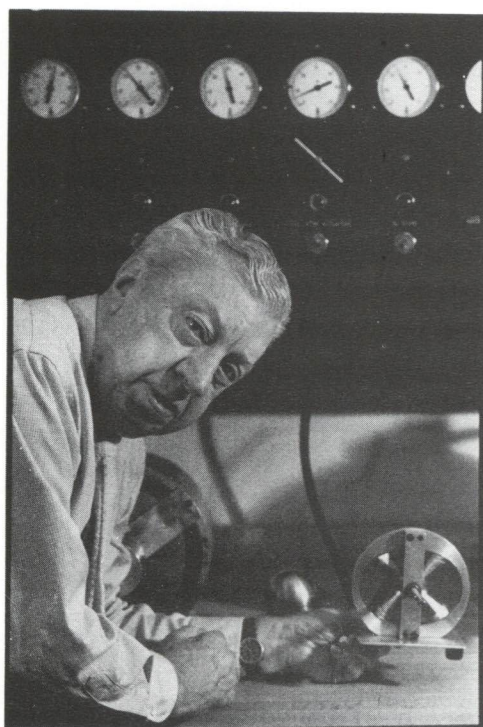
James J. Cronin, CFA
Treasurer

FACES IN THE CROWD

Maybe It'll Run on Gin

When the energy crisis struck in the seventies, most people de-

the verge of revolutionizing the automotive industry.



Jerome Murray, the father of inventions

cided to cancel their weekend drives. Jerome Murray chose to redesign his car's engine. The 78-year-old inventor is now on

fall. The inventor—who sank \$250,000 of his own money into the project before his Landing-based Murray United Develop-

ment Corporation went public—expected the long incubation. His brainchild is the Rotorcam engine, a rotary internal-combustion engine that burns almost any fuel, from natural gas to gasoline of all octanes. Running up to 35 percent more efficiently than conventional engines (according to tests) and weighing 40 percent less, the Rotorcam puts out fewer pollutants and could take up to 100 pounds off a car's weight.

After a successful battery of tests this year, Murray hopes to license the design by

ment Corporation went public—expected the long incubation.

"When the light bulb lights up, it does so very slowly," says Murray, who oversees all his projects. "I'd like to live to be 150 years old to accomplish some of the ideas I have in my head."

A Massachusetts Institute of Technology graduate "and a Leo, in case you want to know," Murray began as a pilot in the early days of aviation. He was one of three people to fly in the *Spirit of St. Louis* and once shuttled Fred Astaire and his sister to a show in Lake Placid.

Murray got a taste for inventing while working for an aircraft hydraulic company during World War II. He went on to patent some 50 inventions, beginning with the pressure cooker in 1946. His favorite is the peristaltic heart pump, which pumps blood without destroying cells. Murray gave away the license for that one when the commissioning hospital was unable to pay him.

"My philosophy in life is that you don't take everything. Sometimes you give something back," he says. "There are a lot of people walking around that wouldn't be here if that were not invented."

—Susan Karlin

Inventor Murray practices philosophy in creative pursuits.

Continued from Page 1

boarding. I said, 'Hell, no! They'd rather have their comfort.'"

Murray literally gave away what he considers his invention with the greatest social impact: the peristaltic pump.

Murray had just finished demonstrating the new pump's power and efficiency (92 percent) when officials from Johns Hopkins Medical School came calling to test it on blood. To their delight, they found the pump caused virtually no damage to blood cells.

"They turned to me and said that, unfortunately, they didn't have any money to offer," Murray recalled, "so I told them to take it, gave them a license free. Since then, it's been used in every heart operation."

"You don't take everything in life," he added. "Sometimes you have to give something back."

Another of Murray's big sellers has been the magnetic stirrer, found nowadays in nearly every laboratory. Licensed to Fisher Scientific in 1965, the device solved various problems faced by chemistry laboratories in the proper mixing of fluids. Sales have reached 20 million. Murray also tried to market it as a kitchen appliance but failed.

Among his other inventions are the AMC pressure cooker (1947), six-way power automotive seat (1955), electric carving knife (1959), high-speed dental drill (1959), jet engine power-thrust indicator (1960) and a hair-waving device (1969).

He also invented an automotive rainswitch that automatically activated the closing of a convertible top at the onset of precipitation.

Hereditary And Hands

Murray has heredity to thank for his genius. His father, Louis Jerome Murray, was a successful inventor who developed a button-hole machine. He was roundly condemned in New York City for

putting women garment workers out of jobs.

Although he earned a bachelor of science degree in aeronautical engineering from Massachusetts Institute of Technology in 1935, the younger Murray, now 73, thinks he would have been a better inventor without it.

"You tend to get conservative with a formal education," he said. "Thomas Edison, Henry Ford and Henry Firestone all came from one-room schoolhouses. An engineer's mind is very methodical. They're plodders, very uninteresting people. Creativity is a great gift."

As a child, Murray said, he was always taking apart his toys and putting them back together.

Aside from being born with the aptitude, Murray said believes that would-be inventors have to be good with their hands. "You can't just have things on paper," he said. "If you want to market anything, you have to make the model."

Moderation

Unlike eccentrics, Murray has kept reasonable and consistent hours throughout his career. He has generally worked from 9 a.m. to 5 p.m. five days a week and he's never taken his ideas and thoughts home. Only occasionally has he "burned the midnight oil."

"During any day, you only have a certain amount of creative time," he said. "I've found that to be about two hours a day. The rest of my time I spend on rubber-stamping."

Perhaps because of his schedule, Murray remains fresh, alert and vibrant. "I'm a happy personality," he said. "I wake up and I can't stay in bed."

Murray says he has led a "wonderful life" in which he's been in the right places at the right times. Hanging around Roosevelt Field on Long Island in the 1920s, for example, he says he was one of

only two people who flew on the Spirit of St. Louis besides Lindbergh. On that flight, he stood on a narrow board as the earth whirled by underneath to help Lindbergh monitor some newly donated parts.

Attracted to airplanes at an early age, Murray soloed at age 15 from Roosevelt Field. During these years, he also learned from his father the safe use of tools.

Adventurous Youth

As a young man, Murray barnstormed the country in bi-planes, selling flights at each town he visited. A plane was a great curiosity at the time, he said, and whole towns led by mayors often turned out for one's arrival. He later flew Ford Tri-motors around the country for dealers.

During World War II, Murray was a test pilot and he became fascinated with hydraulics. That interest led him into his career once the war was over.

To budding inventors, Murray suggests starting with a good idea that is simple to design and produce. His first project was the pressure cooker. His nephew, Thomas Caltabiano, is developing a water-saving device that can be attached to faucets. Its virtues are that it turns on with the brush of a finger and maintains its water-temperature setting.

"You start with things like serrations on a paper clip," Murray said.

As Murray's business became known, he took on contracts with companies seeking solutions to problems, many of them Fortune 500 firms. The consulting fees, he said, paid the overhead for renting space and hiring people, and it helped him finance his own projects.

As part of his "give-it-back" philosophy, he worked for the National Aeronautics and Space Administration from 1958 to 1968 for \$1 a year. He was too old to be

accepted as an astronaut, so he served as director of navigation for the space agency.

Murray resided and worked in New York City from the end of the war until last year. For 20 of those years, he leased an apartment and workshop at 37th Street and First Avenue, along the East River. He moved out to this area specifically to complete his engine project, which he thought would be too noisy for his New York shop.

Asked how much money he has earned over the years, Murray gave the some answer he ostensively gives financial reviews: "Use your imagination."

Offers Help

Money, however, has never been a trapping for Murray. His office, even now, is modest. Except for his home in Budd Lake, he owns no real estate, although he may build a substantial home in the area.

Pastimes, like card games, don't interest him. He likes boating, but for the most part, his work has been his fun.

"Don't ever retire," he advises. "That's when you start to dig your grave."

About the only thing that dismays him is what he perceives as the lack of inventors in the country. "Where are the Tom Edisons and Henry Fords of our day?" he asks. "We've gone downhill so much with regards to creativity. Forty-five percent of our patents are issued to foreigners."

That is one reason he'd like to help would-be inventors who have no understanding of the patenting system and "get tied up with unscrupulous patenting firms." And it would be another way for him to give something back.

Murray may be reached at his office, 770-1498.



(Photo by Gene Sheneky)

Lifetime Of Inventiveness

Jerome Murray, a renowned inventor who recently moved to Budd Lake, looks over the peristaltic pump, which has been used in heart operations since 1955. Murray has leased a Roxbury office and workshop to complete production of an internal-combustion engine that is lighter, cheaper, more powerful and more reliable than today's engines.

Inventor Jerome Murray practices giving philosophy in creative efforts

By RON PANKO

Staff Writer

One of the nation's most prolific inventors has come to Roxbury Township to develop an engine that could revolutionize the auto industry.

Jerome Murray, a resident of Aldersgate Circle in Budd Lake for about a year, has leased space in an office building on Orben Drive.

His staff of engineers and machinists will soon occupy a workshop in which they will build full-sized power plants from working models that Murray has already developed. Once that task is complete, the engine will be put into a vehicle for testing in Detroit.

Murray's company, the Jerome Murray Corp., has devoted a quarter-million dollars in 11 years to development of the working model and expects to raise \$1.5 million next year to further the project.

According to Murray, the new engine is of a rotary cam design. It has only about half the working parts of current car engines, will weigh about 40 percent less and will cost 40 percent less to produce.

However, it will produce more power. It will also be able to run on

At 73, man who invented power car seat, flew with Charles Lindbergh, has turned attention to new auto engine

much lower octanes than traditional engines, perhaps as low as 40, and will accept either diesel or gasoline.

In addition, Murray conservatively estimates that the engine will result in a 30 to 35 percent increase in fuel economy.

"This engine should have tremendous applications right down to lawnmowers," said Murray on Friday at his office. "It may also signal the return of large cars since Detroit has always made the most money from those models."

He estimated, however, that the public won't see the new engine in its vehicles for about eight more years, even though he doesn't expect Detroit to have to retrofit its plants to produce it.

Based on the working model he has already developed, Murray predicts the new engine will set the standards for durability and reliability. The little machine is so versatile that Murray is able to instantly reverse it, with the flick of a switch, even at high revolutions per minute.

Productive Record

Murray's inventions range from the sophisticated and technical to the many simple items that have become part of everyday American life. The television antenna rotator, patented in 1949, has earned Murray 75 cents for each of the 38 million sold.

Two other of Murray's major inventions are commonly seen at airports. Thinking that passengers disliked walking outside to board planes, in 1950 Murray invented the airline passenger bus and the airport jetway.

The bus, whose passenger compartment rises to different levels, enabled prompt and convenient loading and unloading at remotely located aircraft. The jetway is the telescopic walkway through which passengers at most airports enter planes directly from the terminal. The first jetway was constructed in 1950 at Miami International Airport.

"At first, airport managers were reluctant to try them," Murray recalled. "They said passengers wanted to see the planes they were

What's Inside

FRONT SECTION

Editorials, Letters	4,5
Legals	11
Movies	17
Obituaries	7
Court Rulings	12
Police News	2
Sports	18-20
Religion	6

ENTERTAINMENT

Art	4,5
Dance	2,3
In The Parks	12
Music	14,15
Theater	10,11
What's Where?	6
Front section 20 pages, Entertainment Guide 16 pages, Shopping Guide, 26 pages.	

Inventor hopes engine will revolutionize automobile industry

By CAROLYN MCGEE
Contributing Writer

MOUNT OLIVE TWP. — Although he is probably the area's most successful inventor in terms of number of patents and commercial sales, Jerome Murray will not be found in a dimly lit basement laboratory surrounded by switches and gauges hovering over a contraption that appears to be made of coathangers and springs.

Instead, Murray's workplace in Landing looks like any other place of business: a bright open office sparsely furnished with a few desks and chairs where warm friendly people chat and sip coffee.

Perhaps this is due to the fact that Murray, who lives in Budd Lake, prides himself on being quite a businessman.

Although he earned his undergraduate degree in aeronautical engineering in 1935 at the Massachusetts Institute of Technology, Murray believes the small business is a better creative environment than the classroom.

He should know, having achieved a long list of creative successes through the small company he founded in 1953, the Jerome Murray Corporation.

Now, with a costly and extremely valuable invention in the works, Murray has opened up his doors to the public.

After investing \$250,000 in personal funds in his latest project, the rotorcam engine, Murray created

The Murray United Development Corporation three years ago and has raised \$750,000 through the sale of 1,000 shares of stock.

He still owns 70 percent of the development corporation and his own Jerome Murray Corp., but, at 77, Murray would prefer not to risk all of his own earnings.

Judging from his past record, stockholders should be comforted in knowing that to Murray, investing is hardly a risk.

Many of Murray's past achievements are still in use today. Although his name won't be mentioned as a traveler goes from the airport to the plane without ever stepping outside, Murray invented the "jetway," which arrived on the scene in Miami in 1950.

Among his more than 50 patented inventions are the ball typewriter, the power automotive seat, the high speed dental drill and the electric carving knife.

With a number of household gadgets to his name, Murray speaks most fervently about the devices which have done more than just save time for the average homemaker.

His magnetic mixer, although intended for use as a home appliance to clean pots, mix cake batter and cocktails, as well as a dozen other uses, was later licensed by Fisher Scientific in 1965 for use in chemical laboratories to mix fluids.

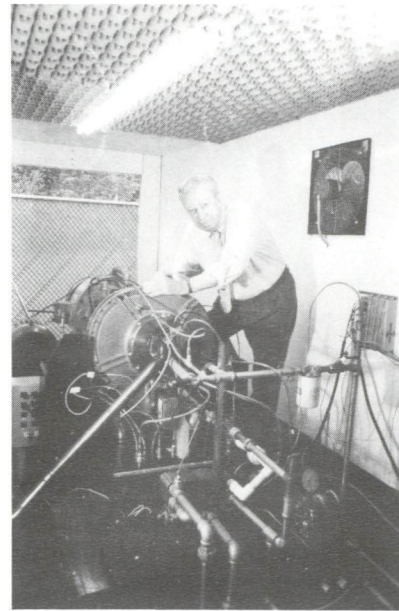
In 1947, after several years of aviation experience before and during World War II, Murray developed a pressure cooker that not only won the top award from the Consumer's Union as best and safest but also was the first pressure cooker approved for the blind because of its audible note rather than gauge design.

Perhaps Murray's greatest invention to date was his most valuable gift to humanity.

After Murray's peristaltic pump was written up in *Business Week*, a team of officials from Johns Hopkins Medical School phoned him, saying that they needed a pump that wouldn't change the molecular structure of blood cells being pumped through its tubes.

"So they came from Baltimore with vials of blood and microscopes," said Murray and found that, indeed, his pump did not damage the cells.

Upon returning with their find



Inventor Jerome Murray shows his revolutionary invention — an engine that will burn cleaner and more efficiently than today's models.

ings, they again called Murray with news that their grant money had run out. So Murray gave them a free license on the "heart" pump, which has been used in heart operations since 1955.

Murray's philosophy on his craft is "You can't take everything with you. You've got to give something back."

The philosophy was ever-present in Murray's years at NASA from 1958 to 1968 when he served as director of navigation for \$1 a year.

His main project for the past 15 years, the rotorcam engine, also promises to give something of value back to mankind.

Keeping in mind the public's mounting concern for the environment, Murray developed an engine that releases energy faster, allowing less combustion to build up and therefore produces less pollution.

The automakers in Detroit will consider the level of emissions but also will be interested in the engine's fuel economy, torque at various speeds, and horsepower.

Murray has been testing the full-size engine in a trailer behind his Landing office building, slowly building up speed in his million dollar investment. He was happy to say that, thus far, the engine has "clean exhaust and is very economical as far as fuel economy."

The engine also has lower idle speeds, high torque at low speed, and contains an innovative device that senses when the engine "pings or knocks" and adjusts the compression accordingly.

Another important characteristic is that the engine has 59 percent fewer parts, no crankshaft and therefore

costs and weighs less.

Murray demonstrated his invention and showed that it has the characteristics of an eight cylinder engine, as the cylinder turns as a single spark plug creates a power stroke every 90 degree turn.

The rotorcam engine, however, is ten inches long and as it rotates acts a gyro which helps to stabilize the car. The engine also requires low maintenance and Murray said it is "so simple, anyone can work on it."

Murray's engine also can burn any fuel including gasoline, kerosene, diesel, JP4 (an aircraft fuel) and even natural gas. The rotorcam engine is also extremely functional and can be used in automobiles, marine craft, aircraft and even lawn mowers.

Murray's representatives have been updating auto experts in Detroit and Washington, D.C. about the status of the rotorcam engine and Murray said he was excited about the possibility of securing a license for the engine in the near future.

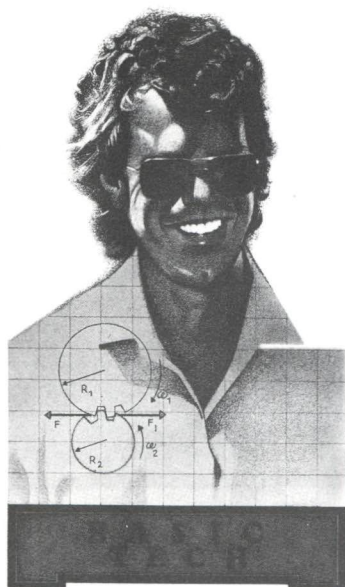
Like any inventor, Murray has faced skepticism and criticism in the past.

His father, Louis Jerome Murray, invented the buttonhole maker and was ridiculed for putting garment workers out of business. Similarly, Jerome Murray was condemned when his magnetic mixer was advertised as a cocktail shaker.

In recent years, Murray's main hindrance was in working in New York City where he and his colleagues encountered noise and fire problems while working on the rotorcam engine.

Murray was "fed up with the city" and moved his company and his team of engineers to Landing in 1985.

AUTOMOBILE



BY BARRY WINFIELD

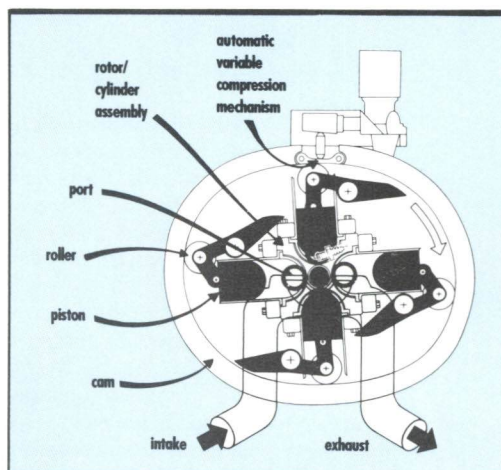
Rotorcam: getting away from steam technology.

Landing, New Jersey—According to Jerome L. Murray, the inventor who gave us devices such as the jetway, the electric carving knife, the power automotive seat, the high-speed dental drill, and the ball typewriter, today's automobile engines still use steam technology. And he's right. However far the piston engine may have advanced in recent years, its basic piston-and-crank configuration was initially contrived for the steam locomotive.

Two disadvantages of using the piston-and-crank for compressing and igniting its own fuel are: the emissions produced while the piston is still around its top-dead-center position, where piston acceleration is slow because of the crank rotation; and the varying moment arm that results for the same reason. There isn't much mechanical advantage until the piston reaches about 22 degrees after top dead center.

These glaring shortcomings have been addressed in Murray's latest project: the Rotorcam engine. Like most original solutions to engineering problems, the idea behind the Rotorcam seems simple in retrospect. Whereas most of us can appreciate a clever idea when we see one, not many of us have the ability to make the necessary lateral shifts of logic, the intuitive leap, or whatever else you might want to call the process of creative originality.

Murray clearly does. His many useful inventions prove it. He has now turned his hand to developing an alternative internal-combustion engine, and he has the track



The photograph (opposite page) shows a working prototype of the Rotorcam, not yet fitted with the counterbalancers you see in the diagram (left). Cylinders, heads, ports, and output shaft are an integral unit. The pistons act on the inner surface of the cam via rods and rollers, and the elliptical shape creates their reciprocating motion.

swinging around to avail themselves of their functions. The pistons on the "long" side of the ellipse

record and the credentials to do it. An MIT graduate in aeronautical engineering, Murray is also a former director of navigation for NASA and a disconcertingly bright individual to boot.

After putting \$250,000 of his own money into his Rotorcam engine idea, the seventy-eight-year-old inventor formed Murray United Development Corporation and raised another \$750,000 through a public offering. Although it's a minuscule amount of finance in conventional auto industry terms, this brought him enough money to acquire an engine test-bed dynamometer and pay technical collaborators.

Not surprisingly, the aeronautical background shows to some extent in Jerome Murray's new Rotorcam engine, which is already up and running, undergoing development. It is, to the casual observer, something like a radial aircraft engine turned inside out. Four cylinders are arranged around an output shaft at 90-degree intervals, but instead of being attached to a central crank, the piston rods face outward and the cylinder heads are at the center of the cruciform. The cylinder assembly is housed within an elliptical casing (the cam), and the piston rods act on its surface via rollers. When a piston is forced outward by the combustion pressure, the rod and the roller naturally seek the widest sector of the ellipse, forcing the cylinder assembly to rotate within the cam.

