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DIRECTORATE STATUS

STATUS I

FROM: DORSEY, Laurens: SYREX INC.

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 12/30/91

SUBJECT: A LETTER ASKING WHICH U.S. POLICIES/PROGRAMS MAY BE
APPLIED NOW TO ASSIST THEIR 1992 EXPORT AND DOMESTIC
SALES OF THEIR NEW, LOW COST COMPUTERS FOR SMALL
BUSINESSES/FARMERS, UNIVERSITIES AND SCHOOLS.

DIRECTORATE STAFF
ASSIGNED: INDUSTRIAL ASSIGNED:

ACTION
REQUIRED: DIRECT REPLY

STAFF
ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 01/20/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
~~PHYSICAL SCIENCES~~
INTERNATIONAL/POLICY

E Wang per 108E 1/18

WHITE HOUSE TRACKING #:

CONTACT PERSON:
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REMARKS:

[Handwritten signature]

[Handwritten number 28]

OSTP RECEIVED: 01/06/92
FILE: P-INDUSTRIAL

DEPT RECEIVED:

CENTRAL FILES:

[Handwritten notes: "Main", "extra copy if files need it", "Sa"]



Service Plus Quality

Mr. D. Allan Bromley
 Assistant to the President for Science & Technology
 The White House Office
 1600 Pennsylvania Ave., NW
 Washington, DC 20500

December 30, 1991

OSTP
 MAIL ROOM

Dear Sir:

We write to ask which U.S. policies/programs may be applied now to assist our 1992 export (& domestic sales) of our new, low cost computers for small businesses/farmers and for related universities and schools.

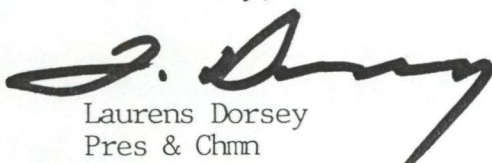
Up to now we have contacted universities, businesses and government points in the USA and in eleven nations (out of a possible 100-150): Saudi Arabia, Tunisia, Mexico, Dominican Republic, Zambia, Costa Rica, Zimbabwe, India, Egypt, Nigeria and Malaysia. We have sent to these contacts the two enclosures, "TECHNICAL ABSTRACT" and "BACKGROUND". Most of these contacts have responded and have provided us with preliminary, first-year sales estimates totalling 74 to 105 thousand computers at \$200 each, grossing 15 to 21 million in the first year.

Our letter to Syracuse University's CASE CENTER on Sept 2 (enclosed) made it evident that we could no longer expect to get government assistance for **development**. Subsequently, SYREX's "Letter of Intent" with SCS obligated SYREX's own funds for development by SCS. On Dec 12 SCS provided to SYREX the report (enclosed) which gives the status up to now of SCS's current development & testing, which is being conducted at Syracuse University and Morrisville College. The goal of this effort is to have manufacture-ready prototypes in hand by mid-1992. The primary business objective of SCS is the production & marketing of computers & supercomputers.

On Dec 17 SYREX formed a new, sister company called "SYREX COMPUTERS". The proceeds of the sell-off of SYREX's former "produce export operations" are being used toward the above indicated completion by SCS of the current development (begun in 1984 by SYREX) of this new, low cost computer. This new, low cost computer will be marketed by "SYREX COMPUTERS" in the USA and in various oversea nations while SYREX INC will continue with the primary business objective begun in 1980: general export trade. Meantime we will be most grateful to learn which U.S. policies/programs may be applied now to assist our sale in USA/overseas of our low cost computers for small businesses/farmers and universities/schools.

Yours truly,

Enclosures: 4


 Laurens Dorsey
 Pres & Chmn

211 WELLINGTON ROAD SYRACUSE, NEW YORK 13214
 PHONE: 315-445-8008 FAX: 315-445-9499 TELEX: 362976 SYREX

4. TECHNICAL ABSTRACT

(Excerpt from a proposal by SYREX INC to the U.S. National Science Foundation)

The proposed research intends to verify that a computerized keyboard with modem and TV receiver compatibility can be designed toward a target sell price of approximately \$200.00 when manufactured in quantity

SYREX INC has assembled a professional team to conduct this research, and to identify the priority functions needed by its target markets - small businesses (including farms), colleges and schools in various countries especially in the developing areas of the world.

No comparable device is known to exist in the target price range and no known large computer manufacturer has evidenced interest in this low margin, but large, market.

On completion, this research will have identified the functional requirements, electronic componentry, design and packaging of the small computer through principal investigation and support inputs from potential small businesses, agricultural and academic users.

II. BACKGROUND, TECHNICAL APPROACH AND ANTICIPATED BENEFITS

The principal incentive for investigating the subject addressed by this proposal (how to make computing power available to small businesses including small farmers, universities and schools in various countries) may be grasped from the following points:

First, the small computer proposed herein would make available to the users a thus-far-inaccessible computer power directly applicable to improved business management needs.

Second, it is common knowledge that the users identified herein would benefit significantly and perennially from increased application of electronic business management techniques.

Third, three extremely well defined and well endowed efforts by a major U.S. Agri business toward making regular microcomputers available to the type users identified herein have failed decisively. This underscored the irony of the situation - the need is keen but satisfaction of this need was sought through conventional small computer technology. However the efforts failed.

The conclusion now seems inescapable. Efforts should be renewed to meet the keen continuing need. The way to meet this need is not with conventional computing power, but rather with an alternative new technical approach. The proposal herein offers this alternative new technical approach.

What follows now is a background summary of this alternative, new technical approach undertaken thus far by SYREX:

In small businesses a few persons expend, daily, a large number of hours in diverse tasks requiring equally diverse skills and background in their efforts to achieve break-even of operations and to make a profit in essential activities.