As one piston completes its ignition stroke, rotating the assembly through 90 degrees, it brings the next piston in line up to the ignition point. In the process, it initiates the compression stroke for that piston, the ignition point being at the short radius of the ellipse. To reduce side loadings on the piston and its rod, Murray designed the cunning "nutcracker" linkages you see in the diagram and incorporated the counterweights to reduce the effects of centrifugal force. (The linkage is fixed at the axis above the roller on the counterweight side, lending the piston rod a rocking action.)

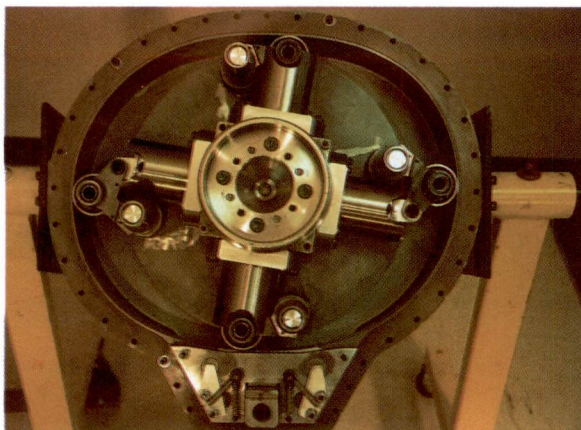
The real beauty of the idea is that the engine only requires one spark plug, one inlet port, and one exhaust port. These all remain stationary while the cylinders

are at the bottom of their intake and power strokes while the pistons at the "short" side are in compression and exhaust strokes. Valving is handled by a simple rotary disc valve, which keeps the ports of each cylinder closed except when they are in the induction and exhaust phases. No camshaft is necessary, and port shape and size can be varied to alter the amount of timing dwell. In addition, with no valve seats to worry about, there is an opportunity to use very lean mixtures.

Murray's four-piston Rotorcam principle produces a power stroke every 90 degrees. It takes eight cylinders to achieve four power strokes per revolution in a normal four-cycle crankshaft engine, with all the complex componentry a conventional overhead-valve format demands. Murray's engine needs only a simple ignition timing pickup to trigger a spark and can make do with one carburetor or—better still—one fuel injector. That's a big deal—injector plungers are expensive items.

Because ignition always occurs at the same point on the cam's circumference, Murray has incorporated an ingenious knock-control system. A movable plate or segment of the cam's surface is mechanically controlled, moving in and out to vary the piston's position at the point of ignition. A knock sensor monitors ignition quality and instructs a control device to reduce the compression ratio until the knock disappears. That renders the engine insensitive to fuel quality and octane. Indeed, it offers the concept an important degree of fuel flexibility, suggesting that it might be fueled by any one of a variety of combustible liquids. The Rotorcam's profile could also be engineered for a full exhaust stroke for optimal gas evacuation.

Another advantage of the Rotorcam principle is that—like the aircraft radial engine that was clearly part of Murray's mental picture—the cylinders cool themselves as they rotate. Murray points out that aircraft radials were so effective in doing this (even with almost complete shrouding) that they frequently stalled during takeoff attempts. So he envisions an engine with oil cooling only. Even here there are resonant



synergies at work, because the rolling elements traversing the cam will splash oil into the cylinder bores and under the piston skirt as a natural consequence of their operation.

Will the Rotorcam work? A practical demonstration we witnessed in Murray's trailer lab proves that it already does. And if the tiny, beautifully crafted scale model powered by compressed air that Murray showed us is anything to go by, the Rotorcam will fulfill all the promises suggested by its wonderful conceptual symmetry. Clearly, the inventor has to be taken seriously. His work is as meticulous as his mind.

When Murray and his associates fired up the Rotorcam prototype they have on the dyno, it stuttered to life and then produced a notably quiet exhaust note from its completely unmuffled stack. The character of the sound is remarkably linear, as you might expect from an engine that produces an ignition event every 90 degrees. The engine idles at an extraordinarily low 50 to 70 revolutions and produces its peak output at equally moderate speeds. Murray says the maximum rotational speed is on the order of 3000 rpm, when there is a tolerable 6000-psi roller loading.

He contends that the engine should be installed horizontally in vehicles so that the gyroscopic forces of the rotating cylinder assembly might stabilize the vehicle. He also foresees the engine being fitted in stages—with two or more modules stacked so that they can be decoupled according to the demands of economy and performance. Manufacturing costs could also be significantly reduced with the Rotorcam. Murray thinks the outer cases could be simple pressings, and the cam might be stamped and laminated.

The sheer reduction of moving parts is another manufacturing asset, and the simplicity of the principle is likely to guarantee outstanding reliability. But Jerome Murray is a realist, and although the Rotorcam engine prototype has demonstrated promising performance at extremely low emissions levels, he knows it is still a way from being fully developed.

He predicts the first uses of the Rotorcam to be industrial, in stationary applications. However, you don't need Murray's remarkable vision to see the potential of this system as a vehicular powerplant, so we'll just await developments. 

The New Jersey PRIDE AWARDS

We can all be excused for dwelling on the negative this year. A war and a big tax increase will do it every time. That's why the accomplishments of 1991's New Jersey Pride Award honorees are so remarkable. With newspapers churning out bad news, these ten people and one organization were still able to grab our attention—and, we hope, inspire others—with their remarkable work. The winners include two women in the medical world who are battling AIDS and a man whose vision resulted in our practice of recycling newspapers; the dedicated president of Trenton State College and a woman who reaches out to victims of domestic violence. As their stories show, having a giving heart is not always easy. But it is worthwhile.

portraits by
CHRISS WADE
and
TIMOTHY REAGAN

SCIENCE AND TECHNOLOGY JEROME L. MURRAY

For inventor Jerome L. Murray, life is an endless road of possibilities and potential. For a man who describes himself as "78 and holding," the trip has been long and rewarding.

"Inventing fills me with a sense of accomplishment," he says. "You know you've done something that has never been done before."

One of New Jersey's most prolific inventors, Murray owns more than 50 patents and is responsible for such conveniences as the electric carving knife, the airplane boarding ramp (the Jetway), the rotary engine, and the peristaltic pump (which made open-heart surgery possible).

Murray has had no problem coming up with great products, because he loves his job. "You wake up in the morning and don't want to get out of the playpen," he says.

His fascination with inventing grew after he graduated from the Massachusetts Institute of Technology and worked as a test pilot for a hydraulics aircraft company in Cleveland. At the end of the World War II, "[I] had sixteen brand-new dollars in my desk drawer for patents that I had acquired on behalf of the company." In 1946, he decided to venture out on his own and open his own company, Jerome Murray Corporation. He formed the Murray United Development Corporation in 1987 to finance the cost of his rotary engine.

A successful entrepreneur, Murray attributes most of his prosperity to his love of the business world. "There are a lot of creative people that have no business knowledge at all," he says. "I've seen a lot of patents that have never gotten off the ground because the inventor couldn't sell [the product]. For me, the selling is a game of wits. It's my chess game."

Murray claims he gets the inspiration for his inventions from watching and listening to people. "If they have a problem, I like to solve it."

—Sandra Di Cesare



CHRISS WADE

MURRAY UNITED DEVELOPMENT CORPORATION

10 Orben Drive • Landing, N. J. 07850
(201-770-3201)

November 10, 1992

The Honorable D. Allan Bromley
Assistant to the President for
Science & Technology
Old Executive Building
17th & Pennsylvania Avenue, NW
Washington, D.C. 20500

Dear Dr. Bromley,

Murray United is successfully testing the prototyped principles of a new internal combustion engine, the Rotorcam Engine (RE). Developed by its founder, Jerome L. Murray, the Rotorcam addresses many of the engineering and societal issues confronting the design of internal combustion engines.

Originally conceived to reduce emissions, the design's flexibility has assumed a number of other characteristics that now rival the original design goal. Paramount to emission abatement are multiplicity of fuel sources, operational simplicity, component reduction, exceptionally high power-to-weight ratio and scalability. These salient aspects qualify the RE as a very unique innovation.

Indeed to make the assertion that the RE simultaneously transcends the technical performance hurdles across the broad spectrum of industrial and transportation applications is a bold statement. Nevertheless, the first prototype is generating test cell data that clearly points in that direction. We believe we are breaching previous world class performance benchmarks for torque.

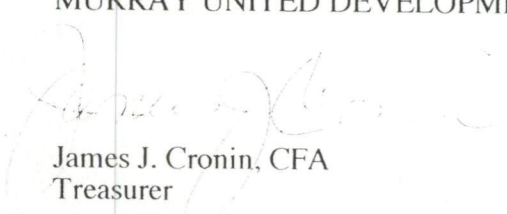
We have our work cut out for us in the days ahead. However, the dramatic readings we are recording argue in our favor that we have not only proven the scientific hypothesis imbedded in the original drawings but have unveiled a true technological breakthrough in engine construction. Such invention will represent the turning point for domestic manufacturing and return Americans to working with their hands again.

Our note to you was composed with the forethought that every major technological introduction required the serendipitous interplay of complimentary technological forces and effective endorsement of influential members of the Fourth Estate, Industry and, of course, Government. Introductions by your office to interested parties would be most beneficial to our company.

Enclosed are materials that will highlight our corporate background. What is not clear is the definite potential for the company to assume a stature equivalent to that of its founder. Such metamorphosis is currently in progress.

Sincerely,

MURRAY UNITED DEVELOPMENT CORPORATION


James J. Cronin, CFA
Treasurer

The Edison Legacy

Following that tradition, New Jersey is home to several world class inventors

By Mel Mandell

New Jersey wasn't named the "invention state" merely because the greatest inventor of all time, Thomas A. Edison, established his laboratory in West Orange. It is also the home of such "world-class" inventors as Dr. Alfonso Di Mino, Jerome Lemelson, Calvin McCracken, Jerome Murray and the late Jan Rajckman.

IMPORTANT INVENTIONS

Between them, they created some of the most important inventions of our time. Di Mino, who previously focused on developing safe alternatives to toxic chemicals used in industry, is now promoting his Sonotron instrument, which purportedly relieves the pain of arthritis.

Lemelson, who holds more patents—over 400—than any other active American inventor, now concentrates on medical instruments. McCracken created the heating/cooling systems for space suits worn by astronauts on the moon.

Murray invented the peristaltic pump used to keep patients alive during heart surgery. And Rajckman came up with some of the key inventions in computing before his death last year.

ADVANCING YEARS

Emulating Edison, who received the last of his 1,093 patents when he was 83, the first four are still inventing, in spite of advancing years. Murray, now 77, is developing a rotary internal-combustion engine that can burn most any fuel, yet weighs 40 percent less than a conventional engine generating the same power.

Technical writer Mel Mandell was formerly consulting editor of High Technology Business magazine.

McCracken, 70, is perfecting an "off-peak" airconditioning system that makes ice during the middle of the night and is used for cooling during the day, when electrical demand is high. Lemelson, 66, is attempting to produce his talking thermometer for blind people who live alone. And the 69-year-old Di Mino's next objective is his most demanding: a cure for cancer.

COSTS ARE HIGH

Unfortunately, the cards are often stacked against individual (read non-corporate) inventors who have so much to offer. The first problem is that the cost of obtaining and keeping a patent has risen astronomically.

Moreover, if you also attempt to patent outside the United States, an expensive process, you may wait decades for the patent to be awarded.

The granting of a patent doesn't protect inventors against theft of their intellectual property. Lemelson has spent over a million dollars to gain redress from giant corporations that infringe on his many patents. Recently, a federal court awarded him damages of \$25 million from the Mattel Corporation for infringing on his patent for the "hot wheels" toy.

The unwillingness of some corporations to pay fair licensing fees may also have deprived the world of useful inventions. Over 30 years ago, Lemelson offered a major U.S. manufacturer a license to his no-power-required blinking reflector. (It reflects back light from headlights of approaching cars). The company offered him one tenth of one percent of sales as a royalty, instead of the reasonable two percent he requested.

Fortunately, not all giant corporations

urge individual inventors to commercialize their own inventions. However, Lemelson's own record at commercializing is poor. Lemelson is still trying to find a semiconductor manufacturer to make the special integrated circuit he needs to make his talking thermometer cost effective.

MARKETS BY HIMSELF

McCracken does commercialize his own patents. But as soon as the business turns profitable, he sells it and the patents supporting it to some giant corporation, and starts all over again. He's done this successfully and profitably no less than eight times.

Murray insists that most individual inventors are "lousy businessmen." He claims that he was successful at commercializing some of his inventions because "...I am a businessman first and an inventor second." Di Mino agrees with Murray, leaving commercialization of his most recent creations to his son Andre, who is executive vice president of the company, ADM Tronics in North Vale.

Nearly all of these world-class inventors were encouraged by some relative or colleague. Both Di Mino's grandfather and father were accomplished inventors. Murray's role model was his father: he invented the machine that makes buttonholes—and was denounced by the women who sewed buttonholes by hand. McCracken spent a summer as a young engineer working for Theodore Edison, the younger son of the famous inventor.

FOREIGN INVENTORS

Most of these inventors note that an ever-increasing share of U.S. patents—close to half—goes to foreigners. That's why

they want to see more inventors advanced as role models.

They feel too many bright young people take up law or want to work on Wall St., which does little to build the technological strength of the nation. McCracken's concern is that too many children never learn to read well, a formidable block to developing one's technical capability.

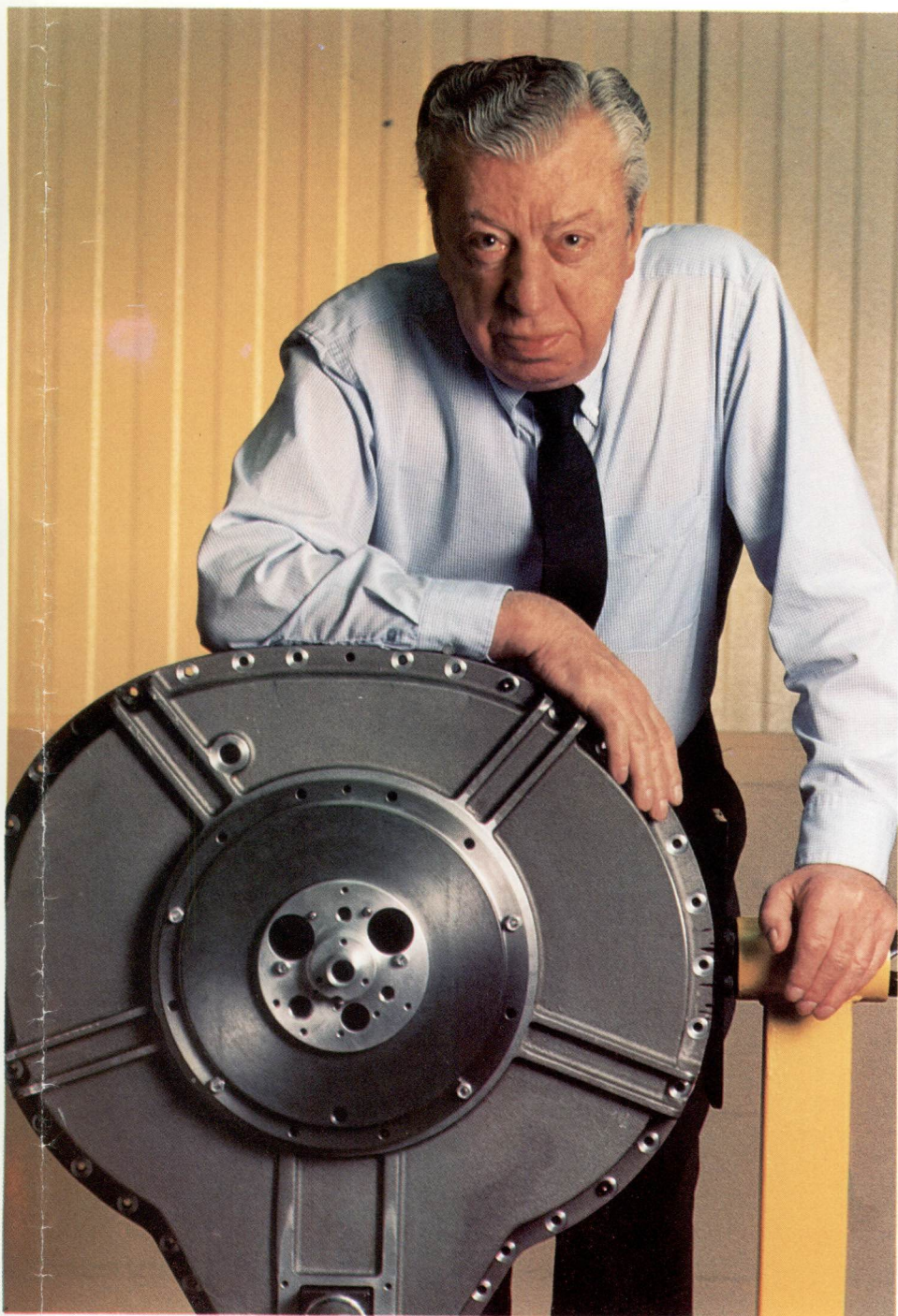
McCracken also decries the extreme conservatism of eastern bankers, including those in New Jersey. In contrast, bankers in the midwest and far west are far more encouraging, he says, to the entrepreneurs who are likely to exploit new inventions.

HALL OF FAME

On the bright side, New Jersey has established a Hall of Fame for inventors. It is on the campus of the New Jersey Institute of Technology in Newark. McCracken was one of the first inducted.

The inventing life, if successful, can be a long one. All of these inventors insist that they will never stop inventing. Di Mino says he intends to devote the next 20 years, if necessary, to finding a cure for cancer. That's no idle boast, since his grandfather, who invented the self-priming pump, lived to be 92.

And why shouldn't they continue inventing? To a man, these world-class inventors find much in New Jersey to support their efforts—including top technical schools, a well-trained and technically sophisticated work force, and sharp consultants available to solve specialized problems. Who knows, perhaps one day one of them will surpass the record age at which an inventor was awarded a patent—100! ■



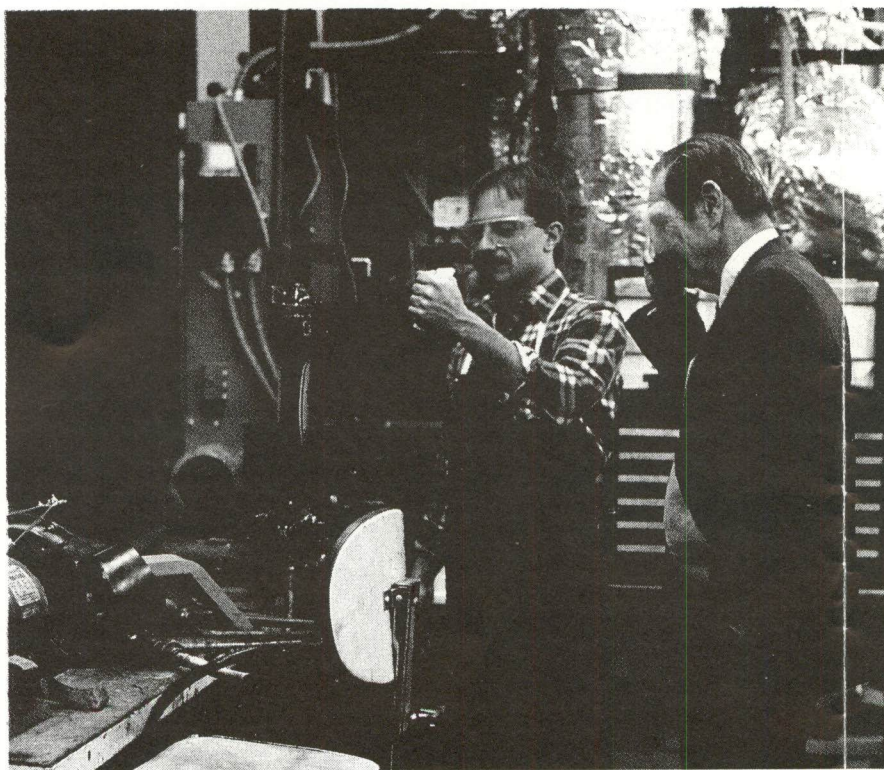
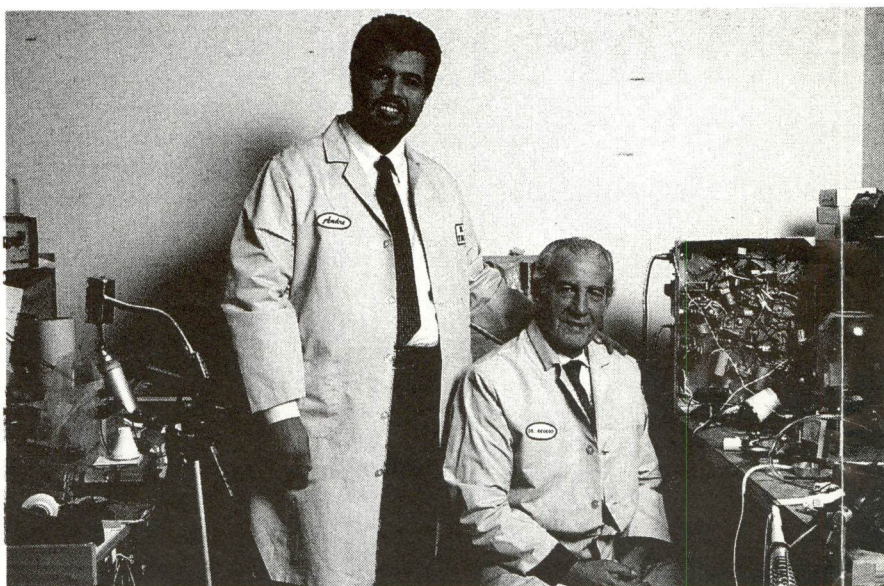
Jerome Murray invented the peristaltic pump for heart patients and stands here with his new rotary engine.

discourage individual inventors or infringe on their patents. The Becton-Dickinson Company, Franklin Lakes, has established a special office that welcomes and reviews submissions. Frank Buono, who heads this office, admits, however, that far fewer than one percent of the many thousands of inventions sub-

mitted each year are licensed.

Di Mino and Murray, unlike Lemelson, claim they have not been rebuffed by the "not invented here" syndrome widely ascribed to industry, especially the auto industry. Over the years Murray, who lives in Budd Lake, has sold licenses for many of his patents, such as the power

Photo by William Neumann



The father-son DiMino team (top) invent in their Northvale lab, while Calvin McCracken directs an assistant (below).

automotive seat, to General Motors Corporation and other giants.

Even if a patent is awarded and not infringed on, the odds are against it ever making any money for its creator. Di Mino, who lives in Woodcliff Lake, leads in commercialization, claiming that nearly all his 200 inventions (only 50 were patented) have reached the mar-

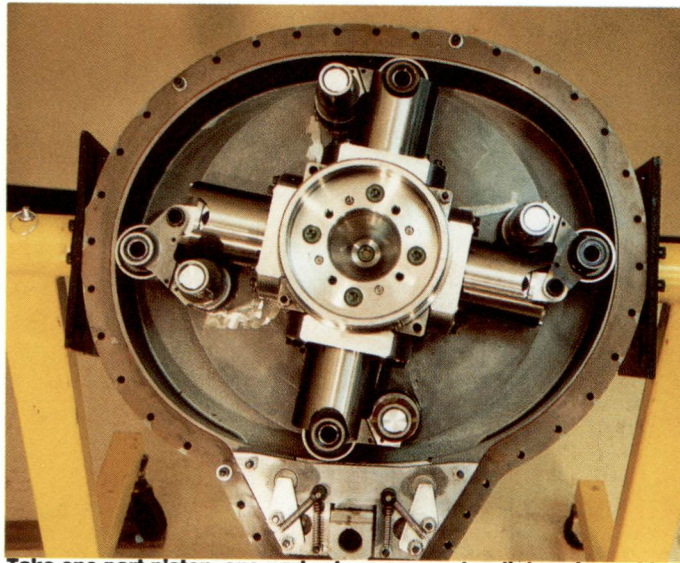
ketplace. McCracken, who lives in Englewood, has had 40 percent of his patents pay off. His advantage is that all his "50 plus" patents are in one field, heat transfer. In contrast, only 20 percent of Lemelson's many patents have been that successful.

What about marketing your own patents? Both McCracken and Lemelson

CHILTON'S *motor/age*

THE CHOICE OF AUTOMOTIVE AFTERMARKET PROFESSIONALS

VOLUME 110 NO. 8 AUGUST 1991



Take one part piston, one part rotary, one part radial engine; add variable compression and a generous helping of vision and what you get is The Rotorcam engine—brainchild of New Jersey inventor, Jerome L. Murray. See page 14

MECHANICAL

Troubleshooting	11
The Rotorcam Engine	14
Fire in the Hole	21
Domestic Factory Bulletins	46

MANAGEMENT

Industry Observer	6
Distribution & the Service Dealer	12
Aftermarket Megatrends	24
Training Resources	45

MERCHANDISING

Product Showcase	18
Buyers' Guide	48
Worth Asking For	53

TRAINING PROGRAM

Mazda 4-Wheel Steering	35
------------------------	----

OPINION

Editor's Comment	2
Calendar, Advertiser Index, Business Staff	56

TO MEET New Jersey inventor Jerome L. Murray, is to believe, that for some, life begins at 79. At an age when many are glad to have given up the *burden* of work, Murray can hardly wait to get to the office in the morning.

The current excitement in Murray's office centers around his latest invention—the Rotorcam engine. It's a rotary powerplant with the potential to run rings around its conventional engine counterparts. The claims of low rpm/high torque power, and use of far fewer parts are reason enough to take a closer look; not to mention the track record of the Rotorcam's designer.

Murray is the man who created many of the products we use everyday. For example, he invented the jetways which shield us from the elements as we board commercial flights, the peristaltic pump which made open heart surgery possible (and which he *donated* to medical science), the high-speed dentist drill, the electric knife, the power car seat, and many, many more.

Motor/age visited the inventor at his office near Landing, NJ. As he sat at his desk, watched over by about 20 miniature owl carvings on a shelf above, he told us how the Rotorcam engine was developed.

A New Vision

The Rotorcam project began about 15 years ago, with Murray's observation that the piston/crankshaft engine configuration was originally designed for steam locomotive powerplants. He knew that there is no energy generated in today's engines when a piston is at top dead center, nor for 20 degrees of its motion on either side of that point. Murray asked himself how he could eliminate the crankshaft.

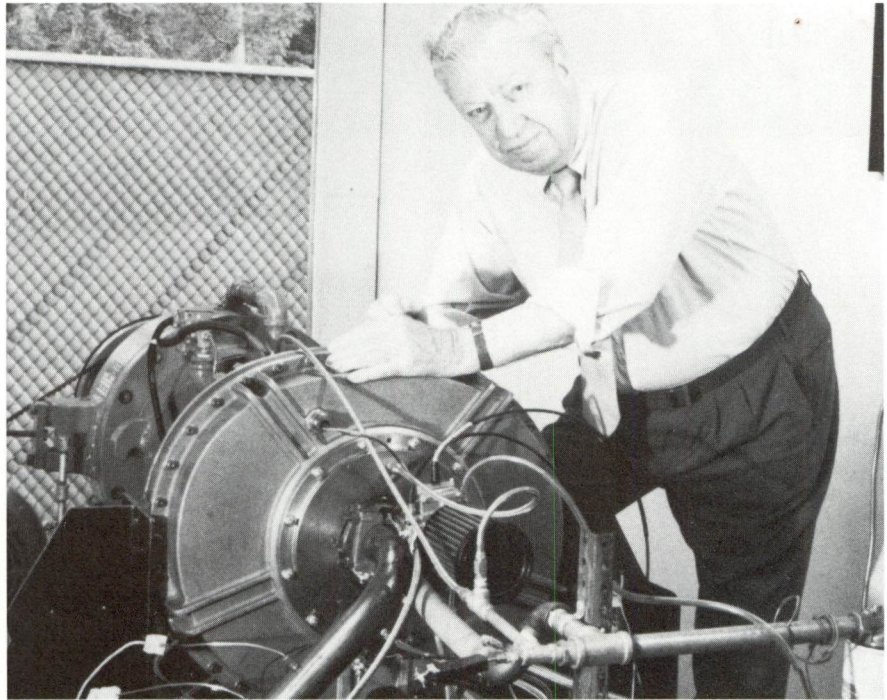
"I like to take things and turn them upside down," Murray said. This led him to the idea of what a conventional engine would look like flattened out. The Rotorcam engine is the result.

After spending \$250,000 of his own money on the project, Murray created the Murray United Development Corp. and went public in 1988 to raise more capital for the project.

Not A Wankel

Though the Rotorcam shares with the Wankel the rotary motion of its four pistons and the fact that they are housed in a casing (versus a block), the similarities end there.

When compared to a conventional Otto cycle 4-cyl. engine, there are 57% less parts to worry about. For exam-



THE ROTORCAM

By BILL CANNON, Senior Editor

MIKE RANDAZZO, Technical Editor

BUD GRONER, Performance Editor

ple, finding the crankshaft, flywheel, water pump or valve train is difficult on this engine because there aren't any! But if you can imagine a radial piston engine turned upside down, then you are on your way to understanding how the Rotorcam works.

The new powerplant is a 4-cyl., 4-stroke design that produces a power stroke every 90 degrees of rotation. Its 1.3L (3 in. bore x 3 in. stroke) displacement yields twice as many power strokes as a conventional 4-banger and more than the three power strokes per rotor revolution in current Wankels.

The main engine components are: the rotor/cylinder assembly, the pistons and the cam. Four hemispherical pistons travel on nutcracker-shaped connecting rods which are connected to rollers (pistons with rollerskates, if you will). The rollers trace their path on an elliptical-shaped cam which circles the inside of the engine casing.

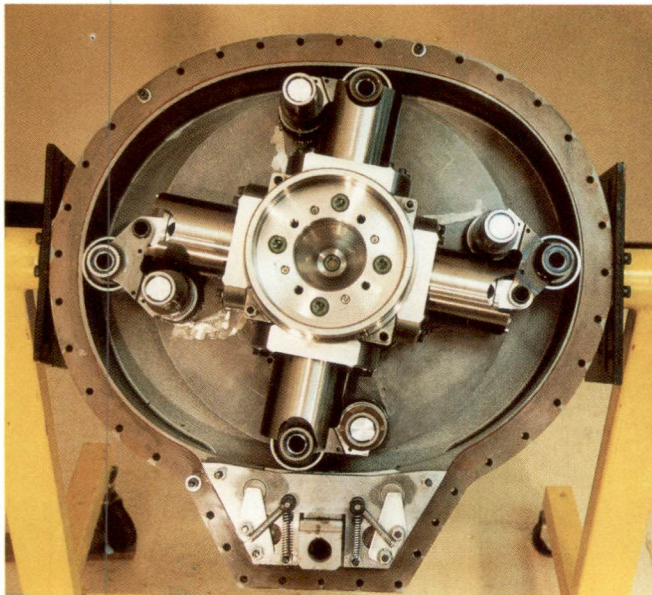
The cylinder head/sleeve portions are located at the center of the engine

and rotate along with the pistons. In lieu of the familiar valve/camshaft configuration, intake and exhaust events are accomplished by a humble rotary disc which opens and closes the cylinder ports on the firing cylinder.

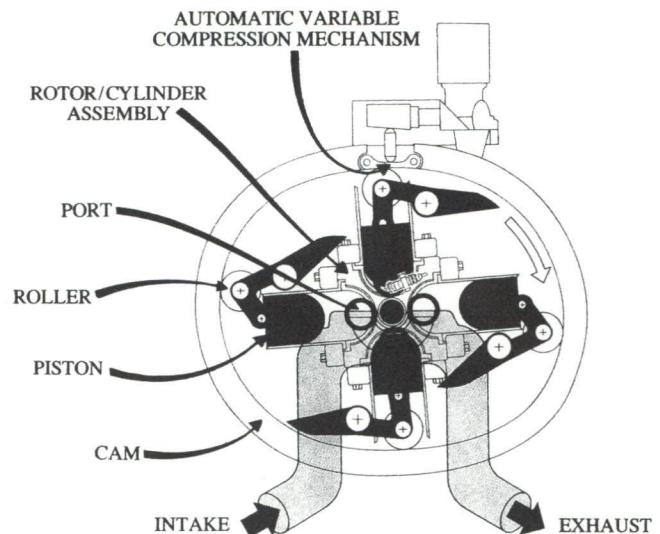
It is the cam's oval shape which imparts motion to the pistons as they rotate from the narrower to the wider portions of the ring.

Rock Around the Clock

Now, here's how the Rotorcam gets those four power strokes per shaft revolution. At 12 o'clock, the spark plug ignites the air/fuel mixture and forces the piston outward. Once in motion, the piston's roller follows the cam's contour as the entire rotor/cylinder assembly rotates. At 3 o'clock, the piston travels back to the center of the engine, expelling all exhaust gases through the open exhaust port and out the exhaust pipe. As the piston passes 6 o'clock, air and fuel are drawn back into the cylinder, and at 9 o'clock the



The Rotorcam contains conventional pistons in a new configuration. The design eliminates the crankshaft and more.



FRONT VIEW

A look at the major components and combustion events of the Rotorcam. Note the variable compression mechanism.

piston begins its downward compression stroke, to complete the cycle.

For now, a Mikuni sidedraft motor-cycle carb takes care of the air/fuel mixture, but Murray does not rule out the use of fuel-injection in the future.

The ignition system is simple in both design and execution. One spark plug handles all the ignition (back-up plugs will be installed in production versions). There is a magnet in each of the plates which holds the nutcracker and piston assemblies together. As the magnets rotate with the piston assemblies, they pass an electronic switch on the casing which triggers the spark. In this type of system, the rotary motion of the pistons actually takes the place of the distributor. Advance and retard are regulated electronically.

Vital Stats & Observations

Murray's prototype engine idles at 275 rpm, but he plans to trim that spec down to a modest 75-100 in production models. The engine is 10 in. long, 23 in. wide and stands 22 in. high.

Other engine vitals include: high torque at low rpm—33 ft-lbs at 500 rpm; 50 ft-lbs at 900 rpm; and a thrifty one horsepower per pound of engine.

Murray's estimated average miles-per-gallon figures are anything but timid. With a single-stage engine, he boasts a 30% increase over comparable displacement engines on small cars. On larger cars, such as a Lincoln or Cadillac, the claims get more aggres-

sive—55 mpg may be feasible with a 2-stage engine. In this dual design, Murray envisions stacking small and large Rotorcam versions. The larger engine would accelerate the car up to cruising speed; the smaller engine would then take over to conserve fuel.

During start-up, there is an audible *click* (as in a diesel at idle) that lasts for about 3-5 seconds. Murray attributes it to expansion of the rollers. But unlike a diesel, the Rotorcam's noise goes away. Murray says the clicking will be designed out of any production model.

A look at the engine oil outlet temperature on the control panel during a load test reveals an impressively low 104°F. The engine's unmuffled exhaust note is surprisingly meek and exhaust temperatures are also relatively low—1204°F.

Totally Flexible

Even in the multi-fuel gas stations of the not-so-distant future, if someone were to drive up to a gas island in a Rotorcam-equipped vehicle and say: "fill'er up with kerosene", you might question his/her mental integrity (or perhaps their planet of origin). But in fact, by simply varying the compression ratio (and without the aid of a legion of ECUs and sensors), Murray claims the Rotorcam can indeed run on fuels as low as 40 octane or even on a combination of fossil fuels.

This is made possible with a unique-

ly simple device known as the Automatic Variable Compression Mechanism (AVCM) which either raises or lowers the compression ratio depending on the octane level of the fuel. For the most part, the engine's cam is a continuous, rigid unit. But at the bottom of the engine there is a small, *moveable* section of the cam that is connected to the ACVM. A tiny microphone mounted in the spark plug plate listens for knocking during ignition of the air/fuel mixture. When it hears a knock, it signals an electric motor/jackscrew drive unit which moves a wedge to either lower or raise two mechanical *fingers* which move the cam in or out.

Physically moving the cam, in effect, changes the distance between the top of the piston and the cylinder head which varies the compression ratio. Even though the total movement of this flexible section is only $\frac{3}{8}$ in., it is enough to achieve a 7:1 to 17:1 compression ratio range. By freeing the engine from the constraints of (and sensitivity to) octane levels, it has the ability to burn diesel fuel, natural gas and kerosene, as easily as gasoline.

Other Advantages

Another interesting aspect of the engine is the cooling system, or more accurately, lack of one. Since the Rotorcam is a dry-sump-type design with no water pump, radiator or anti-freeze, it must rely on the engine oil

(continued on page 17)

Rotorcam Engine . . . continued

for both cooling and lubrication.

Oil distribution and cooling is accomplished by the cylinders themselves and by the windmill action of the rotating pistons. With this type of lubrication and cooling system, Murray can run the engine at 275-300°F for greater combustion efficiency. Just how efficient? Murray told *motor/age* that an initial test on the engine produced tailpipe emissions lower than California emission standards—without a catalytic converter! He claims an independent test conducted recently produced comparable results.

For testing, the prototype engine is installed vertically and is mated with a dynamometer. However, for automotive application, the engine can be mounted in a horizontal position. Murray states this will make it ideal for FWD applications.

Serviceability

Because of its fewer parts and simpler design, the Rotorcam would appear to need less maintenance than a conventional engine. And as to tear-down, once separated from the transmission, the engine can be brought to bare block and back to fighting weight in about three hours—with no special tools or machinery, Murray claims.

The engine requires no castings and won't need major OE retooling for production, Murray also asserts. As much as 60% of the engine parts can be made of sheet metal stampings.

Winged Cousins

Another similarity to the radial piston engine is the Rotorcam's inherent battle by-pass capability. That is, if one cylinder seizes up for some reason, the Rotorcam would still turn, and theoretically, produce enough power to drive the vehicle into the service bay. There is an analogy in the true stories of old war birds coming back to the flight deck or hanger with pistons shot out from enemy fire. And though the average commuter is not likely to encounter gunfire as he or she commutes to the office, a limp-home capability, for civilian, as well as for military travel, would clearly be an advantage over crankshaft-type engines.

Next Moves

Murray would not commit to an installation date for automotive applications, but he did hint that before you see it in a *Big 3* powertrain, first time use in a stationary (air compressors or co-generation) or military application is more likely.

Granted, the Rotorcam has not achieved the ideal combustion by-products of CO₂ and water. However, with variable compression and *crankshaftless* rotary motion, Murray appears to be on the right track with an engine that burns clean without the burden of expensive electronics and with fewer moving parts.

Before concluding our visit, we couldn't resist asking about all the

owls peering down from the shelf above Murray's head. "They are mostly gifts," he told us, and with mock-seriousness, quipped: "With all those eyes looking at you, you're not apt to sit at the desk doing nothing!"

And so, with all those feathered *overseers* perched above him, Murray is not likely to let up in his relentless effort to perfect this radical new way of moving us down the highway. ■

The New York Times

"All the News
That's Fit to Print"

New York: Today, rain tapering to a few showers. High 60. Tonight, clearing, colder. Low 36. Tomorrow, windy, cool, some sun. High 44. Yesterday, high 65, low 51. Details are on page B8.

THE NEW YORK TIMES, SUNDAY, MARCH 3, 1991

New Jersey Q & A: **Jerome L. Murray** Setting No Limits to Man's Inventiveness

By LYN MAUTNER

FOR the inventor Jerome L. Murray, life has been one discovery after another — the electric carving knife, the audible pressure cooker, the airplane boarding ramp and the peristaltic pump (which made open heart surgery possible), to name a few.

Owner of more than 50 patents here and abroad, Mr. Murray, 78 years old, was among 11 inventors inducted into the New Jersey Inventors Hall of Fame last month, joining such distinguished company as Thomas A. Edison and Albert Einstein.

The three-year-old Hall of Fame, which has its headquarters at the New Jersey Institute of Technology in Newark, is establishing a permanent exhibition of plaques inscribed with the names of honorees in its William S. Guttentag Information Technologies Center. As a home of early industry and agriculture, New Jersey is often referred to as the Invention State and has more than 100,000 scientists and engineers working here today.

Although his father developed the buttonhole machine, Mr. Murray said he believed that inventors were born, not made. "I've never seen courses in the art of inventing," he said. "Sci-

Q. What was your first invention?

A. I sold one of my first ideas when I was only 15 years old, to Harold Crosby of Crosby Radio, who came to Roosevelt Field — we had moved from Manhattan to Garden City, Long Island — where I had a windmill running a generator. He used the idea for farmers in the hinterlands without power, so they could have radios powered by wind-driven generators.

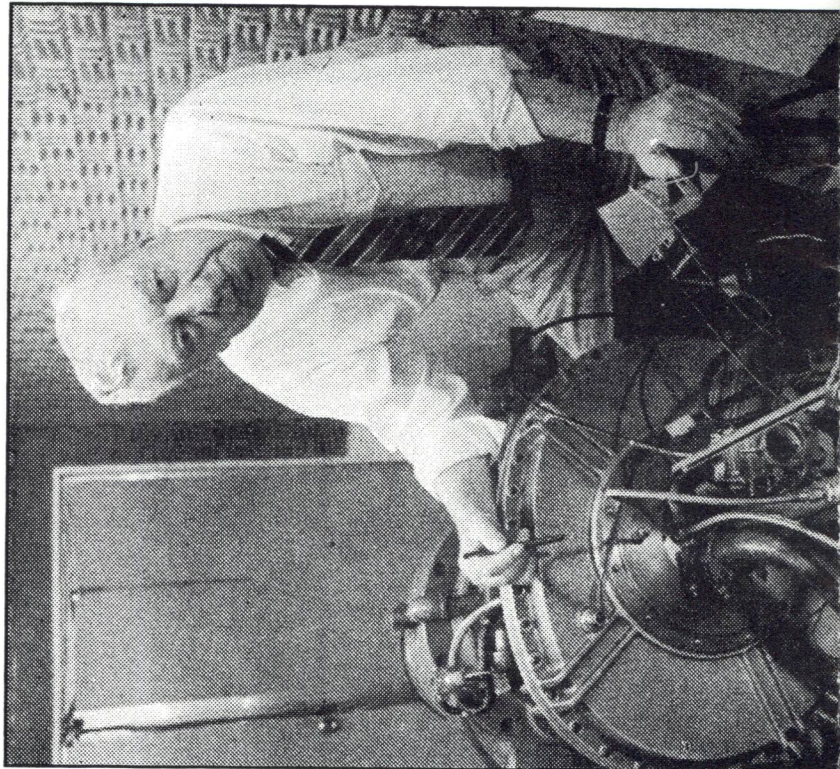
My company's first project was the pressure cooker with an audible signal, which was rated first by a consumer product service among all pressure cookers in 1947. Also it proved to be a special boon to the blind.