There are many aids (including computer aids) that already exist. These aids can be adapted for use in training and for routine operations by the small business person to improve business operations and marketing efficiency. Yet some of these aids - often vital to operating survival - are OUT OF REACH for the small business person. These aids often are too costly and/or too time consuming to be of practical consideration by the hard-pressed user.

Research and development is needed so as to both simplify and make more economical these existing aides. R&D is needed to provide a special, small computer more applicable for routine use.

The requirement as viewed at SYREX INC is to solve (through research, development, test and refinement) the problem of miniaturization, production and distribution to provide the small business or educational person a sufficiently miniaturized, economical microcomputer - containing all needed, variable software within his own keyboard (which he could plug in to his own TV unit). The concept of this small new computer keyboard includes an integral modem in order to facilitate the basic usefulness needed..

This new unit would be used for routine small business operations as well as for teaching these operations at small business-related secondary schools and universities for other educational purposes.



Service Plus Quality

Dr. Bradley J. Strait, Director
CASE CENTER
120 Hinds Hall
Syracuse University
Syracuse, NY 13244-1190

Sept. 2, 1991

SUBJECT: Dev./Export of Low Cost Computer

Dear Brad:

I am now able to offer to invest immediately with CASE substantial personal money and time in the subject project. If this still interests you, kindly let me know an appropriate time and place to talk specifics.

Now that I have sold off SYREX's produce export operations I have the time and money to devote to this project which I consider of major importance. It would provide in a year a tested, manufacture-ready prototype with which to address a large market. We see a market in perhaps 160 nations including the USA. We have in hand preliminary market estimates obtained from eight nations for first year sales of these computers at a cost of about \$200 each. These preliminary estimates of first-year sales range from 73.93 to 103.93 thousand computers/year with an initial gross income for the first year ranging from about 15 to 21 million dollars.

Because we received on August 31 our fourth USA/NYS government rejection in the past seven years, we feel that the time has **NOW** come to get started, using our own money and time in this project. We are not dismayed by these repetitious rejections. In fact we see at least four understandable reasons for these rejections. **First**, we see a good bit of relevant truth in the opinion voiced last night on the CBS television program that regarding technology development, "the USA looks ahead ten minutes", but "Japan looks ahead ten years". **Second**, our creative project is unique to the degree that it simply "falls through the cracks" in a ponderous and complex USA/NYS technology-development-bureaucracy that is seemingly geared to assisting exports. **Third**, this is a time of alarming insularity in the USA (school grads notoriously can't even find their own state on the map), and this is also a time when few USA/NYS government officials have any idea of the oversea need for our product (few have any desire to even **travel** to many places where we would market). **Fourth**, it is very easy for those USA/NYS officials who lack a formal training in economic development to fail to perceive, entirely, the **very positive, long term economic** effect that this project **COULD** have in our Central New York community.

Brad, I look forward to the possibility of meeting soon with you toward getting this project started at long last!

Yours truly,

Laurens Dorsey

cys to: Ted Doyle & Marta Dosa

211 WELLINGTON ROAD SYRACUSE, NEW YORK 13214
PHONE: 315-445-8008 FAX: 315-445-9499 TELEX: 362976 SYREX

A Low Cost Application Specific Management and Information Computer System

A Preliminary Analysis and Program Plan

F. H. Schlereth

B. F. Schlereth

SCS - Schlereth Computing Systems

December 1991

Abstract

In this report we describe the results of a preliminary investigation into the feasibility of a low cost computer product, including hardware and software, which is a low cost tool for application-specific management and information system applications. One example application is farming in third world countries.

Executive Summary

Market research by SYREX, Inc. has established the need for an inexpensive (\$200) computer for educational use and for use as a management and information system tool in small business applications. Typical examples are business management, optimized feeding schedules, optimized breeding schedules, data retrieval via modem and subsequent data utilization, data communication with others in the same business, modem access to powerful computational facilities, resource sharing and education.

Present computer systems are not being applied as well as they might because they are too costly and because software is not properly matched to the applications. In addition, present computer aids are far too time consuming for practical consideration by the hard-pressed user for effective use in daily operations. Present software for this application area is lacking because it is too cumbersome for the typical user and requires too much data input. The typical user either does not have access to required data, or is not willing to take the time required for data input. Present market research indicates that computer technology is not fully utilized because there is a perception that the value added by the computer is not sufficient to supplant traditional paper and pencil methods. A research and development effort is needed to both simplify, and lower the cost of access to and the application of computer technology.

This report describes the results of a preliminary study which indicates that a low cost computer system such as envisioned by SYREX is viable. The report concludes with a follow-on research and development program plan (Phase II) for the design of a prototype, based on existing hardware, which will *demonstrate* the viability of current technology for this application.

The goals of Phase II are to identify and develop detailed specifications for an application which will serve as an initial product offering. The initial offering shall require little or no modification of off-the-shelf hardware, and as a consequence may exceed the initial cost projections. Part of the Phase II effort will be to develop convincing arguments indicating that production models will meet the low cost requirements.

Phase II shall produce a prototype using existing hardware and one application program. This combination shall be suitable for field test starting June 15, 1992.

Cost considerations demand that we use low cost hardware and software technology. Our design will, however, be compatible with both IBM PC and Apple computers to allow present computer users to interact with our low cost system.

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1.0 Introduction

Market research by SYREX, Inc. has established the need for an inexpensive (\$200) computer for educational use and for use as a management and information system tool in small business applications. Farm management in third world countries is identified as a typical application which would benefit from such a device. Many other applications are envisioned including small business and farming here in the U.S.

Specific typical uses are as follows:

1. Business management.
2. Optimized feeding schedules.
3. Optimized breeding schedules.
4. Data retrieval via modem and subsequent data utilization.
5. Data communication with others in the same business.
6. Modem access to powerful computational facilities.
7. Resource sharing.
8. Education.

Present computer systems are not being applied as well as they might because they are too costly and because software is not properly matched to the applications. In addition, present computer aids are far too time consuming for practical consideration by the hard-pressed user for effective use in daily operations.

Present software for this application area is lacking because it is too cumbersome for the typical user and requires too much data input. The typical user either does not have access to required data, or is not willing to take the time required for data input.

Present market research indicates that computer technology is not fully utilized because there is a perception that the value added by the computer is not sufficient to supplant traditional paper and pencil methods. Value is measured in terms of dollar cost as well as ease of use, including the easy and understandable production of useful results. A research and development effort is needed so as to both simplify and make more economical the access to, and application of computer technology.

In this report we state the purpose of this preliminary effort, indicate the parameters of importance for a systems analysis of this application area and describe various hardware and software options which have already been identified.

This report concludes with a follow-on research and development program plan for the design of a prototype, based on existing hardware, which will demonstrate the viability of presently available technology used for this application.

2.0 Purpose

The purpose of this effort is to make an initial estimate of the viability of the concept. This is accomplished by identifying systems alternatives, evaluating hardware options and by setting initial guidelines for the hardware and the software. An additional purpose of the effort is to define an initial prototype to act as a test vehicle for the ideas presented herein. This will be a model for a production prototype and will use existing hardware to clearly demonstrate the usefulness of the proposed solution.

We seek an application which is simple, has high impact on the user, has minimal hardware requirements and which will require very little modification of existing software. We expect that defining such an application will be a formidable task which will require the combined efforts of SYREX, SCS, Morrisville, and representatives of the user community.

3.0 Sources of Data

The primary sources of data were hardware and software product brochures and discussions with various individuals including

Larry Dorsey, President
SYREX, Inc.

Ted Doyle, President
Technology Development Organization, Inc.

Wayne Gillis, Dean and Professor
School of Agriculture and Natural Resources
Morrisville College

Kathleen Colverson, Assistant Professor Animal Science
School of Agriculture and Natural Resources
Morrisville College

Richard Higby, Animal Science/Agricultural Business
School of Agriculture and Natural Resources
Morrisville College.

The product concept was taken from the SYREX Technical Proposal to the National Science Foundation dated June 18, 1990.

4.0 System Options

System options are related to the general characteristics of the proposed design, as related to overall usefulness. In the following sections hardware and software options are discussed. Key system parameters are:

1. Rugged.

The device will be used in a hostile environment such as a farm, factory, etc. It must be relatively impervious to dirt and moisture, and can expect rough handling.

2. Low cost.

The selling price for the device must be about \$200, not including display. The display device is assumed to be a conventional television. The driver for the television is included in the selling price. Also included is a modem.

3. Inexpensive access to remote data and information.

The device will include a modem so that it will be possible to access remote data. One example might be nutritional information for various animal foods. Another example would be the use of remote computational facilities.

4. Easy access to higher performance computational facilities.

The \$200 device will necessarily have limited computational resources. However we believe that these can be enhanced by the use of central facilities which could be accessed by modem.

5. Easy data entry and retrieval.

It is felt that data entry in the field is an important requirement so that simple means for data entry must be provided. Using pencil and paper in the field, and then transferring data to the computer later is to be avoided, if possible.

6. Inexpensive monitors and printers.

The display device will be a conventional television. This means limited resolution and will require extensive effort in the design of user friendly screens for information presentation.

7. Upgrades.

We assume that the product will be successful so part of the initial design should include a well defined upgrade path. Upgrade items might include disk memory, high resolution monitor, more local computing power. Satellite communication is a more distant option. Since the costs of technology are continually dropping, this is an important design requirement.

5.0 Software Options

Software options are specifically concerned with the programs the user will execute on the proposed computer.

1. Spreadsheet.

One of the most useful tools in business analysis is the spreadsheet. One challenge in this design will be the supply of a simplified spreadsheet which is both useful and which fits within the cost constraints of the final product. Memory requirements will be a key issue in this analysis. It is hoped that it will be possible to make use of centralized computing facilities for the majority of the computational requirements.

2. Data base.

If the applications are to be useful, there is likely to be a need for extensive data of various kinds. Transferring such data from written sources to the computer could severely limit the ease and usefulness of the applications. Modem access to data is an important option to include.

3. Information retrieval.

It would be useful if the modem could be used for general information retrieval, such as a weather service.

4. Word processing.

A simple word processor to facilitate writing simple notes.

5. Data entry.

Data entry is a time consuming process and should be as easy as possible. Visual feedback is important, and for this reason the field device should include a simple LCD display. Data entry at the home base should be arranged so that both the LCD and television are used together in a synergistic manner.

6. Data visualization.

This is a key area because of the limited resolution of the display device dictated by the cost constraints. Considerable effort must be expended to make low resolution devices display data in a non-aggravating manner. The use of audio in conjunction with the visual displays is a possibility.

7. Ease of data correction.

One of the most annoying features of data entry on systems with limited capability is finding and correcting a faulty piece of data. Starting the data entry process over is not an option. Data correction is an important software design problem.

6.0 Hardware Options

Hardware options relate specifically to the means for constructing the proposed computer. In the interest of containing development costs it is essential that we utilize existing technology wherever possible.

The major decision is whether to use IBM PC technology or "other" technology. We have made an initial choice of the latter, mostly because it appears more likely that this choice will allow the cost goals to be met more easily. Cost considerations include the unit itself, as well as the peripherals such as displays, printers, modems, memory, microprocessor and software.