Q. Which is your favorite invention?

A. The pump, which I donated to Johns Hopkins Hospital in Baltimore, because it saves lives. It works by a squeezing or pinching principle, as a garden hose or in milking a cow, and was the first device capable of pumping blood without significant blood cell damage.

It is also used to measure intravenous solutions, in kidney dialysis and in food processing, to pump vegetable soup into cans, for example, without crushing the peas and other ingredients.

Q. Is it difficult for an inventor to obtain a patent? How long is



ence and marketing can be learned, but inspiration comes from within."

After earning an aeronautical engineering degree from the Massachusetts Institute of Technology, Mr. Murray worked for a hydraulics aircraft company in Cleveland, where he received one brand-new dollar bill for each of 16 inventions he made.

A test pilot in World War II, he later formed his own company in Manhattan and began a series of inventions that include the television antenna rotator, the power automotive seat, the high-speed dental drill and a device that automatically closes the top of a convertible when it rains.

Mr. Murray's creativity is not limited to one field, but spills over into many areas of industry and home life. His magnetic stirrer, originally designed for kitchen use, is today used for mixing chemicals in industry, and a roaster-grinder that roasts coffee beans at home is licensed to Farberware and awaits market introduction.

"Whether in the kitchen or on the plant floor with the chief engineer," he said, "I'm watching and listening to people and the needs that they have."

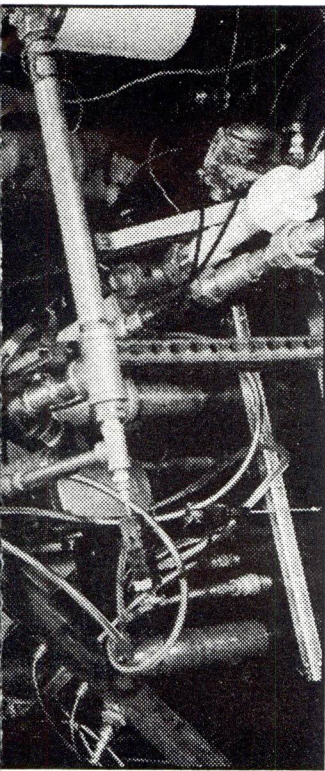
From 1958 to 1968, Mr. Murray was a consultant to NASA for its Mercury, Gemini and Apollo space projects.

After working for 15 years on his newest invention — a fuel-efficient four-cylinder internal combustion machine called the Rotorcam — and putting \$250,000 of his own money into the project, he moved to Morris County six years ago and formed the Murray United Development Corporation in Landing. "By going public, we raised sufficient funds to complete the project," he said.

Mr. Murray lives with his wife, Frances, in nearby Budd Lake and looks forward to going to the office every day. "This is the first time I've ever found a way to make a living without working," he said.

Q. What are the characteristics of a successful inventor?

A. Curiosity, creativity, tenacity, being a businessman. Invention is an art — creativity, not in music or writing, but in mechanical areas, for example. It's a full-time job, not a hobby, so I learned the ways to bring ideas from concept to marketplace. I believe Edison said, "Invention is 10



Eddie Hausner/The New York Times

Jerome L. Murray, who has more than 50 patents, with the Rotorcam, an internal combustion machine he invented.

'Creativity is still here, that Yankee ingenuity that made America great.'

percent inspiration; 90 percent perspiration." I think about the market first, before even thinking about the invention. What's the sense of inventing something you cannot sell? And I look for a gimmick or shortcut. Does it do a little better job and cost less?

Q. Should inventors be well educated?

A. Some of our greatest inventors — Tom Edison, Henry Ford — came from a one-room schoolhouse. The Wright brothers had the same education. They were considered a couple of nuts with a bicycle factory in Dayton, Ohio, yet they invented all the aerodynamics of basic flight. Too many books will tell you that you cannot do it. I wonder sometimes if I would have been a better inventor if I did not have a formal education.

Q. Are there different types of inventors?

A. Generally, two types. A one-shot inventor gets an idea that is successful, then puts all his money into other ideas that never are marketed. Many others specialize in one particular field, like electronics or mechanics. But the real inventors, like Edison, were all over the lot. He invented not only the electric light bulb but the photographic camera and dozens of medical devices.

Q. It is said that necessity is the mother of invention. Do you agree?

A. Yes. Take my TV antenna rotator. I had one of the first television sets and discovered that if I went up on the roof and turned the antenna a little bit, I got a better picture. At the time, only Channel 4 was on top of the Empire State Building; WOR built a tower on the Palisades in New Jersey. I wasn't scrambling up on the roof every time I changed channels, so I attached two strings to the antenna and fed them through my window to pull. That was the start of the electronic rotator, which has reached sales of \$38 million to date.

Around 1951, at Miami Airport, I noticed that people had to climb down stairs and walk outside in the rain to go from the plane to the terminal. Wheelchairs had to be removed by forklift. So that's where I had the idea for a covered walkway between plane and terminal that is used in airports all over the world today.

the protection period?

A. Patents, which cost a minimum of \$3,000, are protected for 17 years. To make an invention worthwhile financially, it should have a long enough life so that the patent pays off the cost of development.

There is a confidential disclosure form, which costs \$35, and registers the invention's date of conception. It protects the inventor for two years and allows him to go to manufacturers and show his product. If there is interest, a patent process can be begun, which usually takes two to three years.

A patent search is usually done initially by an attorney, at a minimum of \$500.

Q. What is unique about the Rotorcam? How will it be used?

A. It has less than half the parts of the average four-cylinder combustion engine with reduced maintenance costs. It is lighter, more compact and uses less fuel, with the power of an eight-cylinder engine. It can run on any fuel — petrol, diesel, kerosene, propane or a mixture of these. Oil-cooled, it needs no antifreeze.

We are now running a prototype of the engine, and emissions tests without a catalytic converter are below California standards, the strictest in the country.

I believe the Rotorcam will be used first in industrial applications such as lawn mowers, chain saws and generators, as it takes four to five years for an engine to be accepted in the automotive field.

Q. What is the future for inventors?

A. Creativity is still here, that Yankee ingenuity that made America great, but we have to promote it, especially in our children. I prefer radio, because it lets a person use all his or her imagination; television lays everything out for you.

At the beginning of the 20th century, 95 percent of patent applications were from Americans; today, more than half are from foreigners. We are teaching young people on Wall Street to make money on top of money, which produces nothing. Man has to work with his hands and do something; make a product to make life better for people, such as a cure for cancer. ■

60 HOT PRODUCTS FOR THE HOME OFFICE

Popular science

**CAN ELECTRIC
CARS CLEAR
THE AIR?**



GM'S HYBRID HX3

WILD WEASELS

**ELECTRONIC
WIZARDS OF
DESERT
STORM**



MAY 1991
\$2.00
CANADA \$2.50



ROTORCAM: PISTON ENGINE TURNED INSIDE OUT

By STEVE McKEE

The Rotorcam is one of those engines that at first glance doesn't seem as if it should even revolve, let alone operate more efficiently than a familiar piston-and-crankshaft power plant. But run it does, and it's claimed to offer some significant advantages over traditional designs by Jerome L. Murray, a New Jersey-based inventor who holds more than 50 patents on devices ranging from aviation instruments to peristaltic pumps, and even one for the electric carving knife.

"Everyone was trying everything they could think of with the crankshaft engine," says the 78-year-old Murray, who sees the Rotorcam as a clean-burning alternative to contemporary automotive power plants. "Catalytic converters, reverse gas mechanisms. I thought that was the wrong way to approach the problem. The crankshaft is a wonderful engine, but we had gotten to the point of no return."

Murray claims his Rotorcam will have 59 percent fewer parts than a standard engine, will be lighter and less expensive to manufacture, will never need antifreeze because it is oil cooled, and will produce high torque at low engine speeds—all plausible enough statements. From there, the assertions get bolder.

According to Murray, the Rotorcam will act as its own supercharger. The fuel injector will be cheaper, and an automatic variable compression ratio feature will enable it to run on a variety of fuels. The engine will idle at 75 rpm. Murray claims emission readings below the present California standards—"and that's without a catalytic converter," he says. Fuel economy will be 55 mpg in a Cadillac or Lincoln; 70 in a

mid-size car, 80 in a subcompact. All this, Murray estimates, at \$1 per horsepower.

Murray's engine isn't brand new. POPULAR SCIENCE cover stories reported on an engine

of similar design back in 1964 and '69. Austin Mercer Sr. developed the concept in England; his son, Austin Jr., retooled the design five years later. Both the Murray and Mercer designs use a cluster of pistons that eschew the conventional crankshaft in favor of a large cam that encircles the engine. The power thrust of the piston presses against the cam track via a roller, causing the entire block and piston assembly to rotate, while the cam stays still. Murray says he came upon the Mercer after about seven years of spinning around his own ideas. Rather than view the Mercer as a failed enterprise, Murray chose to be encouraged.

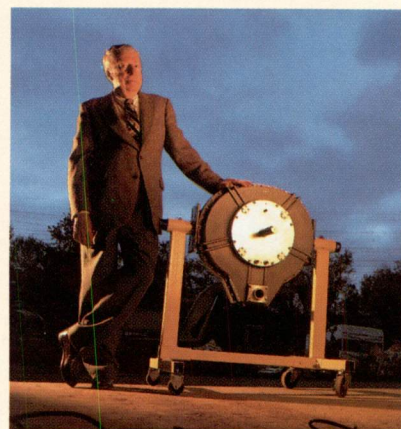
In the Rotorcam, a movable section of the cam also can be shifted while the engine is running, which enables the compression ratio to be varied from 7:1 to 17:1. This is the key to its multi-fuel capability, and one reason why the engine may have renewed appeal to auto makers. Intake and exhaust movements are timed by cylinder ports sliding by the manifolds.

To make an automotive engine, Murray envisions stacking two Rotorcam units, like double cheeseburgers, flat under the hood and connecting them through a hydraulic clutch. The theory is to start up the second set of cylinders only on demand. Most of the horsepower will be in the second engine. The first will have about 50 hp; when you need the extra horses, you'll hit the gas pedal, and the hydraulic clutch will kick in engine number two. "We can pack a lot of horsepower in that second engine," Murray says. "You'll have acceleration like a Corvette."

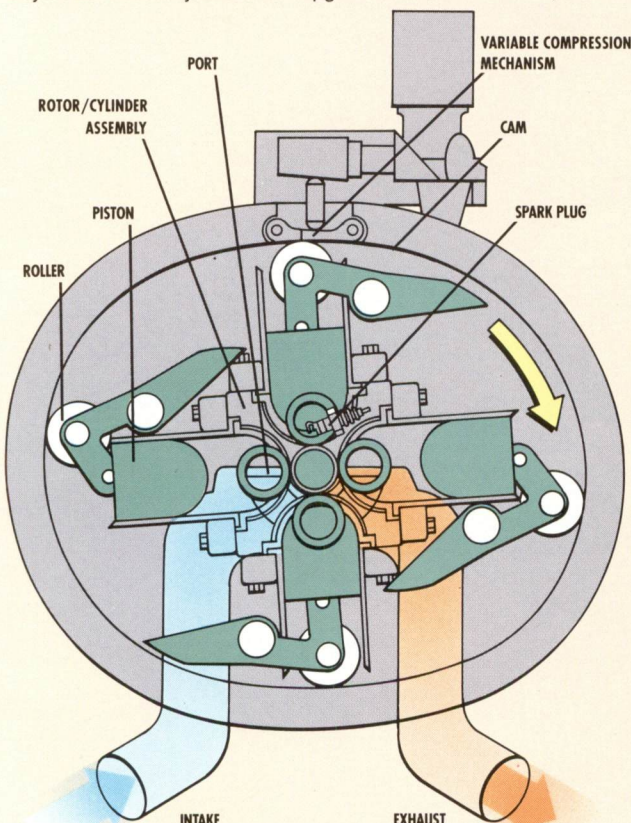
Murray, who took a test flight with Charles A. Lindbergh in the *Spirit of St. Louis* to check out the plane's compass, began working on his Rotorcam engine during the mid-1970s oil crisis. So far, Murray has a prototype of the Rotorcam running on a dynamometer in his New Jersey shop.

Murray plans to have a Rotorcam in "a big American car" in about two years. He will then drive his car to Detroit and make his point firsthand: "Here's what I've got, boys, and it's sitting in your parking lot."

Only time will tell if the Rotorcam goes round in circles according to Murray's law. A real-world confirmation of the design's practicality lies in the future. Skeptics will need to be convinced that both wear and frictional losses will be reasonable, and that the engine can meet upcoming pollution limits. Meantime, Murray remains undaunted. ES



JOHN B. CARNETT



RUSSELL VON SAUERS

Jerome Murray, above, inventor of the Rotorcam engine, with his running prototype. The four-cylinder 1.3-liter engine, left, uses no crankshaft. Instead, rollers at the bottom of each connecting rod follow a path described by the engine housing's cam track; the piston and cylinder assemblies all rotate when the engine is running. Each cylinder has a round opening to enable intake or exhaust gas flow when rotated past the corresponding stationary port. Each cylinder fires one time per engine revolution, just like a two-stroke, though the Rotorcam is in fact a four-stroke design.

TECHNOLOGY

American inventor unveils multi-fuel engine

Mel Mandell, New York

JEROME MURRAY, the prolific 78-year-old inventor of such wonders as the peristaltic pump, the electric carving knife and the moveable covered walkway to convey passengers to aircraft without exposing them to the elements, has now come up with an entirely new form of internal-combustion engine. His "Rotorcam" engine has no camshaft, flywheel, distributor or water pump and can run on virtually any type of fuel: petrol, diesel, kerosene, propane, jet fuel or a mixture of any of them.

The four-cylinder, four-stroke engine, which has been evolving for 15 years, would also be much lighter, more compact, and cheaper to manufacture than present internal-combustion engines, because it has many fewer parts. Running costs would also drop sharply, because the Rotorcam does not require periodic and increasingly costly tuning by computer-equipped mechanics.

The Rotorcam is of rotary design. Unlike the ill-fated Wankel rotary, which has only been used in a limited number of cars because of difficulties in achieving a seal around the combustion chamber, the Rotorcam uses conventional cylinders with pistons and rings to maintain a tight seal during combustion. But that is where the resemblance to conventional engines ends.

The engine's cylinders radiate outwards from a central axle like the spokes of a wheel, with the heads of the cylinders pointing inwards. At the end of each piston arm is a small wheel which runs along the inside of large flat ring that encloses the whole engine. The ring is oval in shape, so when the cylinders rotate around the central axle the pistons are pushed in and out as the wheels roll from the narrow part of the oval ring to the wide part.

As they rotate, a large port in each cylinder successively passes apertures through which fuel enters and exhaust gases exit. Thus, the Rotorcam does not require the usual mushroom-shaped valves, rocker arms, valve springs or cams of a conventional engine. To take in fuel and exhale the products of combustion better and faster, the latest conventional engines have four instead of two valves per cylinder, adding to the complexity of the engine. Some carmakers are even experimenting with five or more valves per cylinder.

Murray believes his engine will be inherently less polluting than other engines. It runs on a leaner fuel mixture, with more air intake compared to the amount of fuel consumed, which should aid complete

combustion of the fuel. Also, the inside of the cylinder head and the top of the piston are hemispherical. This leaves a much smaller clearance between cylinder head and piston which, he claims, means the fuel burns more efficiently and is expelled completely on the exhaust stroke.

Only one sparking plug is needed, which each cylinder rotates around to use in turn, thus eliminating the need for a distributor.

cause the engine has high torque at low rotational speeds, it could operate with fewer forward gears, perhaps only two, claims Murray.

Besides its rotary design, the Rotorcam also differs markedly from conventional engines in its ability to change compression ratio automatically, depending on what fuel it is ingesting. Compression ratio is the ratio of the volume contained in the cylinder at the beginning of its compression stroke to the volume at the end of the stroke. Normally this is an immutable aspect of an engine because the engine is designed to run on a particular type of fuel.

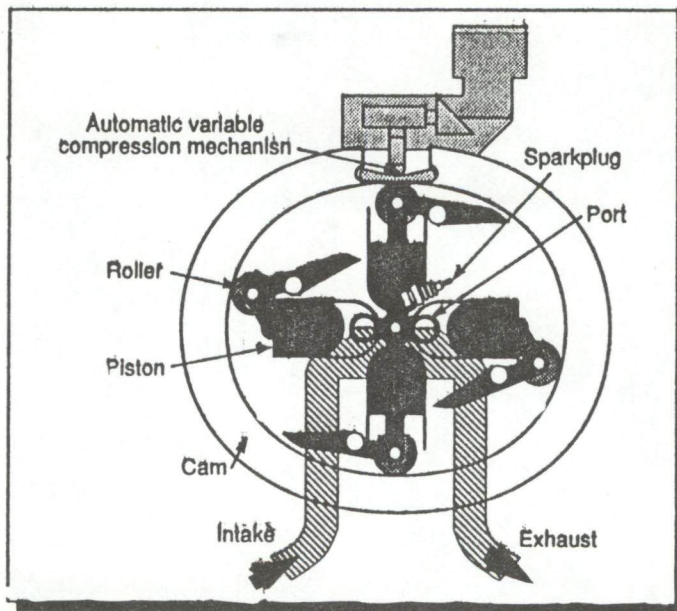
In the Rotorcam a tiny microphone senses the "knocking" caused when the fuel-air mixture is compressed too much and ignites before the sparking plug fires. The microphone activates a solenoid that moves a solid cam mounted in the large outer ring in and out very slightly. As each cylinder rolls past this adjustable cam, its piston is moved in or out very slightly at the moment of ignition. The compression ratio can be modified in this manner from 7:1 to 17:1. The lowest ratio is for kerosene, while the highest is for diesel fuel.

So far a very modest \$1 million has been expended on development of the Rotorcam engine, the last \$750 000 coming from a sale of shares in 1988. Murray himself provided the initial \$250 000 out of profits from his 50 earlier inventions. He is best known as the inventor of

the peristaltic pump, which made open-heart surgery possible. Murray waived royalties on the pump for all applications in health care. The pump is also used in dialysis machines, to pump drugs continuously via intravenous tubes, and in food processing; it does not crush blood cells or the vegetables in soups.

Murray foresees the initial applications of the Rotorcam being in light aircraft, lawnmowers, stationary engines and military vehicles. Armed vehicles powered with Rotorcam could burn whatever fuel was available. In motorcycles, the Rotorcam would be mounted inside the rear wheel, driving it directly in highest gear. The gyroscopic effect would tend to hold the vehicle upright, making it safe.

Convincing carmakers to license his invention, for which patents have been applied, will be much tougher. However, Murray claims that in Detroit, which is the heartland of the US's automobile empire, hostility to innovations from outside is weakening, and manufacturers are much more open to new concepts. □



Pistons in a spin: the Rotorcam engine's cylinders rotate past stationary fuel and exhaust parts and sparking plug

However, Murray believes that a second plug would be included in production models in case the first plug failed. No water pump is needed, because the engine is cooled by circulating oil. Because it is oil-cooled, the Rotorcam can operate at 180 °C, over 70 degrees hotter than conventional engines, which raises efficiency. Carmakers are currently experimenting with engines with ceramic parts in order to allow them to run hotter.

The Rotorcam does not require periodic tune-ups, it just needs its oil and oil filter replaced every 5000 miles or so. Car owners could replace the air filter and sparking plug themselves; they are very accessible. No antifreeze is needed.

The prototype Rotorcam is only 25 centimetres thick and less than a metre in diameter. It would be installed horizontally in cars, which offers three advantages: a lower bonnet for improved aerodynamics; less dipping on turns because the spinning cylinders provide a gyroscopic effect; and simpler gearing to a front-wheel drive. Be-

Rule breaker

Inventor finds success by defying conventional wisdom

By JOHN T. HARDING

Advice to inventors, especially young graduates of engineering schools, from a man who has developed products ranging from the electric carving knife to the pressure cooker to the aircraft jetway to a rotary engine and the heart pump:

"Forget the textbooks; they only give reasons why something can't be done."

For example, the textbooks said rain is essentially distilled water, and therefore cannot carry an electrical current.

Jerome L. Murray, president of Murray United Development Corp. of Landing, ignored that dictum after his car got soaked during a rainstorm when he went to the movies and neglected to close the convertible top. He decided there had to be a way to get raindrops to trigger a mechanism to close the top. Result: The rain switch, which automatically closed the top when raindrops activated a relay.

"It's very true that necessity is the mother of invention," Murray said. "I always tell young engineers to observe people and the things they do, and don't ignore the little things that are designed to sell for 75 cents," he added.

An example, Murray said, was a challenge to improve the ordinary paper clip. It was done, he pointed out, by putting grooves on the clips to reduce slippage.

Murray did not claim credit for that one. But he was asked to improve the design of carving knives, and did it by inventing the electric knife.

The pressure cooker was developed from aeronautical engineering work he did for the military during World War II, Murray said.

In the early days of television broadcasting, when the major New York City stations had their transmitting antennas in different places, Murray noticed that if he turned his receiving antenna slightly, he got a better picture.

Moreover, he noted TV antennas on thousands of homes in Central New Jersey that could receive signals from either New York City or Philadelphia stations.