In the "other" category there are several low-cost products which have been identified as potentially suitable. These are Apple II, PC4, IQ- Unlimited. (The PC4 is not an IBM machine or clone, but programs written for the PC4 will be compatible with both IBM and Apple computers.) Appendix A includes information on each of these products. The primary advantage of the "other" category is low cost of both hardware and software. We are convinced that because of the application-specific nature of the problem, we will be able to adapt these lower cost machines to the applications identified. We intend to rely on the modem and central facilities to enhance the home unit when appropriate. This mode of operation is similar to present bulletin board services which are prevalent at the present time.

We have purchased the IQ-Unlimited and the Apple II and have performed some initial experiments designed to give us the "look and feel" of these products. This effort has convinced us that the hardware needed to meet the aforementioned requirements is readily available. Our preference is for the PC4 for the following reasons.

1. Cost.

Present retail prices for the PC4 are just over \$200 for the configurations of interest.

2. Rugged.

It appears that the commercial units could be ruggedized to meet our requirements.

3. Display.

A four line LCD display is included as part of the unit. A TV display driver is also included.

4. Software.

Applications software is available at a reasonable price. Modification and enhancement of this software to meet specific needs is not too costly.

5. Enhancements.

Initial estimates indicate that it will be possible to include additional enhancement such as audio and additional memory at low cost.

7.0 Conclusions

There is no question that it will be possible to meet cost and system constraints for a product which meets the concepts outlined by SYREX in the NSF proposal. Hardware does not appear to be at issue since several suitable possibilities are presently available at very attractive prices. Suitable software also appears to be available to meet initial application needs.

The challenge in this product design will be to take these existing products and modify them at low cost, so that application needs specific to the target markets are appropriately addressed.

In our discussions we have been duly cautioned that even though the potential users are not sophisticated in their knowledge of computers, they are very sophisticated in their own areas of expertise, and will in fact be very demanding users of the equipment we propose to offer. Thus the production of hardware and software for this class of user is much more demanding than for the computer literate user. The latter has learned to live with software and hardware bugs, and is in many cases willing to develop his own software patches to overcome minor product deficiencies. There is no such leeway in the product we plan to offer. This we see as a major design challenge.

The initial success of this product will depend, in part, not only on the hardware, but will be very sensitive to the nature of the application software. A truly useful application will make the product. It is felt that this initial software product should stand on its own merits, requiring as little in the way of "bells and whistles" as possible. One of the major efforts in the follow-on program plan described in the next section is to develop such an application. However it is important that we not attempt to write applications software from "scratch" but that we build on existing applications wherever possible.

The purpose of this first product offering is to establish the basic usefulness of the concept, and to demonstrate the need for the enhancements mentioned above.

Our decision not to use IBM PC technology is based on cost considerations. The negative is that we are not using a system which is prevalent throughout the industry. However we believe that we will be able to design the hardware and software in such a way that there will be enough compatibility to allow the more sophisticated users of the IBM PC technology to use and otherwise interact with our low cost system.

8.0 Follow-on Program (Phase II) Plan Outline

8.1 Goal

The goals of Phase II are to identify and develop detailed specifications for an application which will serve as an initial product offering. The initial offering shall require little or no modification of off-the-shelf hardware, and as a consequence may not meet the initial cost projections. Part of the Phase II effort will be to develop convincing arguments indicating that production models will meet the low cost requirements.

The initial offering shall meet the application requirements as determined by a product specification team, as described below.

We believe it is vital that this, and subsequent product offerings have a "look and feel" which will have a natural attraction to the potential user. We believe we have the task of attracting users who have become skeptical of computer technology because of past over-selling.

We visualize a product which has the acceptance of a hand calculator, but which has enhancements to solve application specific problems. It has a window to the world through a simple, easy to use modem interface to a central bulletin board service, which we will provide at low cost.

8.2 Time Schedule

A suitable application shall be operational and ready for alpha¹ testing by June 1, 1992. This will use existing hardware, and minor modification of existing software. Beta² testing will commence on or before August 1, 1992.

8.3 Manpower - Phase II

Name - Assignment	Man-weeks
1. F.H. Schlereth - Project Management	8
2. B.F. Schlereth - Technical Direction	20
3. Programmer 1	20
4. Programmer 1	20
5. Consultant 1 - Morrisville	4
6. Consultant 2 - Morrisville	4
7. Consultant 3 - Hardware	2

^{1,2} Alpha test is in-house testing by the design group and other persons closely related to the product. Beta test is testing by potential users who are expected to put the product through normal use.

8.4 Travel

At this time we anticipate a small amount of travel as follows:

1. Several trips to potential users to establish specifications. Two persons per trip.
2. Two trips to hardware supplier. Two persons per trip.

8.5 Tasks - Time Schedule

TABLE 1. Tasks vs. Time Schedule - Prototype Development

Task	Time Schedule (weeks)			Manpower (see Sec.8.3)
	0	10	20	
1. Develop specifications for application.	↓ S	↓ F		1, 2, 5, 6
2. Develop specifications for hardware.	↓ S	↓ F		1, 2
3. Application programming.		↓ S	↓ F	2, 3, 4
4. Alpha test of application program.			↓ S ↓ F	1, 2, 5, 6
5. Beta test of application program.			↓ S ↓ F	1, 2, 5, 6
6. Report and documentation			↓ S ↓ F	1, 2, 5, 6
7. Hardware complete		↓ F		
8. One application program complete.		↓ F		

8.6 Deliverables

1. Two prototype units suitable for field test.
2. One application program
3. Beta test plan.
4. Beta test evaluation.
5. Manufacturing program plan.
6. Report

8.7 Capital Equipment

1. Four PC4 systems and associated monitors.
2. Development software.
3. Applications programs
4. Four modems.
5. Host computer for bulletin board.
6. Printer.
7. Disk memory and other peripherals.