Result: A device to rotate TV antennas, which retailed for \$35 and brought royalties of 75 cents each. More than 38 million of the units were sold.

And the airliner jetway was developed after Murray noted the inconvenience passengers suffered walking from the plane to the terminal in inclement weather. Moreover, disabled passen-



Inventor
Jerome L. Murray's
advice to young people
in his field:

*"Forget the
textbooks;
they only
give reasons
why something
can't be
done."*

Photo by George Baumann
**Jerome L. Murray in
his office with scrapbook
of inventions and articles
about his work**

gers had to be hoisted from the plane in a freight lifter, he said.

"I like to go into old industries" as a source of new ideas, Murray said. "It's amazing the dumb things" people do, simply because that's the way things had been done, he said.

Inventions, however, "are funny things," Murray said. "You can paint yourself into a corner" when trying to develop an idea, he said, focusing too closely on some preconceived notion of what should work.

"Then some nuts and bolts salesman will look over your shoulder and offer a suggestion and you think he's a genius," Murray said.

When he started his career as an inventor, Murray said, his degree from the Massachusetts Institute of Technology "was a hindrance" because he kept remembering books and research papers that said his project "could not be done."

"Many great designs have come from people who got their education

in a one-room schoolhouse," Murray said.

His current project, nearing the prototype stage, is a rotary engine that uses the piston and cylinder assembly found in traditional automobile engines, but uses 59 percent fewer parts because it eliminates the crankshaft, camshaft, valve train, flywheel and distributor.

In the Murray engine, called the Rotorcam, four piston and cylinder assemblies rotate around a drive shaft. It differs from the Wankel rotary engine, which uses a triangular rotor and crankshaft, Murray pointed out.

The Rotorcam uses the proven technology of the piston-cylinder, enabling higher compression ratios and cleaner combustion, Murray said.

Murray said he hopes to demonstrate the running prototype by the end of July.

He has been president of his own company, Jerome Murray Corp., since 1953, but to help raise capital for the rotary engine project, he formed the Murray United Development Corp. in

October 1987. Murray United went public last February, raising \$560,000 in a public offering of stock and warrants.

He had already invested \$250,000 of his own money in the rotary engine project, he said, and still controls 73 percent of the stock in the company.

Murray went public, he said, because "I wanted to raise additional capital, and at my age I didn't want to risk any more of my own money." Murray is 75.

The stock is traded over the counter, with information available on the so-called pink sheets.

The initial public offering was a combination of stock and warrants priced at 5 cents per unit.

The common stock has been trading in the range of 2 cents to 8 cents per share.

Murray moved his operations to Landing from New York City four years ago, he said, partly because he needed the space to run the prototype

Please turn to next page

'Maverick' inventor finds success by defying conventional wisdom

From preceding page

engine. Murray had operated from the East Side of Manhattan.

His work is about evenly divided between developing his own ideas and working under contract as a consultant to manufacturers.

The electric knife was invented after a knife manufacturer asked him to develop a better instrument, he said. But Murray went one step further, and decided to electrify the carving tool. The client later licensed the electric knife to larger corporations, which had bigger, more established sales and distribution channels.

But his proudest achievement, Murray said, is one that pays him no royalties: The peristaltic heart pump, used by

surgeons around the world to keep a patient's blood flowing while work is done on the heart.

Murray said that Johns Hopkins Hospital of Baltimore had noted his work on other pumps and asked him to design one that would pump blood, yet not damage molecules.

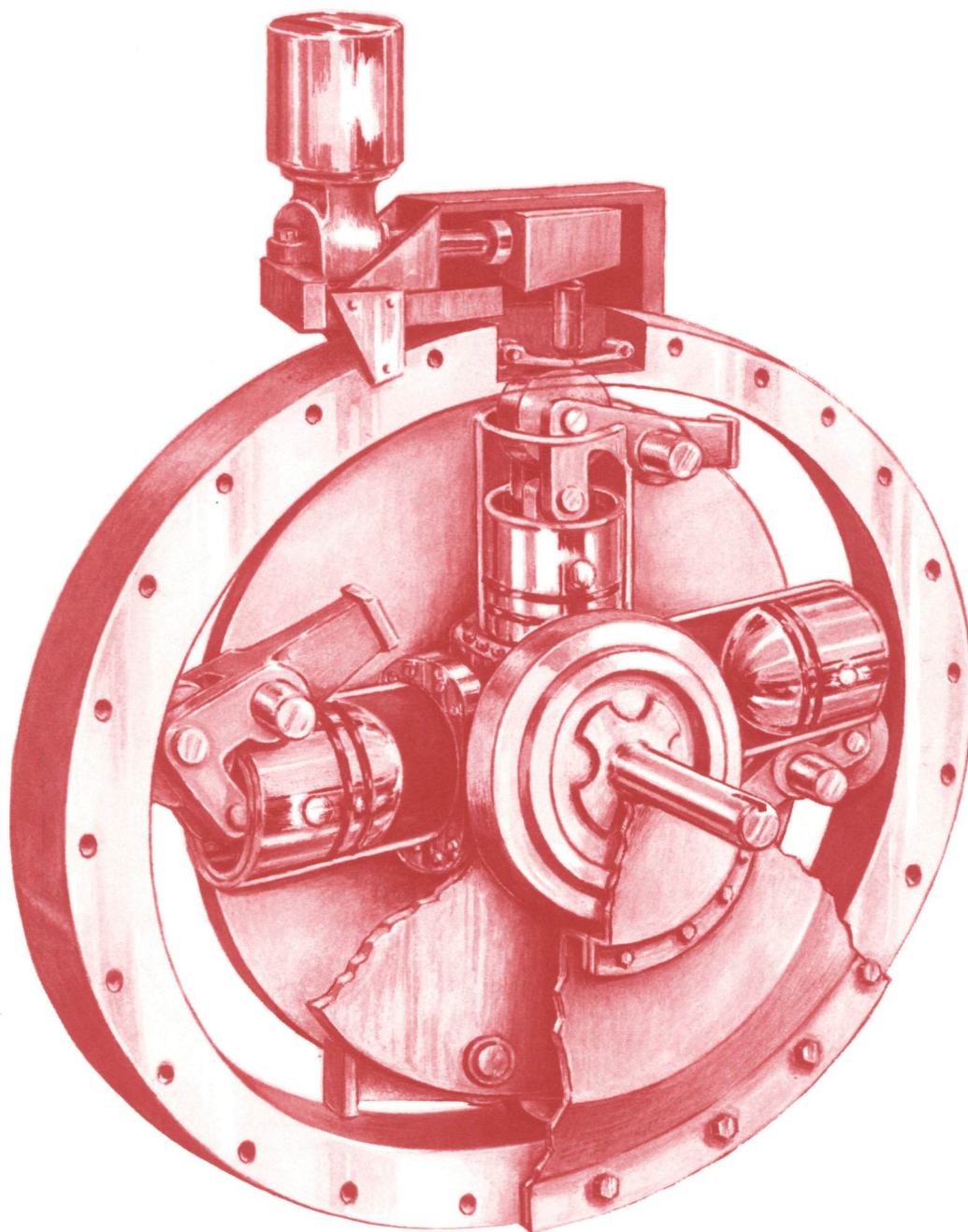
When Murray had finished, however, the hospital said its grant money had run out, and it was unable to pay him.

So after deciding that "you have to give something back in life," Murray gave Johns Hopkins a free license for the pump in three areas: Pumping blood, pumping intravenous solutions, and for use in kidney dialysis.

A variation on the pump is used in commercial food preparation, Murray said.

MURRAY UNITED DEVELOPMENT CORPORATION'S

ROTORCAM ENGINE



MURRAY UNITED DEVELOPMENT CORPORATION

10 Orben Drive • Landing, NJ 07850

(201) 770-3201

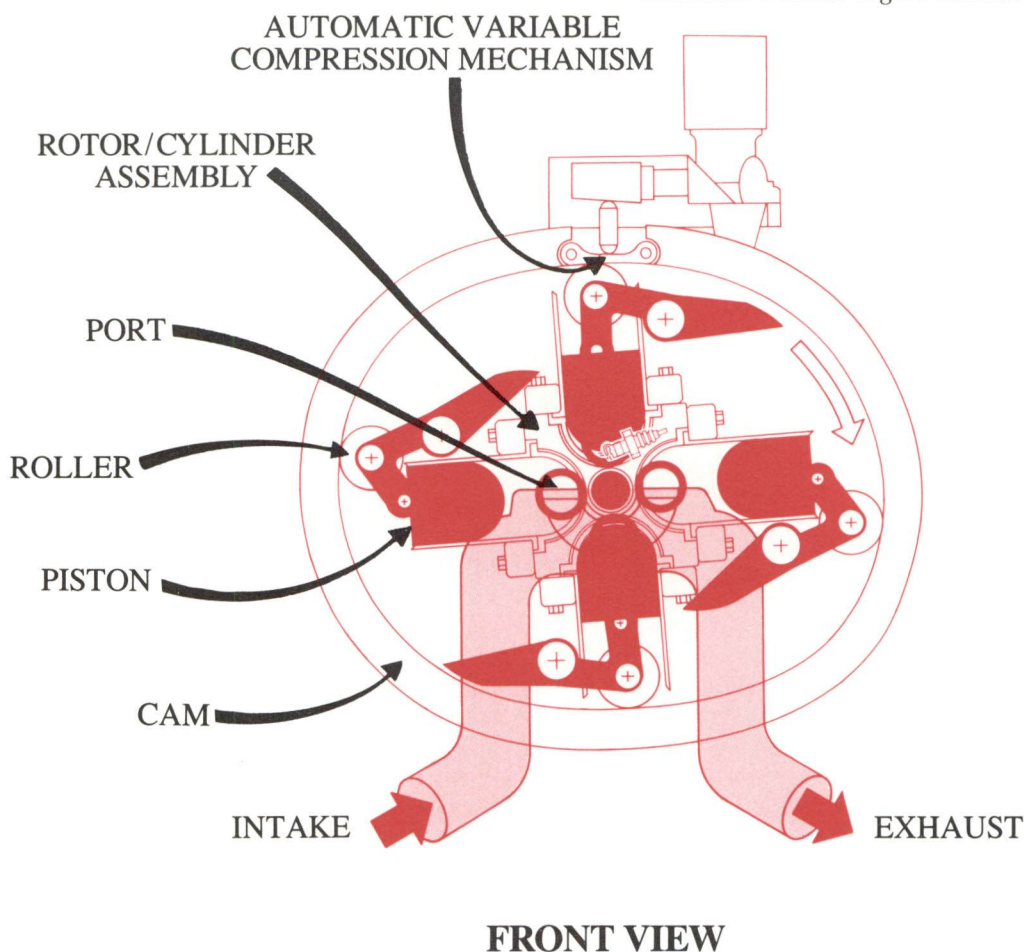
(A Publicly Held Company)

HISTORY

The Rotorcam engine (patent pending) is the creation of Jerome L. Murray, an MIT graduate, holder of over fifty patents and former director of navigation for NASA (see back cover). In March of 1988 Murray United Development Corporation raised \$750,000 through a public offering to develop the Rotorcam engine. An engineering team was assembled whose goal, to design and run a fuel driven prototype of the Rotorcam engine, was met in January 1990. Once testing is completed, the prototype will be used to concretely demonstrate the numerous advantages of the Rotorcam to existing engine manufacturers and other potential licensees.

THE MARKET

A five hundred thousand dollar study on the feasibility of alternate engines initiated by Mr. Lee Iacocca concluded that the success of an alternate engine is dependent on a prototype demonstration of the engine's technological superiority in a majority of performance and manufacturing criteria. **Analysis of the Rotorcam engine indicates that it may be superior in every performance and manufacturing characteristic** (see characteristics right). This superiority, plus increased demand for low cost, low emission, fuel efficient engines, could make Rotorcam the engine of choice in all applications (i.e. automotive, truck, marine, motorcycle, aircraft, industrial, stationary, lawn tractor etc.) of the worldwide, multibillion dollar engine market.

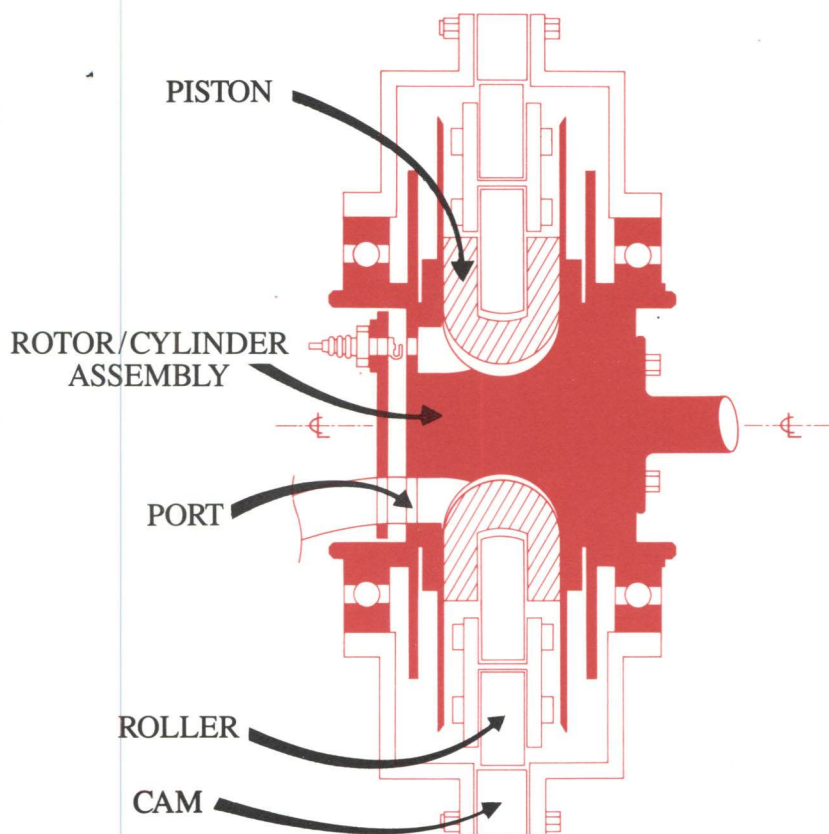


HOW IT WORKS

Each of the Rotorcam's four cylinders fires once per shaft revolution, this provides twice as many power strokes as a conventional four cylinder, four cycle engine operating at the same speed. As shown in the illustration, the engine's main components are the rotor/cylinder assembly, the pistons and the cam. The outer end of each piston is attached to a connecting rod and roller which is free to roll on the smooth inner surface of the cam. Each cylinder has a round opening or port which passes over the appropriate stationary port during intake, exhaust and ignition. When the spark plug ignites the air/fuel mixture in the cylinder at the twelve o'clock position, the piston is propelled outward. The roller follows the contour of the cam causing the rotor/cylinder assembly to rotate. When the

rotor/cylinder assembly turns to the 3 o'clock position, the piston is forced back toward the center of the engine, forcing the exhaust gases out through the open exhaust port and pipe. As the rotor/cylinder assembly passes the 6 o'clock position, the piston travels outward drawing the air/fuel mixture into the cylinder through the open intake port. As the cylinder passes the 9 o'clock position, the piston travels toward the center of the engine compressing the air/fuel mixture to complete the cycle.

A unique feature on the Rotorcam engine allows the compression ratio (the degree the air/fuel mixture is compressed by the piston) to automatically adjust to the load, speed and even the octane rating of the fuel supplied, allowing the engine to run at the highest performance level the fuel is capable of supporting without engine knock.



SIDE VIEW

ANSWERS TO COMMONLY ASKED QUESTIONS

What applications can the Rotorcam engine be used for?

The Rotorcam engine can be utilized in any application where conventional engines are found, (i.e., automotive, truck, marine, motorcycle, aircraft, industrial, stationary, lawn tractor, etc.)

What is a quick summary of the advantages of the Rotorcam engine?

The Rotorcam engine, when compared to a conventional four cylinder engine, has approximately 59% fewer parts, a higher power to weight ratio, multi-fuel capability, high torque at low speed, reduced exhaust emissions, lower idle speeds and reduced maintenance. It's variable compression feature automatically adjusts to load, speed and even the octane rating of the gasoline used, yielding higher efficiency (more miles per gallon). Running at the same speeds, a four cylinder Rotorcam engine puts out the same power as a conventional eight cylinder engine.

Is the Rotorcam engine the same as the Mazda RX-7, Wankel engine?

No it is not! It is also different from rotary and radial engines used in older aircraft. Although the Rotorcam and Wankel engine both impart a rotary motion, that's where the similarities end. The Wankel's rotary motion is derived from the use of a triangular rotor and crankshaft. Sealing and limitations on its compression ratios have proven to be severe drawbacks. The Rotorcam, on the other hand, imparts its rotary motion utilizing a proven piston, ring and cylinder assembly.

PERFORMANCE CHARACTERISTICS

- Increased Efficiency (better fuel mileage)
- 59% Fewer Parts (No Crankshaft, Camshaft, Valve Train, Flywheel, or Distributor)
- High Torque at Low Speed
- Automatic Variable Compression Ratio
- Multi-Fuel Capability
- Reduced Exhaust Emissions
- Reduced Maintenance
- Compact Size
- Lower Idle Speeds
- Long Life

MANUFACTURING CHARACTERISTICS

- Low Material Costs
- Manufactured With Existing Technologies And Materials
- Low Labor Content
- Low Total Costs

Won't some oil company buy this engine and put it on a shelf?

A common myth. A patent holder negotiates the price which he is willing to sell or license his patent for. That price includes a minimum guaranteed royalty, paid by the company to the patent holder even if the product is never produced. So if a company licenses your patent and does put it on a shelf, they will still have to pay the minimum guaranteed royalty.

The automobile companies spend millions of dollars on research; if they can't invent a better engine, no one can.

Another common myth. Nicholas Otto developed the conventional engine as we know it today. Rudolph Diesel developed the Diesel engine and Felix Wankel developed the Wankel engine. In other words, every major engine in use today, was originally conceived by an independent inventor.

Even if someone did develop a better engine, everyone knows Detroit would never buy it.

As an example of Detroit's willingness to experiment with new engines, General Motors became the 20th licensee of the Wankel engine when it signed a \$50,000,000 licensing agreement with Curtiss Wright. GM invested an additional \$400,000,000 to \$700,000,000 in their Wankel program. Other licensees were Ford, Volkswagen, Rolls Royce, Nissan, Toyota, Mazda and Mercedes-Benz. Recently, Ford licensed a variation of a two cycle engine which was developed by an independent inventor. Detroit is more willing than ever to look at an alternative engine, especially one such as the Rotorcam engine, which does not require costly retooling.

MANAGEMENT

Jerome L. Murray, President

Mr. Murray has a B.S. in Aeronautical Engineering from the Massachusetts Institute of Technology and is a former Director of Navigation for NASA. He is the holder of over 50 domestic and foreign patents. His developments include the ball typewriter, the power automotive seat, the peristaltic "heart" pump, the jet engine power thrust indicator, the high speed dental drill, the airport jetway, the sodium filled exhaust valve and the electric carving knife. Mr. Murray has spent 20 years in the aviation industry during which time he was continuously involved in the development and testing of aircraft and aircraft engines.

Joseph O. Mosca, V.P. Engineering

Mr. Mosca received his B.S. in Mechanical Engineering from Columbia University and studied Aeronautical Engineering at Massachusetts Institute of Technology. He has been employed by Garret Turbine Engine Corporation as a Senior Development Engineer responsible for development work on T800 jet engines, General Electric as an Advanced Technology Development Engineer responsible for development on T700 jet engines and a Mechanical Design Engineer at Curtiss Wright Corporation responsible for development work on Wankel rotary engines.

Benjamin B. Shereshaw, Chief Engineer

Mr. Shereshaw received a B.S. in Mechanical Engineering from New York University. He is the designer of the 3.2 opposed twin engine for Consolidated Vultee Aircraft Corporation, the 4.0 opposed twin for Republic Aviation Corporation and numerous other high output two cycle engines for military aircraft drones and experimental airplanes. He founded and was President of The Bantam Aircraft Engine Corporation, which produced the Bantam engine, winner of five consecutive National Aircraft Engine Performance Championships and one of the best selling small scale engines ever produced.

Yihwen Shen, Mechanical Engineer

Mr. Shen received a B.S. degree from the National Taiwan College of Marine Science & Technology and a M.S. degree in Mechanical Engineering from the New Jersey Institute of Technology. He has extensive experience with marine engines including the Mitsubishi Marine Diesel and Stal-Laval Steam Turbines.

Thomas A. Caltabiano, Treasurer, Director

Mr. Caltabiano received his B.S. degree in Finance and Management from New York University. Prior to joining Murray United Development Corporation in 1987 he was employed by The Jerome Murray Corporation as an assistant Vice President.

Maurice Zeldman, Director

Mr. Zeldman received his B.M.E. from the City College of New York, and his M.S. in Electronics and Mathematics from Adelphi University. He is the president of EMZEE Associates, a consulting firm which he founded in 1973. Mr. Zeldman is the former director of Technical Development for Rockwell International. Prior to joining Rockwell, Mr. Zeldman was with AMF, where he invented and developed a version of Versatran, the first robot exported to the Japanese and utilized by the parent company of Toyota Automobile.