Appendix

Hardware Brochure

Like all our products, the Laser PC4 provides top performance, reliability, and compatibility at an affordable price. When you buy a PC4, our highly-trained service and support professionals are ready to serve you long after the sale.

As a leading manufacturer of IBM compatible computers and the only manufacturer of Apple compatible computers, our commitment to quality, service, and excellence has earned us a large and loyal customer base over the past seven years. For information on our complete line of products, contact the authorized Laser Computer dealer in your area. If you need assistance, call us at any of the numbers listed below.

//// LASER

Laser Computer, Inc.
A Video Technology Company
800 N. Church Street,
Lake Zurich, Illinois 60047-1596

To Locate A Dealer	(708) 540-8911
Technical Support	(708) 540-5022
To Become A Dealer	(708) 540-5000
Main Switchboard	(708) 540-8086
In Canada	(800) 387-9672

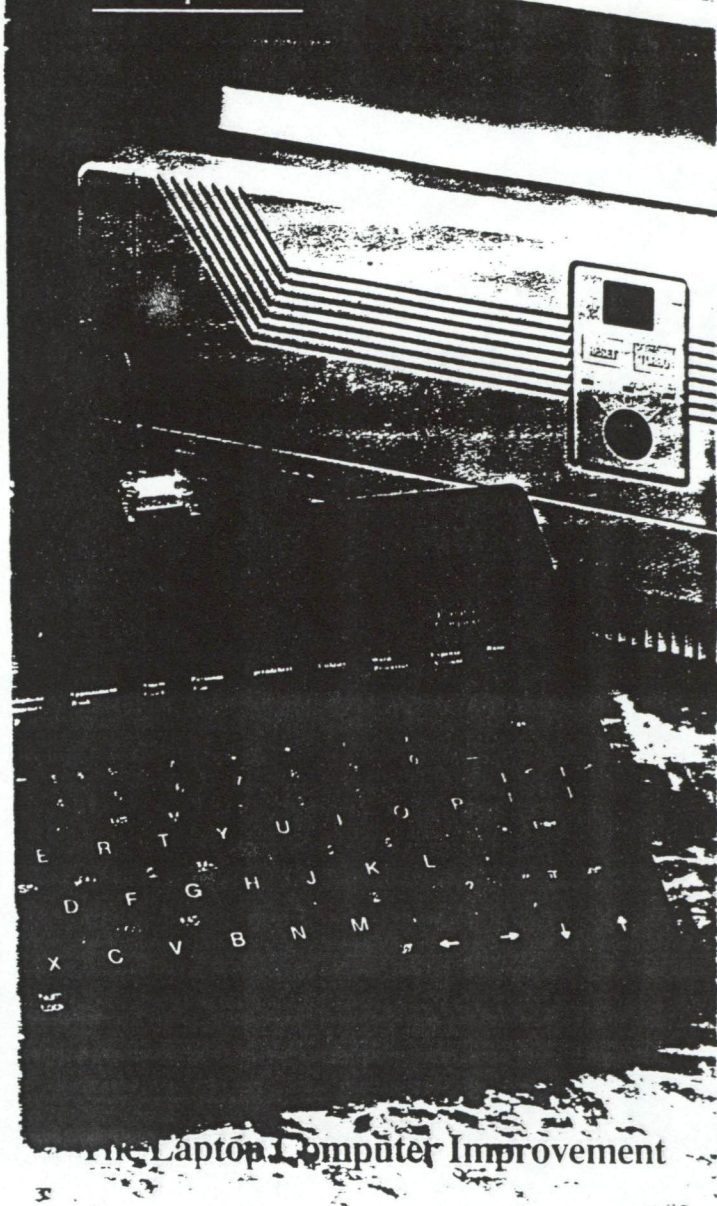
Available at your nearest dealer

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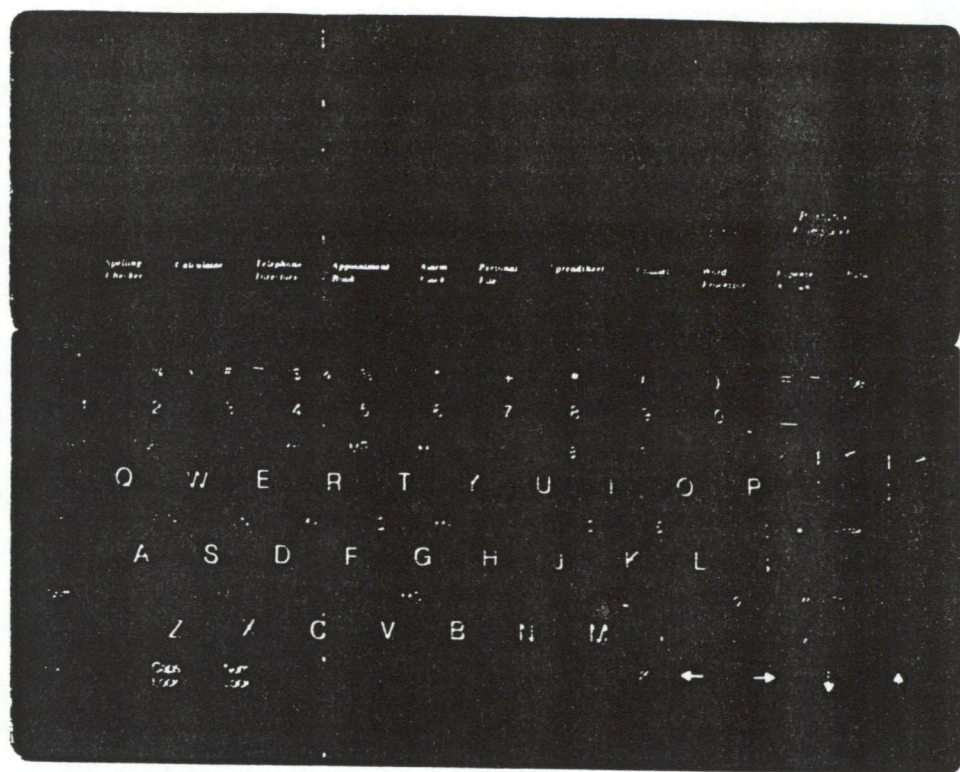
pc4™
Portable
Computer



The Laptop Computer Improvement

Everything A Laptop Should Be

The Laser PC4 is more than an alternative to a laptop computer...it's an improvement! The PC4 is everything a laptop computer should be - affordable, compact, and easy to carry. It builds in all the easy to use software a laptop computer needs. It also comes with all the necessary accessories (even PC Tools™ Desktop, a \$129.95 value!) for effortless file transfers and printouts. Priced affordably and weighing less than 2 pounds, the PC4 can meet all your computing demands.



The Word Processor with Spelling Checker and Lotus® compatible spreadsheet let you take the two most popular personal productivity tools anywhere.



...and the Laser PC4 is the only laptop computer that can handle all your computing needs. It's the only laptop computer that can handle all your computing needs. It's the only laptop computer that can handle all your computing needs.

Productivity

From the rigors of the office to relaxing at the beach, you'll never be without the two most widely used features of a personal computer...a powerful word processor and spreadsheet.

Word Processing

If you have contracts, quotes, or other important information that needs to be created at a moments notice, the PC4's powerful Word Processor takes the work out of writing. There's all the features found on more expensive PC-based word processors, including formatting options, text search, and on-line help. Add the optional Thesaurus for 500,000 synonym suggestions of everyday words.

Spreadsheet

Want a program to monitor a diet, determine a family budget, or launch a multi-national corporation? The Lotus-compatible Spreadsheet lets you build easy worksheets, add formulas, and experiment with "what if" scenarios.

Highlights include:

- Build worksheets up to 256 columns wide by 1024 rows deep!
- Support for many financial, statistical, and date functions.
- Display 4 columns by 2 rows at a time.
- Create Macro programs to eliminate repetitive keystrokes

Expense Account Module

Traveling people will love how easy this feature makes recording

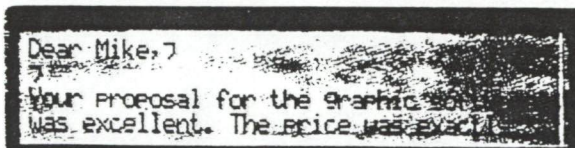
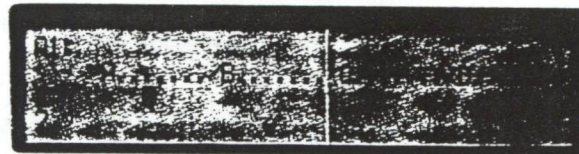


DATE	AMOUNT
1/22/90	\$18.40
1/26/90	\$37.57
1/30/90	\$21.39

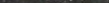
business-related expenses. There's seven built-in categories like Food and Transportation. If there isn't a category that fits a particular expense, create your own custom category!

Spelling Checker

Throw away that weak Franklin Spelling Ace™! With over 80,000 words contained in memory, the advanced PC4 Spelling Checker ensures accuracy in whatever you write. Accessible by itself or in the Word Processor, the Spelling Checker lets you type in the word the way you think it's spelled and the correct spelling is instantly displayed.



Dear Mike, 7
Your proposal for the graphic design
was excellent. The price was exactly



Take all those important addresses and phone numbers with you wherever you go. Forget scribbled notes...add new entries on the spot! For the ultimate in convenience, use the built-in Auto Dialer for easy telephone dialing.

1:11:55
2:800 N. Church Street
3:Lake Zurich, IL 60047
4:(708) 548-8086

Get to important meetings on time by setting one of sixteen reminder alarms on the built-in Alarm Clock. This function also acts as a real time clock for time, day, and date headings in the Appointment Book.

Protect sensitive information by storing it in the Personal File with a Password that only you know.

You'll never forget another appointment again with this handy function. Create up to

JAN 22 90 10:00 AM
Photoshoot at Images
PC4 packaging
Baker equipment

five lines of information per entry and record the time and date. Then print out your entries for a quick reference itinerary:

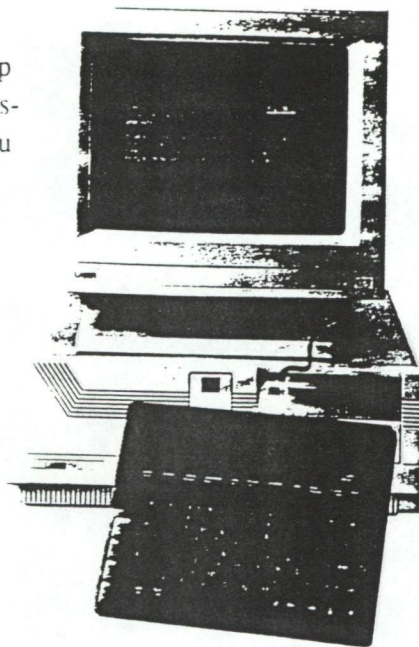
Balancing that check-book, figuring a tip, or adding up tax returns is a breeze with the built-in Calculator. An "electronic tape" lets you review past entries for accuracy.

Balancing that check-book, figuring a tip, or adding up tax returns is a breeze with the built-in Calculator. An "electronic tape" lets you review past entries for accuracy.

Creating and sharing information is one of the most valuable elements of a personal computer. With the Laser PC4, you can communicate with the outside world in many different ways.