Murray United Staff, Jerome L. Murray (center)

SCIENTIFIC ADVISORY BOARD

Dr. Martin I. Hoffert

Dr. Hoffert received his B.S. in Aeronautical Engineering from the University of Michigan, Ann Arbor and his M.S. and Ph.D. in Astronautics from Polytechnic University. He is currently Professor of Applied Science and Chairman of the Department of Applied Science at New York University. Professionally he has been on the research staffs of Riverside Research Institute, Advance Technologies Laboratories, General Applied Science Laboratories, and the Curtiss Wright Corporation.

Walter Mahnken, P.E.

Mr. Mahnken received his M.E. from Stevens Institute of Technology. He was employed by Dorr Oliver, Inc. (a former subsidiary of Kennecott and Curtiss Wright) from 1966 to 1986 where he served as Special Assignment Project Director and as Director of Operations Planning. Prior to that period he was with Curtiss Wright Corporation where he served as Project Manager for Aircraft Propulsion Systems, Director of Administration for Aerospace and Director of Development for the Wankel engine.

Dr. Bernard W. Shaffer

Dr. Shaffer received his B.M.E. from City College of New York, his M.S. in Mechanical Engineering from Case Institute of Technology and his Ph.D. in Applied Mathematics from Brown University. Dr. Shaffer is a Professor of Mechanical and Aerospace Engineering at Polytechnic University. He has been a consultant to the National Science Foundation, General Electric and NASA. Dr. Shaffer has published over 100 papers on numerous branches of mechanical and aerospace engineering including stress analysis of rotating machinery. He is a recipient of the American Society of Mechanical Engineer's Richards Memorial Award for outstanding achievement in mechanical engineering over a 20 to 25 year period. He is listed in the *World Who's Who in Science from Antiquity to the Present*, *Who's Who in America* as well as other national and international directories.

"Document Control"

TYPE: INFORMATION

DOCUMENT NUMBER: 9203385

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: DEMARS, B.: NAVAL REACTORS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/10/92

SUBJECT: HAVING JUST RETURNED FROM POST-REFUELING OVERHAUL
SEA TRIALS HE IS PLEASED TO REPORT THAT THE
PROPULSION PLANT PERFORMED FLAWLESSLY.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
PHYSICAL SCIENCES
INDUSTRIAL

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

OSTP RECEIVED: 11/13/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
02. Letter	To: Allan Bromley From: B. DeMars Re: Sea trials of NR-1 (1 pp.)	11/10/92	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

NOV 12 1992

"Document Control"

TYPE: ACTION

DOCUMENT NUMBER: 9203365

ORIGINATOR: 02

STATUS I

DIRECTORATE STATUS

FROM: SMTIH, Mike: SJS ADVANCE STRATEGIES

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/03/92

SUBJECT: HE WANTS TO KNOW IF THE WHITE HOUSE IS PLANNING ANY
KIND OF COMMEMORATIVE EVENT FOR THE 50TH ANNIVERSARY
OF THE ENRICO FERMI SUCCESS.

DIRECTORATE

STAFF

ASSIGNED: DIRECTOR'S OFFICE

ASSIGNED:

ACTION

STAFF

REQUIRED: DIRECT REPLY

ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE: 11/16/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

12/22/92

COPIES TO: PHYSICAL SCIENCES

WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE:

EXT:

REMARKS:

Dr. Schneider drafted ltr for DAB

OSTP RECEIVED: 11/07/92

DEPT RECEIVED:

FILE: P-PHYSICAL SCIENCES

CENTRAL FILES:



THE WHITE HOUSE
WASHINGTON

December 22, 1992

Michael

Dear Ambassador Smith:

Thank you for your letter of November 3rd requesting information about possible White House plans for commemorating the 50th anniversary of Enrico Fermi's monumental achievement of the first self-sustaining chain reaction. It is fair to say that this was an event of extraordinary proportions--one which has cast its shadow over the world in terms of its implications for both peace and war for the last fifty years, and one which will certainly continue to do so into the foreseeable future.

While there were no plans for commemorating this event at the White House, appropriate events were held elsewhere. For example, under the sponsorship of the American Physical Society and the University of Chicago, a symposium was held at the University of Chicago on December 2-3, 1992, entitled "The Physical Sciences at the University of Chicago--From the Beginning to Fermi." In addition, a symposium, jointly sponsored by the American and European Nuclear Societies (ANS/ENS) was held in mid-November in Chicago. The theme for their meeting was "Fifty Years Controlled Nuclear Chain Reaction: Past, Present and Future."

Thanks for inquiring about this singularly important event--in our, and the world's history.

Sincerely yours,

Dan

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

Ambassador Michael B. Smith
President, SJS Advanced Strategies
1330 Connecticut Ave., NW
Washington, DC 20036

*I gave a keynote address at
the 40th anniversary celebration
but was not invited to the 50th.
DAB.*

SJS ADVANCED STRATEGIES

1330 CONNECTICUT AVENUE, N.W.
WASHINGTON, D.C. 20036

(202) 429-5500
TELEX: 89-2503
FACSIMILE: (202) 429-9204

AMBASSADOR MICHAEL B. SMITH
PRESIDENT

B. TIMOTHY BENNETT
VICE PRESIDENT

Memorandum

November 3, 1992

TO: Dr. Alan Bromley
FROM: Ambassador Mike Smith 
SUBJ: 50th Anniversary of Fermi self sustaining nuclear reaction

I wonder if any plans are being made by the White House to commemorate the 50th anniversary on December 2, 1992 of the famous Enrico Fermi success, under the stands of the University of Chicago football stadium, in bringing about the world's first self-sustaining nuclear reaction? Regardless of the national election's results, this occasion in my view should not go unmarked by your Office.

With kindest good wishes.

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9203416
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: PACKARD, DAVID

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/26/92

SUBJECT: LETTER TO THE PRESIDENT ENCOURAGING FUNDING FOR THE
STANFORD LINEAR ACCELERATOR (SLACK) IN THE FY93
BUDGET SUBMISSION.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
PCAST
INDUSTRIAL
PHYSICAL SCIENCES

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

OSTP RECEIVED: 11/04/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:

C O P Y

DAVID PACKARD
26580 TAAFFE ROAD
LOS ALTOS HILLS, CALIFORNIA 94022

3416
RECEIVED

92 NOV 4 P2:36

OSTP
MAIL ROOM

October 26, 1992

President George Bush
The White House
Washington, DC

Dear Mr. President:

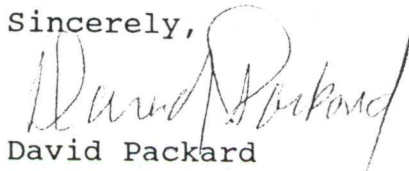
I am writing to encourage you to provide funding for the Stanford Linear Accelerator (SLACK) in the FY93 Budget Submission.

SLACK has made an outstanding contribution over the years to our knowledge of the universe. Four of its scientists have received Nobel Prizes and it has made important contributions to the economy in California. They have also educated many scientists and engineers at SLACK who have made major contributions in keeping the United States at the forefront of world-wide technology.

They plan to upgrade the facility into a B-factory which would explore some of the unanswered questions about matter and anti-matter in the early universe.

SLACK needs \$143 million in FY93 and \$150 million in FY94. The increase in FY94 is just the amount to keep up with inflation. This is an important program for California and for our Nation.

Sincerely,


David Packard

bcc: ✓ Dr. D. Allan Bromley

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9203433
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: ROY, RUSTOM: PENN STATE

TO: D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/19/92

SUBJECT: ANNOUNCEMENT TO THE MEDIA EXPLAINING A NEW PROCESS
DISCOVERED AT PENN STATE MATERIALS RESEARCH
LABORATORY PROVIDING A SIMPLE AND CHEAPER ROUTE TO
THE PRODUCTION OF SHAPED DIAMOND, OR DIAMOND
COMPOSITE, OBJECTS.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
Karl Erb

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

OSTP RECEIVED: 10/20/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:

PENNSTATE

Telephone (814) 865-3421
Fax No. (814) 863-7040 or 863-7846

Materials Research Laboratory

The Pennsylvania State University
University Park, PA 16802-4801

October 19, 1992

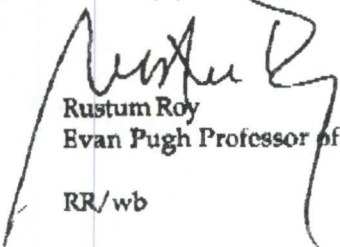
Allan Bromley
Science Advisor to the President
1600 Pennsylvania Avenue
Washington, DC 20500

Dear Allan,

As mentioned at the Drexel conference, I thought you would be intrigued with what suddenly happened to diamond science and technology.

Why the government funding is so low *compared* to superconductors and ceramic engines—which have gone nowhere—is a puzzle to me. But, as I said, we thrive on adversity!

Sincerely yours,



Rustum Roy
Evan Pugh Professor of the Solid State

RR/wb

PENNSTATE



Materials Research Laboratory

Telephone (814) 865-3421
Fax No. (814) 863-7040 or 865-2326The Pennsylvania State University
University Park, PA 16802-4801**ANNOUNCEMENT TO THE MEDIA****DIAMOND SYNTHESIS VIA LOW PRESSURE SOLID STATE SOURCE PROCESS***STRICTLY EMBARGOED TILL 1500 HOURS, WEDNESDAY, OCT. 21, 1992*

A new process has been discovered at Penn State's Materials Research Laboratory which holds the promise of providing a simple and cheaper route to the production of shaped diamond, or diamond composite, objects. It makes it feasible to conceive of making previously inconceivable sizes and shapes out of diamond.

The key scientific innovation is the use of a **solid state source** for the carbon which becomes diamond, in sharp contradistinction to all low pressure chemically vapor deposited (CVD) diamond processes which require the (less efficient) activation, long-range transport, and deposition of the carbon from the **vapor phase**.

Solid state sources for the carbon have been used for decades in the traditional very high pressure process for diamond synthesis. This new finding may allow industry to combine the simplicity of atmospheric pressure processing with the rapidity afforded by the 1000× greater concentration (compared to CVD) of carbon atoms in solids.

A second element in the invention is the appropriate dispersal within the solid state carbon source of a second phase of insulator, semiconductor, or metal. Objects of any shape in the mm range have been converted to diamond either completely if thin (<100μm) or porous, or partially converted if dense. There appears to be no inherent limitation to the size attainable, obviously subject to processing limitations. Figures 1, 2, 3, and 4 show the scanning electron micrographs of the diamonds formed; Figures 5 and 6 show one of the mm size cubes. The x-ray and Raman data on one sample which are typical of *all* samples are shown in Figures 7 and 8.

The research, supported by the U.S. Office of Naval Research and DARPA, has been done at Penn State's Materials Research Laboratory, perhaps the nation's largest such laboratory, and one which has focussed for 30 years on synthesis of new materials. The laboratory started into diamond research over 25 years ago and at present has one of the largest efforts in the country. The inventor of the generic concept is Rustum Roy, Evan Pugh Professor of the Solid State, founding director of the Laboratory for 23 years, who was responsible for bringing diamond film research to the U.S. from Japan in 1984. Professor Roy was recognized this past year by the National Academy as the one American to give the International Science Lecture in several foreign capitals on his specialty—Materials Synthesis. The American Chemical Society has just honored him with the Dupont Award in Materials Chemistry. Professor Roy is a member of the U.S. National Academy of Engineering, and of the National Academies of Japan, Sweden, and India.

More background on the science involved follows.

BACKGROUND

In 1955 a reproducible process for making synthetic diamonds was announced by the General Electric company and confirmed worldwide. The diamonds were synthesized at very high pressures (above 50,000 atmospheres) and high temperatures. The basic process, still in use today, requires very complex and expensive equipment and batch processing, produces one-half billion dollars worth of diamond grit annually for the grinding industry. Large crystals have also been grown in the U.S. and Japan for niche markets, but not for the gem market.

Starting in the fifties and sixties Soviet research by Derjaguin, Fedoseev, Spitsyn et al. first demonstrated in exhaustive work that thin diamond films could be made, at ordinary atmospheric pressure in the presence of atomic hydrogen, by several methods including chemical transport reactions. This work was ignored worldwide till Japanese scientists Kamo, Sato, Matsumoto, and Setaka at the National Institute for Research in Inorganic Materials (NIRIM) in Tsukuba, Japan, using a microwave plasma triggered the present worldwide research effort by coating large areas (some square inches) with thin, beautifully crystallized, diamond films. This work—published in an American journal—was ignored in the U.S. and Europe, till Professor Rustum Roy was shown the process. He made the U.S. community aware of the breakthrough, and with Office of Naval Research support, he and his Penn State colleagues, Professors R. Messier, A. Badzian, K. Spear, in 1986 confirmed the Japanese work and it was reported on the front page of the Sunday *NY Times*. Today a few hundred laboratories all over the world are working very actively on diamond films. The U.S. government program is very small in this industrially vital field. A dozen products ranging from acoustic speakers to cutting tools—largely from Japan—are already on the market. The ability to coat a very wide variety of surfaces of materials with thin films of real diamonds has, obviously, a very wide range of applications and these are appearing in new products every few months. The principal drawback of the chemical vapor deposition (CVD) process is the fact that the carbon atoms which go to make up the diamond films all start from a *vapor* phase of typically methane, or other organic material and hydrogen, and the atomic "efficiency" of this process is very low.

NEW FINDINGS

With a grant from the Office of Naval Research and DARPA, Professor Roy has been exploring radically innovative routes to making diamond. One of them has yielded some unexpected results. The new process is precisely described and distinguished by its title: *low-pressure, solid-state-source* process. In contrast to the traditional high pressure process which also uses solid state sources of carbon, this process operates at atmospheric pressure. In contrast to known CVD processes, the source of carbon, which is transformed to diamond, is a solid which does not experience the long-range gas phase transport characteristic of the CVD processes. Moreover, the process does not require the introduction of any carbonaceous vapor species.

The present scientific advance uses a very fine mixture of phases. One phase is the "solid state source" which can be virtually any form of carbon (some perhaps being better than others). The second phase, either inherently present in the first phase or added to the first phase, may include tiny crystals or templates or seeds of very fine diamond, or indeed a select group of other materials, many with diamond-like structures. These two phases are intimately mixed, by the sol-gel or other mixing process, shaped into desired shapes and reacted at modest temperatures, 600°-1000°C being the most common. The process appears to proceed fastest in the presence of atomic hydrogen which may be supplied by a microwave plasma, a hot metal filament, or an ordinary oxyhydrogen torch as in current diamond production. No methane or any other organic species is necessary in the vapor feed.

It has also been shown that one can simply mix finely divided nickel, copper, and various other metals with the same finely divided forms of carbon. When such mixtures are reacted in the H_2 plasma, the carbon is completely converted to diamond. So far, in small scale laboratory apparatus, the process also has produced *porous* diamond objects (which can subsequently be infiltrated with diamonds, ceramics, or metals) in the mm thickness regime. Figure 4 shows a cubic die some 1/2 mm on edge nearly fully dense. *Dense* shaped precursors of sizes in the centimeter range, e.g. a right cylinder 1 cm high, 6.25 mm diameter, have also been converted to diamond for some tens of a micrometer from the surface.

All the diamonds produced have its unmistakable signature in the Raman spectrum, the x-ray diffraction pattern, and the morphology in the scanning

electron microscope. In thick sections, the bonding is strong enough that when broken they show transgranular fracture.

Among the various ways in which the mixtures may be made is the sol-gel technique and its recent adaptation by Professor Roy to make nanocomposites. The scientific reasoning behind Professor Roy's discovery has been described by him and his coworkers in a series of a few dozen papers over the last decade. Professor Roy created the term "nanocomposite" to describe the mixtures of phases on a very, very fine (approximately nanometric) scale. In this research supported for years by the Air Force Office of Scientific Research he also showed that such nanocomposites could most easily and generally be made by the so-called sol-gel process which he himself had initiated in 1948. With his colleague, Professor S. Komarneni, and their students he demonstrated in a wide variety of ceramic systems what appeared to be convincing evidence for "solid state epitaxy." That is, the synthesis of a crystalline phase driven by providing templates or "seeds" of the final desired phase, often under conditions which would not lead to its formation. This is the principle now modified for the synthesis of diamond.

♦ ♦ ♦ ♦ ♦



Figure 1. SEM of diamonds formed using carbon-gel containing diamond second phase.

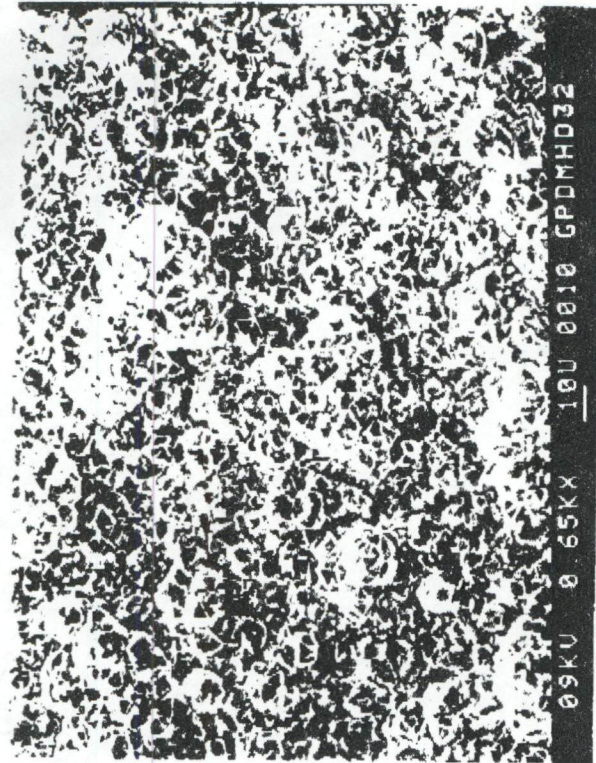


Figure 2. SEM of diamonds formed from graphite with fine silicon as second phase reaction in pure H_2 (only) plasma.



Figure 3. SEM of thick film of diamond formed from graphite and metallic nickel.



Figure 4. Carbon-black and diamond second-phase reacted to give porous diamond body.



Figure 6. Higher magnification of corner of cube in Fig. 5 showing complete conversion to diamond.

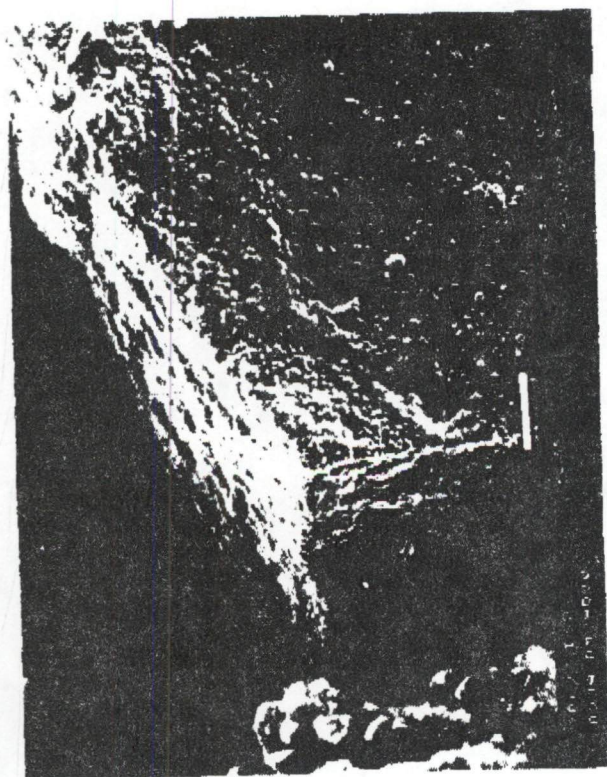


Figure 5. Shows the corner of a shaped cube approximately 0.5 mm on edge converted to diamond.

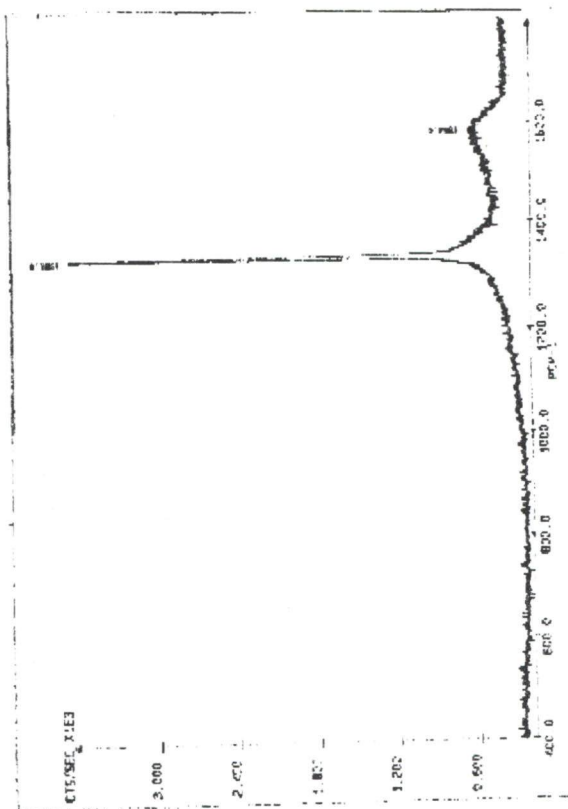
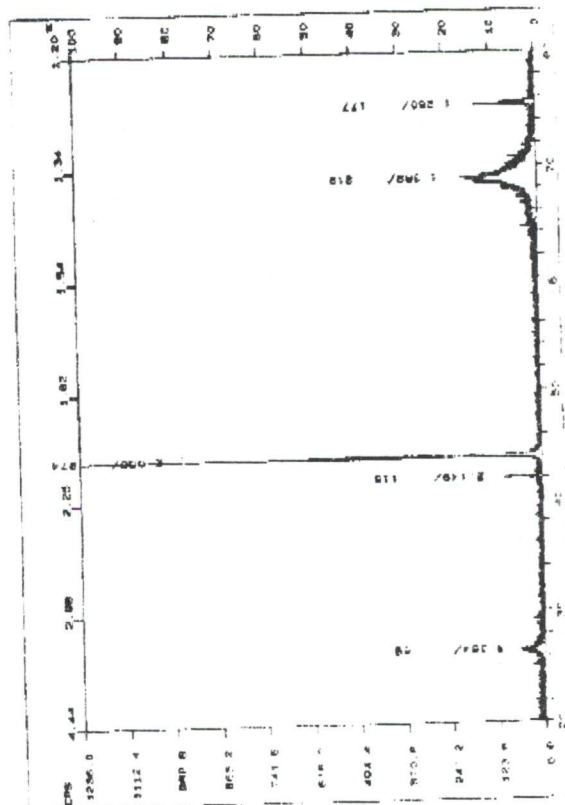


Figure 8. Raman spectrum of same sample confirming evidence of the conversion to diamond.



TYPE: INFORMATION

DOCUMENT NUMBER: 9203161

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: DEPARTMENT OF MATHEMATICS, HARVARD UNIVERSITY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/14/92

SUBJECT: COPY OF A LETTER TO WALTER MASSEY REGARDING FUNDING
FOR MATHEMATICS RESEARCH.

DIRECTORATE
ASSIGNED:

STAFF
ASSIGNED:

ACTION
REQUIRED:

STAFF
ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE:
DATE COMPLETED:

STAFF DUE DATE
DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
PHYSICAL SCIENCES

WHITE HOUSE TRACKING #:

CONTACT PERSON:
PHONE:

EXT:

REMARKS:

OSTP RECEIVED: 10/19/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:

FAX: _____ MAIL: ☒

OSTP #: 920 3161

Date of Correspondence: 10/14/92

Date of Receipt of Correspondence: 10/19/92

From: Several Members of Dept of Mathematics

Affiliation: Harvard University

Subject: copy of letter to Walter Massey, NSF, re funding
for mathematics research

Action:

FYI:

Assign to: _____

Due Date: _____

Copies to: K Erbe, DAB, Tom L

TYPE: ACTION
ORIGINATOR: 02

STATUS I

DOCUMENT NUMBER: 9203124
DIRECTORATE STATUS

FROM: RICHTER, Burton: STANFORD LINEAR ACCELERATOR CENTER

OCT 20 1992

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/13/92

SUBJECT: HE IS WRITING TO EXPRESS HIS CONCERNS ABOUT THE
FACILITIES BUDGET FROM THE DEPARTMENT OF ENERGY.

DIRECTORATE STAFF
ASSIGNED: PHYSICAL SCIENCES ASSIGNED:

ACTION
REQUIRED: AS NECESSARY *None* STAFF
ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 11/02/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT: 12/22/92

COPIES TO: D. Allan Bromley

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

REMARKS: The incoming letter is a response to a
previous (outgoing) letter. We have nothing to add
to our previous response
KTE 12/22/92

OSTP RECEIVED: 10/16/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:



STANFORD LINEAR ACCELERATOR CENTER**Office of the Director****Mail Bin 80 • P. O. Box 4349 • Stanford, CA 94309**

To D. Allan Bromley	From Burton Richter
Inst/Facility Science & Technology Advisor - Presidential Staff	Inst/Facility SLAC
Dept.	Phone No. (415) 926-2601
Fax No. (202) 395-3719	Fax No. (415) 926-4500
Number of Pages: Total of Three	Date: October 15, 1992

Karl Erb
Comment & draft a
reply please

STANFORD LINEAR ACCELERATOR CENTER

OFFICE OF THE DIRECTOR

P. O. Box 4349
Stanford, CA 94309
(415) 926-2601
Telefax: (415) 926-4500
Bitnet Address:
BRIGHTER at SLACVM

October 13, 1992

Dr. D. Allan Bromley
Assistant to the President for Science and Technology
358 Old Executive Office Building
17th Street and Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Allan:

Ed Zschau has sent me a copy of your response to his letter about funding for an upgrade of the SLAC PEP colliding beam storage ring to turn it into a *B*-meson factory. I fully appreciate the fiscal constraints on the government's science programs because of the deficit and the general state of the economy, but I do wish to comment on some of the statements in your letter.

The high energy physics community has indeed assigned as top priority for the field the completion of the SSC. The HEPAP subpanel that functioned as the voice of the community in making recommendations on the base program for the rest of this decade took that as a given. However, there were two other budgetary constraints imposed on the panel that were unexpected by the community at large. These were the requirement that \$144 million (integrated over the rest of this decade) be set aside for the SSC Physics Division from the base program in addition to the construction funding, and that the Fermilab Main Injector was a Presidential Initiative. In its deliberations, the subpanel was told to consider three scenarios — a 2% real increase, a constant purchasing power, and a constant dollar budget which thus eroded the program by inflation. The subpanel unambiguously stated the importance of the work that could be done with the *B*-Factory, including it in their recommendations for both the increased and constant purchasing power scenarios, while being unable to fit it into the lowest scenario. There is no way that anyone can tell whether the recommendations of the panel might have been different with different input constraints, but those constraints were real and played an important part in determining the conclusions of the panel. I was pleased that because of its scientific importance the *B*-Factory was included in the panel's recommendations in all except the lowest scenario.

Looking broadly at the budget for Energy Research in the Department of Energy, I personally feel that increased resources are warranted in many fields including the high energy physics base program. The entire scientific community hoped that with the Administration's success in arms reduction negotiations the amount of funding going to defense programs

real, never the less
KE

page 2

October 13, 1992

in DOE might come down significantly, allowing increased funding for civilian programs within the Administration's overall constraints. However, the guidance given to the Assistant Secretaries by Admiral Watkins last spring in the preparation of the DOE initial budget submission to OMB made it clear that that was not to be.

From my more narrow perspective, as the Director of the DOE's leading laboratory in high energy electron physics, I am even more regretful at what seems to be coming in the FY94 budget. I have learned that the SLAC budget is down for a sharp decrease from FY93 which has the danger of severely compromising the long-term future of the laboratory. Our physics program is going very well (a recent DOE review involving eight outside consultants said that), the *B-Factory* addresses a critical unanswered question in particle physics and many laboratories in the world are relying on us for R&D leading to future high energy linear colliders (after all, we have the only operating one). In addition, we have produced a great deal of technology important to industry and other sciences, including such things as high-power klystrons, high-intensity radiation sources for therapy, the modern synchrotron light source, etc.

Our proposal to construct the *B-Factory* out of the constant level of effort budget at the President's FY93 budget submission level still seems to be to be a very responsible proposal to advance science and technology, while recognizing the financial constraints on all programs in Washington. The amount of money we need above the DOE's recommendation to the OMB is not large and I very much hope that your office could look again at the balance between civilian, military and environmental programs in DOE to find such funds. While my problem is small compared to the broader problems that you face, I hope that you can help for I think that the SLAC program is important to science, to the nation, and to California.

Sincerely,



Burton Richter
Director of SLAC

BR:bjf

CC: E. Zschau

TYPE: ACTION

DOCUMENT NUMBER: 9203124

ORIGINATOR: 02

STATUS I

DIRECTORATE STATUS

FROM: RICHTER, Burton: STANFORD LINEAR ACCELERATOR CENTER

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/13/92

SUBJECT: HE IS WRITING TO EXPRESS HIS CONCERNS ABOUT THE
FACILITIES BUDGET FROM THE DEPARTMENT OF ENERGY.

DIRECTORATE

STAFF

ASSIGNED: PHYSICAL SCIENCES

ASSIGNED:

ACTION

STAFF

REQUIRED: AS NECESSARY

ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE: 11/02/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley

WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE:

EXT:

REMARKS:

OSTP RECEIVED: 10/16/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:

STANFORD LINEAR ACCELERATOR CENTER**Office of the Director****Mail Bin 80 • P. O. Box 4349 • Stanford, CA 94309**

To D. Allan Bromley	From Burton Richter
Inst/Facility Science & Technology Advisor - Presidential Staff	Inst/Facility SLAC
Dept.	Phone No. (415) 926-2601
Fax No. (202) 395-3719	Fax No. (415) 926-4500
Number of Pages: Total of Three	Date: October 15, 1992

*Karl Erb
Comment & draft a
reply please*

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Washington, D. C.

TO: [illegible]
FROM: [illegible]
SUBJECT: [illegible]

[illegible handwritten notes and signatures]

STANFORD LINEAR ACCELERATOR CENTER

OFFICE OF THE DIRECTOR

P. O. Box 4349
Stanford, CA 94309
(415) 926-2601
Telefax: (415) 926-4500
Bitnet Address:
BRICHTER at SLACVM

October 13, 1992

Dr. D. Allan Bromley
Assistant to the President for Science and Technology
358 Old Executive Office Building
17th Street and Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Allan:

Ed Zschau has sent me a copy of your response to his letter about funding for an upgrade of the SLAC PEP colliding beam storage ring to turn it into a *B*-meson factory. I fully appreciate the fiscal constraints on the government's science programs because of the deficit and the general state of the economy, but I do wish to comment on some of the statements in your letter.

The high energy physics community has indeed assigned as top priority for the field the completion of the SSC. The HEPAP subpanel that functioned as the voice of the community in making recommendations on the base program for the rest of this decade took that as a given. However, there were two other budgetary constraints imposed on the panel that were unexpected by the community at large. These were the requirement that \$144 million (integrated over the rest of this decade) be set aside for the SSC Physics Division from the base program in addition to the construction funding, and that the Fermilab Main Injector was a Presidential Initiative. In its deliberations, the subpanel was told to consider three scenarios — a 2% real increase, a constant purchasing power, and a constant dollar budget which thus eroded the program by inflation. The subpanel unambiguously stated the importance of the work that could be done with the *B*-Factory, including it in their recommendations for both the increased and constant purchasing power scenarios, while being unable to fit it into the lowest scenario. There is no way that anyone can tell whether the recommendations of the panel might have been different with different input constraints, but those constraints were real and played an important part in determining the conclusions of the panel. I was pleased that because of its scientific importance the *B*-Factory was included in the panel's recommendations in all except the lowest scenario.

Looking broadly at the budget for Energy Research in the Department of Energy, I personally feel that increased resources are warranted in many fields including the high energy physics base program. The entire scientific community hoped that with the Administration's success in arms reduction negotiations the amount of funding going to defense programs

page 2

October 13, 1992

in DOE might come down significantly, allowing increased funding for civilian programs within the Administration's overall constraints. However, the guidance given to the Assistant Secretaries by Admiral Watkins last spring in the preparation of the DOE initial budget submission to OMB made it clear that that was not to be.

From my more narrow perspective, as the Director of the DOE's leading laboratory in high energy electron physics, I am even more regretful at what seems to be coming in the FY94 budget. I have learned that the SLAC budget is down for a sharp decrease from FY93 which has the danger of severely compromising the long-term future of the laboratory. Our physics program is going very well (a recent DOE review involving eight outside consultants said that), the *B-Factory* addresses a critical unanswered question in particle physics and many laboratories in the world are relying on us for R&D leading to future high energy linear colliders (after all, we have the only operating one). In addition, we have produced a great deal of technology important to industry and other sciences, including such things as high-power klystrons, high-intensity radiation sources for therapy, the modern synchrotron light source, etc.

Our proposal to construct the *B-Factory* out of the constant level of effort budget at the President's FY93 budget submission level still seems to be to be a very responsible proposal to advance science and technology, while recognizing the financial constraints on all programs in Washington. The amount of money we need above the DOE's recommendation to the OMB is not large and I very much hope that your office could look again at the balance between civilian, military and environmental programs in DOE to find such funds. While my problem is small compared to the broader problems that you face, I hope that you can help for I think that the SLAC program is important to science, to the nation, and to California.

Sincerely,



Burton Richter
Director of SLAC

BR:bjf

CC: E. Zschau

FAX: ☒ MAIL: ☐

OSTP #: 9203124

Date of Correspondence: 10/13/92

Date of Receipt of Correspondence: 10/16/92

From: Burton Richter

Affiliation: Director of SLAC
Stanford, CA

Subject: Concerned about the SLAC budget from DOE

Action:

FYI:

Assign to: Kare Ene

Due Date: 11/2

Copies to: —

DAB has seen

TYPE: INFORMATION

DOCUMENT NUMBER: 9203182

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: BIRMAN, Joseph L.: CITY COLLEGE OF NEW YORK

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/04/92

SUBJECT: HE IS FORWARDING A COPY OF HIS LETTER TO WALTER
MASSEY REGARDING THE FUTURE OF THE NSF.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
PHYSICAL SCIENCES

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

OSTP RECEIVED: 10/13/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:



3182

1

THE CITY COLLEGE
OF
THE CITY UNIVERSITY OF NEW YORK
CONVENT AVE. at 138 ST.
NEW YORK, NEW YORK 10031

JOSEPH L. BIRMAN
DISTINGUISHED PROFESSOR
DEPARTMENT OF PHYSICS

4 October 1992

Tel: (212) 650-6871
FAX: (212) 650-6940
e-mail: birman@sci.ccny.cuny.edu

Dr Walter Massey, Director NSF;
Members National Science Board;
Commission on Future of NSF,
Washington, D.C.

Dear Dr Massey, and Members of the Board and Commission:

I appreciate the opportunity to express my views on the policy matters affecting the future of the NSF as requested by Dr Massey. Having heard Dr Massey at CUNY on 15 September and having read the written material in Physics Today; in What's New; in Science; and in other public sources, I write to express my profound dismay with the proposed new directions.

I believe that NSF is being redirected in precisely the wrong directions, and with precisely the wrong priorities. Certainly I agree on the major problem areas which need to be addressed (as in Dr Massey's Open Letter) are:

changes in the nature of research itself;
new demands on academic institutions;
end of the cold war;
and growing international competition.

The proposed new directions, which emphasize fulfilling (again to quote Dr Massey) "what the public expects from investments in science and technology" are all too familiar to someone like myself who spent the first 10 years of post-PhD scientific life in Industry and then joined University where I have spent the last 30 years. On the contrary, I am persuaded that: the "public" needs to be educated as to what to expect, (and in particular) on what time-scale, and not (as NSF policy now wishes) to be pandered to, by neglecting the actual experience in this country in the 47 years since the end of WWII.

In my view, the policy being proposed for NSF attempts a task which should be performed by Industrial Research Laboratories and not NSF. Let me support this from my own experience.

In the 50's and for a period thereafter there was a Federal policy on tax-write-offs which encouraged individual Corporations to set up, and expand, basic research laboratories. I joined the nascent Sylvania (later GTE) Laboratory when I received my PhD in 1952. In addition there were basic research laboratories at ATT Bell, Westinghouse, RCA, GE, Howard Hughes, IBM-Watson, and many others. Each such laboratory responded to the needs of that Corporation as articulated by its own scientific-technological management, and approved by its Board. The explosion of basic science, and patents, and later products in the period 1950-1970 is well known. The electronics, communications, lighting,

computer, and many other industries enjoyed great growth and profitability and still benefit from the basic work done at that time. The US was never in as strong a position from the point-of-view of science-based technology.

The key to this was explained to me by my management during my GTE days---Federal Tax Policy made it very cheap for these corporations to support basic research--it only cost about ten cents on the dollar; a fraction of the usual advertising cost. It was an excellent speculative investment for these "enlightened" corporations: if an important patent and product resulted, they would make profits exceeding by far their cost, if not then the "excellent public relations" would itself be a justification for the expenses.

I left the GTE Labs for New York University in 1962, and some decade after this, Federal Tax Policy started to alter so that the remarkable benefits just mentioned disappeared. With this went the gradual (and now precipitous) termination of Industrial support for basic research. In this period, NSF support of basic science in Universities increased.

At present the level of basic research in Corporate Laboratories is shrinking to the near-vanishing point. Even ATT Bell (once the hallmark of enlightened industrial research policy for the whole world) has largely diminished support of basic science. The once important Laboratories of RCA, Hughes, GE and others are now defunct or have changed their missions so drastically that basic research has practically no place in their program.

So, in my observation, at present the only support for basic science comes from NSF, and to varying degrees from DOE, and the DOD Service organizations.

Turning to the four areas mentioned above, from a National point of view the most relevant in my view is that we are falling behind in the industrial-technological sector vis-a-vis Japan and Western Europe. The key to our survival as an important player on the world scene is that we leap-frog over the present situation, and look to the science based technology of the future. Whether this is in communications, computer-science, energy, biotechnology or whatever, the basic science is essential, and is being neglected here at present in the USA and the announced plans accelerate this neglect.

NSF has already been far too responsive to political pressures of one-or-another sort (from Congress or other groups) and has instituted large multi-disciplinary Laboratories, and Centers, or other projects of dubious value to the development of basic science. This has of course come at the expense of the "small science" individual-projects which are truly the core of our creativity. The new directions indicated by Dr Massey's plans will go further in this direction and finally eviscerate the core of small and basic science.

Let me turn to another domain in which NSF has been insufficiently attentive: the challenge and opportunity afforded us by the large-scale emigration of scientists from the Former Soviet Union. These people have generally been highly trained, include world-famous "stars" like Sagdeev, Abrikosov, Gor'kov, Dzaloshinsky to name a few. But many others are largely underutilized at present, and very many are on the job-market. NSF could expand (rather than contract) the basic research level of support at Universities, and National laboratories and thus get these people working to develop our scientific base.

So I consider that the NSF has already largely abdicated the very function for which it was created, namely the support of undirected, and basic research in the sciences.

There is a serious question as to whether this wrongful direction is reversible. If not, two options would then be possible. One is a return to "pre-NSF" days when basic research at Universities was supported out of the agencies like ONR, the Army etc. in which there

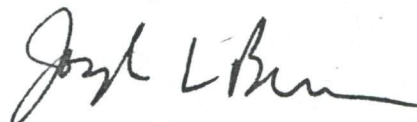
always existed a cadre of officers who realized that ultimately the defense strength of the USA depended on the entire chain from basic research to production. These offices supported such work as Willis Lamb's QED studies at Columbia, the mix of pure and applied mathematics at the NYU (later Courant) Institute of Mathematical Sciences, and many others. Of course much of this was driven by the anticipated needs for WWII or the Cold War-- but the international economic competition we now face is as good a substitute as should be needed to justify a balanced research effort extending to, and firmly anchored in fundamental science.

A second route would be to abdicate Federal support and let individual Universities prioritize basic research in order to attract excellent and motivated staff, or become known in the world, in order to attract paying students. The second option will, I am convinced, inevitably lead to the European Community being the leader in innovative research --as exemplified already in such topics as the discovery of High Temperature Superconductors, and of The Quantum Hall Effect, (and other phenomena of the last decade or so)--followed soon after by Japan. The US will then be second-rate and destined to try to "catch-up".

Of course yet another option is to rename the NSF to correspond to its new mission say "The National Science and Development Foundation", and then to create a new Federal entity to support small-scale and basic research. That is, to support the mission for which NSF was originally created !!

In summary I believe NSF's new emphasis is detrimental to the basic-science enterprise upon which this country's 20 years (1950-70) of dominance in technology rested. NSF seems to be trying to move into a domain of R&D abandoned by Private Industry, where the Foundation does not belong. Meanwhile, by assuming new missions without an increase in real-money budget, the NSF is allowing a decay of the basic sector. The Foundation should spearhead an effort to educate the public to the importance of Tax-Write off for private industry, for long term research [let us say as defined in the 50's] which will certainly not pay off for the next decade, or perhaps ever. The NSF should return to its mission of support of the essentials--individual investigator creativity.

Yours truly,



Joseph L. Birman

C.C. Rep. G. Brown
Rep. Rick Boucher
Rep. Bot. TRAXLER
Sen. Barbara Mikulski
Dr. D. Allan Bromley

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9203061
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: MASCHERONI, P. Leonardo: LMFI GROUP, LOS ALAMOS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 09/29/92

SUBJECT: HE IS FORWARDING A COPY OF HIS LETTER REGARDING THE
RECONVENING OF THE 1990 NAS PANEL ON THE NATIONAL
ICF PROGRAM.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
Karl Erb

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: ENCLOSURES TO DR. ERB PER DAMAR.