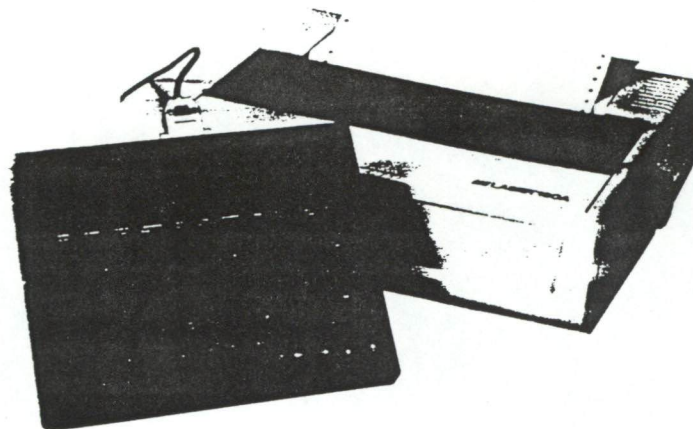
File Transfer

Thanks to the included PC Tools Desktop software and file transfer cable, you can exchange information to and from your IBM compatible desktop computer. By pressing a few keys, you can take your important office phone numbers with you on the road, or transfer the letter you created while you were away.



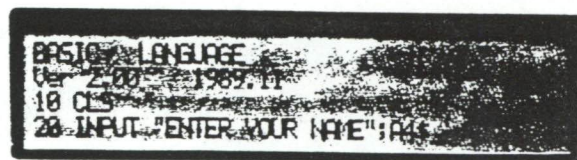
Printouts

Attach the PC4 with the included parallel printer cable to Laser 190™ Series, Apple®, Brother®, Epson®, Panasonic®, or other popular printers for fast, easy printouts. Now you don't have to wait to get back to the office to print that important document.



BASIC Language

Write your own programs with this built-in programming language!



The Details

- Z80 Processor Operating At 3.58 MHz
- 32K SRAM
- 2MB ROM Storing Programs & Dictionary
- High Contrast STN Blue LCD Screen
- 4 Line Display, 40 Characters Per Line
- ROM Expansion Slot
- Centronics Parallel Interface
- RS 232C Serial Interface
- Full-Travel, Typewriter-Style Keyboard

- PC Tools™ Desktop (\$129.95 Value)
- Parallel Printer Cable
- File Transfer Cable
- AT Adapter Cable
- A/C Adapter
- Carrying Case

- File Transfer To Personal Computers
- Powerful Word Processor
- 80,000 Word Spelling Checker
- Lotus-Compatible Spreadsheet
- Telephone Directory
- Appointment Book
- Personal File
- Expense Account Module
- Advanced Function Calculator With Memory
- Alarm Clock With 16 Alarms
- Automatic Telephone Dialer
- BASIC Programming Language
- System Utilities

- Ten Minute Tour
- Illustrated User Manual
- File Transfer Guide
- Quick Reference Card

- Four "AA" Batteries (Not Included)
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 - Easy to install.
- Other PC4 Versions*
 - Laser 128 B/Apple II E
 - Apple Macintosh B
 - PC4/XL with Advanced Communications

in for availability

"Document Control"

TYPE: INFORMATION

DOCUMENT NUMBER: 9125192

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: SPENCER, William J. and GALVIN, Robert W.: SEMATECH

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 12/17/91

SUBJECT: RE: PLANS FOR THE CONSORTIUM FOR 1992.

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
INDUSTRIAL
PHYSICAL SCIENCES
NATIONAL SECURITY

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EXT:

REMARKS:

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FILE: P-INDUSTRIAL

DEPT RECEIVED:

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Withdrawal/Redaction Sheet

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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. Letter w/ attachments	To: Allan Bromley From: William Spencer, Sematech Re: Plans for consortium [P.L. 100-180, Sec 276(a)] (4 pp.)	12/17/91	(b)(3)	

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: Industrial: General [1 of 7] [1991]

Date Closed:	3/10/2010	OA/ID Number:	62034-001
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.

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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: 9125207

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: BLOCK, I. Edward: SOCIETY FOR INDUSTRIAL AND APPLIED
MATHEMATICS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 12/17/91

SUBJECT: A THANK YOU LETTER TO DR. BROMLEY FOR HIS COMMENTS
ABOUT SIAM. HE IS ENCLOSING A COPY OF THEIR NOVEMBER
NEWSLETTER, AND IS ADDING DR. BROMLEY TO THEIR
MAILING LIST.

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
INDUSTRIAL

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DEPT RECEIVED:

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91 DEC 23 P 3: 50

Society for Industrial and Applied Mathematics

3600 University City Science Center
e-mail: siam@siam.org

Philadelphia, PA 19104-2688
Fax: (215) 386-7999

Telephone: (215) 382-9800
Telex: 446.715



OSTP
MAIL ROOM

December 17, 1991

Dr. D. Allan Bromley
Assistant to the President
for Science and Technology
Old Executive Office Building
17th Street and Pennsylvania Avenue, NW
Washington, DC 20506

Dear Dr. Bromley:

Thank you for your kind letter of December 3. We appreciated your comments about SIAM very much.

I thought you might like to have future copies of SIAM News. I am putting you on our complimentary distribution list. Enclosed is a copy of our November issue which we published last month.

Yours for the holiday season and the new year.

Sincerely,

A handwritten signature in black ink, appearing to read 'I. Edward Block', written in a cursive style.

I. Edward Block
Managing Director

IEB/agb

Enclosure: SIAM News, November 1991

The bimonthly newsjournal of the Society for Industrial and Applied Mathematics

SIAM News

VOLUME 24/NUMBER 6/NOVEMBER 1991

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CHAMMP Researchers Exploit Emerging Hardware & Software in Advanced Climate Models

By Lisa J. Rudy

If the Earth were to warm by only nine degrees centigrade, the world as we know it could be utterly changed. The possible causes of such a change in temperature would include increased levels of carbon dioxide and other "greenhouse" gases in the atmosphere. If mathematical models reveal that major temperature increases are indeed in store, American policies regarding energy, waste disposal, and other environmental issues could change dramatically.