OSTP RECEIVED: 10/07/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:

FAX: _____ MAIL: ☒

OSTP #: 920 3061

Date of Correspondence: 9/29/92

Date of Receipt of Correspondence: 10/7/92

From: P. Leonardo Mascheroni

Affiliation: LMFI Group

Los Alamos

Subject: copy of letter to Frank Press re reconvening
1990 NAS panel on the national ICF program

Action:

FYI:

Assign to: _____

Due Date: _____

Copies to: DAB, KERh

(w/attachment)

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
03a. Letter	To: Frank Press From: Leonardo Mascheroni Re: Inertial Confinement Fusion program (5 pp.)	11/29/92	(b)(1), (b)(6)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
03b. Article	Federation of American Scientists Bulletin re: Pedro Mascheroni [personal information redacted] (1 pp.)	9/92	(b)(6)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
03c. Letter	To: Pedro Macheroni From: New Mexico Department of Labor, Human Rights Division Re: Complaint against Los Alamos National Laboratory [personal information redacted] (1 pp.)	6/7/89	(b)(6)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

"Document Control"

TYPE: INFORMATION

DOCUMENT NUMBER: 9202972

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: GOODSTEIN, David L.: CALIFORNIA INSTITUTE OF TECHNOLOGY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 09/21/92

SUBJECT: HE IS FORWARDING A COPY OF HIS ARTICLE REGARDING THE
"MALAISE OF ACADEMIC SCIENCE".

DIRECTORATE
ASSIGNED:

STAFF
ASSIGNED:

ACTION
REQUIRED:

STAFF
ACTION:

SENDER'S DUE DATE:

OSTP DUE DATE:
DATE COMPLETED:

STAFF DUE DATE
DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
PHYSICAL SCIENCES

WHITE HOUSE TRACKING #:

CONTACT PERSON:
PHONE:

EXT:

REMARKS:

OSTP RECEIVED: 10/01/92
FILE: P-PHYSICAL SCIENCES

DEPT RECEIVED:

CENTRAL FILES:

2472

CALIFORNIA INSTITUTE OF TECHNOLOGY

Pasadena, California 91125

David L. Goodstein
Vice Provost
Professor of Physics and Applied Physics

Mail Code 104-31
Telephone 818/356-6365
Fax 818/796-7820

September 21, 1992

Dr. D. Allan Bromley
Executive Office of the President
Office of Science and Technology Policy
Old Executive Office Bldg.
Washington, DC 20506

Dear Allan:

After reading some of your public utterances recently, it occurred to me that you might be amused by the enclosed article, which sets out my theory of the malaise (excuse the word) of academic science. It's to appear, under the title Scientific Ph.D. Problems, in this month's *American Scholar*.

It was a pleasure to see you in Monterey. Keep up the good fight.

Best regards,



David L. Goodstein

DLG/jp

PH.D. PROBLEMS

by David Goodstein

Word has gotten round that the country will face a grave shortage of Ph.D.'s, in both the sciences and the humanities, later in this decade. Within academic middle-management circles this dilemma is well known to be related to the "pipeline" problem. Just say the word pipeline and every dean in earshot will nod gravely, expecting the phrase to be self-explanatory. The idea is that our young people start out in the early grades as a torrent of bright, eager, curious intellects, ready to study and learn and become scholars and scientists, but wind up at the other end of the line as a mere trickle of Ph.D.'s. Thus, our entire educational system is seen as a leaky pipeline, badly in need of repair. To make matters worse, the number of American students who go to graduate school has been declining for a decade, the number of the best students who take on graduate study has been declining for two decades, and half the students who do start graduate school drop out before they get their Ph.D.'s.

Moreover, the story goes, these are difficult times for professors as well, especially in the sciences. Leon Lederman, one of the true leaders in American science, issued a booklet recently titled *Science--The End of the Frontier*. The title is a play on *Science--The Endless Frontier*, the 1940's report by Vannevar Bush that led to the creation of the National Science Foundation and the modern academic/government research establishment. Lederman argues that university based scientific research is being starved to death by government underfunding. Professors, who got their positions by proving their skills as scientists, spend all of their time raising money for research instead, and the best students, who quickly catch on to the situation, are discouraged from aspiring to go into the research

profession. I confess to being the anonymous Caltech professor quoted in one of Lederman's sidebars to the effect that my main responsibility today is no longer to do science, but rather to raise money to feed my graduate students' children. Lederman's appeal was not well received in Congress, where it was pointed out that academic research support is not an entitlement program, nor in the press, where the Washington Post was seen to speculate about the unlikely specter of hungry children haunting the hallowed halls of Caltech.

I should like, at this point, to raise my hand modestly and point out that all of these concerns are misplaced. The Ph.D. shortage is an illusion, a kind of mirage caused not by the hot sun, but by too much staring at statistics unmoderated by serious thought. What we face instead is a chronic, systemic oversupply of Ph.D.'s, a rising tide of Ph.D.'s that we seem helpless to stem. The educational system is not a leaky pipeline, and if it were and we could repair it the result would be a genuine torrent of Ph.D.'s that would threaten to flood the place. And finally, the very real problem Lederman writes about is caused by the fact that we have too many academic researchers. It is a consequence not of government penury, but of academic promiscuousness.

To be sure, the Ph.D. is the jewel in the crown of American education. The crown is badly worn and much tarnished, but the jewel is brilliant nevertheless. In spite of an education system that is abysmal in every respect from kindergarten through college, we lead the world in most fields of scientific research. That research is done in our universities, by our graduate students, who are, without doubt, the best in the world. Young scholars from all over the world, if they are going to have a serious career, especially in the sciences, must spend at least a year of postgraduate study in the United States. Before World War

II, American students who aspired to the upper reaches of science had to go to Europe for the same purpose. It is said that in antiquity, Roman students likewise went to Greece. This era may or may not be seen by history to be the point at which America passed the torch of world leadership to other hands, but we do seem to be playing the role traditionally reserved for the former world leader, at least in graduate studies in the sciences.

I believe, however, that even this last pocket of excellence in American education will eventually be brought to grief, because we are constitutionally incapable of solving our chronic problem of Ph.D. overproduction. To understand my personal view of this issue, it's necessary to go back more than 20 years, to 1970, when I was a young Assistant Professor of Physics at Caltech. At that time I became aware that it had become difficult for Ph.D.'s to get jobs. Even Caltech Ph.D.'s in physics, in other words my very own students, couldn't necessarily get any jobs their hearts desired.

Casting about for an explanation of this unhappy phenomenon, I happened on the book *Little Science, Big Science* by Derek de Sola Price. From that book I learned that the number of Ph.D.'s in science (or any other quantitative measure of the size of science) had been growing exponentially, with a seven year doubling period, since about 1800. If that trend continued, every man, woman and child in the United States would have a Ph.D. in physics by the year 2050.

Now I was really alarmed. My students' difficulties in finding a suitable job were symptomatic of the saturation of the growth curve. I could not anticipate a steady flow of graduate students in the future. If that happened, who would do my research for me? I tried to imagine what would be needed to design a stable,

sustainable academic world. At the time, ZPG, standing for zero population growth, was a popular slogan. What would be required for ZPG in academic science? The answer was not hard to find: each professor in a research university should produce, on the average, during an entire career, no more than one graduate student who would become another research professor. In the system as it then existed, in the scientific fields I was familiar with, each professor was turning out an average of about 15 Ph.D.'s per career! Of course not all Ph.D.'s become research professors, but a lot do, and most would like to if they could find such a job. Obviously, the system would have to be changed dramatically if we were ever to reach a sustainable steady-state.

I discussed the problem with my colleagues at Caltech. No one disputed my reasoning, but all stoutly resisted any suggestion that we change our ways. They knew the proper solution: all universities would go out of the graduate business with the exception of Caltech and a handful of others, who would continue happily on, doing as we had always done. One exception to this attitude was expressed by Harold Brown, then President of Caltech, later Secretary of Defense. He had a more creative idea. Harold (who himself has a Ph.D. in physics, but never actually practiced the trade) said the solution was to require a Ph.D. in physics as a kind of mental discipline before beginning any serious career, just as Latin and ancient Greek had once been required for the British civil service. At least that would put the problem off until 2050.

As it has turned out, neither I, nor my colleagues at Caltech, nor Harold Brown anticipated correctly what was to happen over the next twenty years. What has happened is that foreign students have rescued the great American academic research machine. Today, in many fields of science and engineering, half or more

of the graduate students in the United States are from abroad. They have replaced the American students for whom there would have been no jobs anyway, and life in the research universities has not changed very much from what it was in 1970.

To understand the dynamics that led to all of this, it is necessary to go back yet another 20 years. Beginning around 1950, the Government's newfound responsibility to support scientific research in the universities, combined with the G.I. Bill of Rights, produced a brilliant golden age for the American academy. Before the war, about 8% of our young people went to college, a figure comparable to that in England or France. Higher education was reserved for the rich and the intellectually elite. After the war, however, spurred by the G.I. bill, we became the first nation on Earth to try the noble experiment of mass higher education. Today, more than half of our young people get some sort of post-secondary schooling and nearly one third actually graduate from college. Thus, 1950-1970 was a period of breakneck expansion in the U.S. academic world. The number of Ph.D.'s in America increased by a factor of 10 during that period, and they were absorbed by the need created by rapidly expanding college enrollments. It was an exhilarating time to be a professor, and the people expected it to go on forever.

It could not go on forever, of course. By 1970 even I had begun to notice the ominous signs of a declining academic market. Nevertheless, the factor of ten growth in Ph.D.'s fitted smoothly onto Price's exponential growth curve: in 21 years, from 1950 to 1970, Price would have expected three seven-year doubling periods, or growth by a factor of $2 \times 2 \times 2 = 8$. That is close enough to what actually happened. But it was the last hurrah of Price's growth curve (which had extended back unbroken, remember, to 1800). With half the kids in college already,

it would never happen again. The golden age was over.

But we didn't know it at the time. And, during the long period of exponential growth, we had developed a system in which it was considered normal, even virtuous and necessary, for each professor in a research university to produce, on the average, 15 Ph.D.'s in the course of a career, many of them aspiring themselves to become research professors who would themselves turn out 15 more Ph.D.'s. In a time of exponential growth, that's just what was needed. In a time when no more growth is possible, it is a prescription for disaster. Moreover, it is not easily changed. The social structure of the typical university scientific research group is such that it demands that enough graduate students be around that one is bound to graduate every couple of years. Besides, there is a well-entrenched bureaucracy, typically presided over by the Dean of Graduate Studies, that would not be pleased should graduate enrollments begin to drop.

Enter the foreign graduate students. With the saturation of demand for Americans with doctorates around 1970, the best American students proved their superior abilities by reading the handwriting on the wall, and began to choose other lines of work. In the meantime, however, the golden age had produced an unprecedented degree of genuine excellence in research and graduate education. Almost unnoticed, the declining number of American students was replaced by an increasing number of foreign students.

Now, another 20 years later, our entire system of education reminds me of what I suppose Soviet industry to have been like before perestroika and subsequent events. Like the education we offer, the goods the Soviets turned out were shabby and ill-fitting, but at least they were for everyone. Just so, we educate everyone,

rather poorly, and the education we offer in the sciences is the worst of all. Nevertheless, we have a special line of scientific goods so superior - like certain Russian caviars and vodkas - that it competes successfully in world markets. We have kept the momentum of excellent graduate education going for twenty years after the growth curve saturated by straining to the limit America's ability to absorb Ph.D.'s, and by exporting the rest.

The generally sorry state of American pre-graduate education brings us back to the matter of the pipeline. To view the American system of education as a leaky pipeline misses the point rather badly. To produce Ph.D.'s is not, and should not be, its purpose. Its purpose is to produce citizens who are sufficiently educated to participate in a Jeffersonian democracy, and possibly even to contribute to our economic well-being. These things it does not do very well, and it does them most poorly of all in the sciences. To cite just one example among many of the consequences of that failure, the vast majority of the country seems to have believed without question President Reagan's 1983 promise that an impenetrable shield against missile attack could be built in space. All scientifically literate people knew that the promise was fraudulent, but that is a tiny fraction of the populace.

There remains a strange enigma to explain. How can such a poor system of education continue to produce the best graduate students and the best scientists in the world? (It may also produce the best scholars and the best poets -- I'm not in a position to know that.) Traveling abroad, one cannot help but be impressed by the broad culture and demanding education received by university-bound students elsewhere compared to the lamentable state of our own freshmen. Yet, young Americans catch up with the rest of the world at about the second year of

second to none. How do these selected students manage not to leak out of the pipeline?

The answer, it seems to me, is that they are carefully selected. The system is not a leaky pipeline, but rather a series of filters designed to reject those who do not qualify. The teaching of physics (just to take an example) in American colleges is a dreary business, depressing to students and professors alike, except for the hand-picked few who are groomed to become professionals. Once the professor recognizes a diamond-in-the-rough, ready to be cut and polished into a brilliant gem just like himself, education becomes exhilarating and successful. I rather imagine something similar happens in many other fields, and at all earlier levels of education. This is the way we have rescued elitism from the jaws of democracy. College in America may be for the masses, but the superior graduate school is still for the chosen few.

The number of Ph.D.'s in America did not stop growing in the last two decades. However, instead of three doublings as predicted by Price's exponential growth curve, there has been only one. There are twice as many academic researchers in America today as there were in 1970. Federal support for scientific research in the universities (corrected for inflation) has also doubled during that period. That of course is no mere coincidence. I would predict we will always have just enough Ph.D.'s to absorb whatever research funds are available. The painful condition of the university researcher that Lederman writes about is very real -- and it had better be. It's the only mechanism that limits our Ph.D. production. To be sure, the generation of professors that came to maturity during the boom years 1950-1970 will start retiring in this decade. Thus, a superficial analysis indicates there will be empty classrooms to fill once that starts

analysis indicates there will be empty classrooms to fill once that starts happening. Don't believe it. Just the hint that academic posts may become available in a few years has already caused graduate enrollment by American students to increase sharply in the last year or two. The looming shortage of professors is one problem we really don't have to worry about.

Americans should be proud of our role as the world's principal source of culture and learning in the sciences. The students who come here to learn from us enrich our lives and contribute energy, ingenuity, and ideas to our research. Nevertheless, there is another way to view all this. Foreign graduate students in the sciences (and engineering and mathematics) generally receive a stipend, either to do research towards their own degrees, or to teach, which they often do poorly because their English is imperfect. In addition, their tuition is usually either heavily subsidized or waived entirely. The American taxpayer (both state and federal) is supporting extremely expensive research universities whose main educational purpose is to train students from abroad. When these students finish their educations, they either stay here, taking relatively high paying jobs that could have gone to Americans, or they go home, taking our knowledge and our technology with them.

The American research universities are currently in a dither because Congress has discovered an interest in indirect cost payments on federal research grants and contracts, an issue so arcane it confuses even the experts (I'm one of them). Congress and the public doesn't seem yet to have noticed that, while largely ignoring our own students, we are putting our money and our best talent into training our economic competitors. Just wait until this one hits the fan.

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202908
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: ROKACH, Abraham J.: HYPERMEDIA SYSTEMS INC.

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 09/22/92

SUBJECT: HE IS WRITING REGARDING THE NATIONAL SCIENCE
FOUNDATION'S SMALL BUSINESS INNOVATION RESEARCH
PROGRAM AND THE DIFFICULTY HIS COMPANY HAS BEEN
HAVING.

DIRECTORATE STAFF
ASSIGNED: INDUSTRIAL ASSIGNED:

ACTION STAFF
REQUIRED: AS NECESSARY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 10/12/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
INDUSTRIAL

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: ASSIGNED TO PHYSICAL SCIENCES PER DAMAR. REASSIGNED TO PHYSICAL
SCIENCES PER DR. ERB.

OSTP RECEIVED: 09/28/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202908
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: ROKACH, Abraham J.: HYPERMEDIA SYSTEMS INC.

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 09/22/92

SUBJECT: HE IS WRITING REGARDING THE NATIONAL SCIENCE
FOUNDATION'S SMALL BUSINESS INNOVATION RESEARCH
PROGRAM AND THE DIFFICULTY HIS COMPANY HAS BEEN
HAVING.

DIRECTORATE STAFF
ASSIGNED: INDUSTRIAL ASSIGNED:

ACTION STAFF
REQUIRED: AS NECESSARY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 10/12/92 STAFF DUE DATE
DATE COMPLETED: 29 DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
INDUSTRIAL

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: ASSIGNED TO PHYSICAL SCIENCES PER DAMAR. REASSIGNED TO PHYSICAL
SCIENCES PER DR. ERB. INDUSTRIAL

OSTP RECEIVED: 09/28/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:



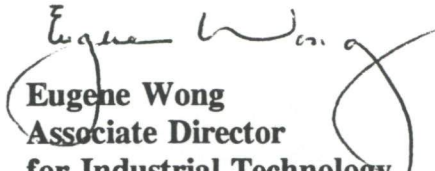
EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

October 26, 1992

Dear Mr. Rokach:

I am responding to your letter to Dr. Bromley concerning NSF's SBIR program. We have no authority to review NSF's handling of your proposals and it would be highly inappropriate for us to intervene on your behalf.

Sincerely yours,


Eugene Wong
Associate Director
for Industrial Technology

Mr. Abraham J. Rokach
President
Hypermedia Systems Inc.
6754 North Whipple Street
Chicago, Illinois 60645-4123

FAX Transmittal

September 22, 1992

To: Dr. D. Allan Bromley / FAX: (202) 395-3261

Attached herewith: 5 pages

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
04a. Letter	To: Allan Bromley From: Abraham Rokach Re: Request for assistance with NSF grant (2 pp.)	9/22/92	(b)(4)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
04b. Letter	To: Frederick Bernthal From: Abraham Rokach Re: Request for reconsideration of proposal to NSF (2 pp.)	9/11/92	(b)(4)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
04c. Letter	To: Joseph Bordogna From: John Carleo, McGraw Hill Re: Request for reconsideration of proposal to NSF (1 pp.)	9/3/92	(b)(4)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: General Science Files
WHORM Cat.:
File Location: Physical Sciences: General (1) [2 of 7] [1992]

Date Closed:	3/19/2010	OA/ID Number:	62042-002
FOIA/SYS Case #:	2005-0336-F	Appeal Case #:	
Re-review Case #:		Appeal Disposition:	
P-2/P-5 Review Case #:		Disposition Date:	
AR Case #:		MR Case #:	
AR Disposition:		MR Disposition:	
AR Disposition Date:		MR Disposition Date:	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

TYPE: ACTION DOCUMENT NUMBER: 9202924
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: KELLY, Francis J.: THE CATHOLIC ASSOCIATION OF SCIENTISTS AND ENGINEERS

TO: DR. D.A. BROMLEY

SEP 29 1992

DATE OF
CORRESPONDENCE: 09/19/92

SUBJECT: HE IS WRITING REGARDING AN INTERVIEW DR. BROMLEY HAD WITH THE NAVAL RESEARCH REVIEW WHERE HE COMPARED THE SSC TO THE CATHEDRALS OF THE ROMAN CATHOLIC CHURCH.

DIRECTORATE STAFF
ASSIGNED: PHYSICAL SCIENCES ASSIGNED: *Mc Kingston*

ACTION STAFF
REQUIRED: AS NECESSARY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 10/12/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT: *10/27/92*

COPIES TO: D. Allan Bromley
Steve Olson

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: *Mc Kingston requested.*



OSTP RECEIVED: 09/28/92 DEPT RECEIVED:
FILE: P-PHYSICAL SCIENCES
CENTRAL FILES:



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

October 26, 1992

Dear Dr. Kelly:

While being interviewed for the Naval Research Review, Dr. Bromley wished to convey that the community spirit and intellectual achievement engendered by a large national project such as the Superconducting Super Collider is a reflection on the abilities of society to accomplish great things. He compared that endeavor to the building of cathedrals which also involves a strong common effort.

Dr. Bromley did not intend to imply that the SSC will be inspirational in the same sense as cathedrals or to compare science and religion. Please accept our apologies for any offense taken by this analogy.

Sincerely,



Marguerite J. Kingston
Policy Analyst

Dr. Francis J. Kelly
Chief Scientist, Our Lady of Fatima Section
The Catholic Association of Scientists
and Engineers
8308 Rambler Drive
Adelphi, MD 20783

2924

DR. FRANCIS J. KELLY
8308 RAMBLER DRIVE
ADELPHI, MARYLAND U.S.A. 20783

(11) 001-722-9000
(W) 202-767-2941

Dr. Allen Bromley
Assistant to the President for Science and Technology
Director of the Office of Science and Technology Policy
Executive Office of the President
Washington, DC

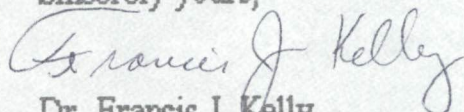
Dear Sir,

In your recent interview (1991) in the Naval Research Review, you compared the Superconducting Supercollider to the beautiful and inspiring cathedrals of the Roman Catholic Church. Such a comparison is highly inaccurate and misleading. It indicates that you do not understand the place of Jesus Christ, the Son of God and the King of Kings. A cathedral is a beautiful house made for Jesus, who inhabits the cathedral in His body and soul under the appearance of the Holy Eucharistic Host. Jesus invites us to visit Him at His house and gives us His flesh to eat and His blood to drink. While there we listen to inspiring preaching and hymns and participate in the sacrifice that He made at His Crucifixion.

The SSC is just a long tunnel which will be highly magnetized and crammed with electronics. Few will visit. If you think that the SSC will become some sort of religious shrine, you can check out your ideas by taking a walk around the LEP ring at CERN. I'm sure that all you will get are sore feet.

In contrast, I will gladly take you on a tour of the National Basilica Shrine of the Immaculate Conception on Michigan Avenue in Washington, D.C.

Sincerely yours,



Dr. Francis J. Kelly,
Chief Scientist, Our Lady of Fatima Section (#1)
The Catholic Association of Scientists and Engineers