Several well-known scientists believe we are in for just such a catastrophe. To back up their statements, they cite a rise in global temperature over the past several years and point to the theory that the last ice age was caused by a drop in temperature of no more than the same nine degrees.

Meanwhile, scientists with similar credentials are pooh-poohing these dire predictions, saying that a change of only one to two degrees is in store—a minor change that will mean very little to our way of life. They see recent temperature increases as statistically insignificant and refer weather watchers to similar warming and cooling patterns that have occurred over the past century.

Although strong statements have been made on both sides of the global warming issue, climate modeling is still an embryonic science. Robert Ward, director of the Engineering Physics and Mathematics Division at Oak Ridge National Laboratory, explains that "there are about six models available today that reasonably

opinion, would be tantamount to establishing a "non-growth" policy for the national economy.

The fiscal importance of the question has spurred government funding of research on climate models, to the tune of billions of dollars for fiscal year 1992. Government funding for research on climate observation and modeling is administered through an umbrella organization called the U.S. Global Change Research Program (USGCRP). This organization, an offshoot of the Office of Science and Technology Policy's Federal Coordinating Council for Science, Engineering, and Technology, involves more than two dozen science-related government agencies, including the Department of Energy, the National Science Foundation, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and the Smithsonian Institution. Its budget includes such high-ticket items as satellites administered through NASA and NOAA, as well as expeditions to Greenland, the Arctic Circle, and tropical rainforests.

USGCRP has developed four overall "integrating themes" for FY 1992:

- Climate modeling and prediction,
- Global water and energy cycles,
- Global carbon cycle, and
- Ecological systems and population dynamics.

Among the climate modeling programs sponsored by USGCRP is the Department of Energy's Computer Hardware, Advanced Mathematics, and Model Physics Program (CHAMMP), which incorporates both mathematical and modeling research. An ongoing

AHPCRC Scales up to CM-5

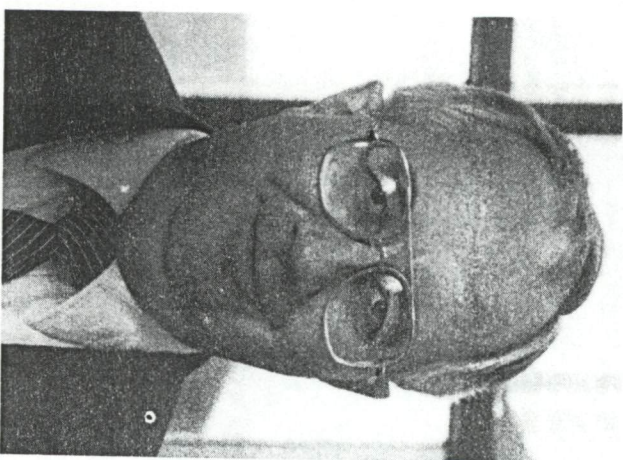
By Barry A. Cipra

The Army High Performance Computing Research Center (AHPCRC) is set to shift into high gear with the recent installation of a next-generation supercomputer from Thinking Machines Corporation—a computer so new it only got a name, the CM-5, last month. According to George Sell, a professor of mathematics at the University of Minnesota and director of AHPCRC, the new Connection Machine will greatly enhance the center's efforts in areas ranging from computational fluid mechanics to biomedical modeling.

"The new system will provide university and Army scientists with the first model of a new supercomputer that will be potentially the most powerful in the world for solving problems in continuum mechanics, nonlinear dynamics, computer science, computational chemistry, biomedical science, and modern materials," says Donald Austin, executive director of AHPCRC.

AHPCRC was established in 1989 to conduct unclassified research in high performance computing in diverse areas of science and engineering. The center is based at the University of Minnesota but involves scientists and students from Howard University, Jackson State University, and Purdue University as well. In addition to the more than 50 researchers associated with the center, there are approximately 40 graduate and postdoctoral fellows in mathematics, chemistry, electrical engineering, and a variety of other fields. AHPCRC also hosts a summer program for undergraduates. Last summer, 27 students from 17 universities attended the six-week program, which combined a course in numerical analysis with a "hands-on" introduction to parallel computing.

The CM-5 joins AHPCRC's 32K CM-2



AHPCRC Director George Sell

SIMD (single instruction, multiple data), in which all processors work in lockstep doing the same thing at the same time, and MIMD (multiple instruction, multiple data), a kind of computational free-for-all. SPMD is not a new concept—in practice, Sell points out, most MIMD machines have been used on an SPMD basis—but the new system is the first to have been built explicitly for SPMD programming.

Bailey also stresses the scalable nature of the CM-5 and the "high availability" of its hardware. In terms of hardware, scalability means that the system can grow in a balanced fashion. In terms of software, it means that users can

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9124898
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: MURPHY, Jeremiah L.: SIEMENS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/20/91

SUBJECT: HE IS ENCLOSING AN ARTICLE REGARDING THE ROLE OF
MANUFACTURING AND ASSOCIATED SERVICES AS THE
BACKBONE OF INDUSTRIALIZED SOCIETIES.

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
INDUSTRIAL
Steve Olson

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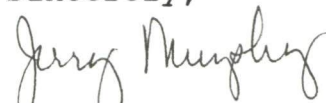
Dr. Allan Bromley
Assistant to the President for Science and Technology Policy
Old Executive Office Building
17th Street and Pennsylvania Avenue
Washington, D.C. 20506

Dear Dr. Bromley:

Given your leadership role on issues of importance to the performance of U.S. industry and the strength of the U.S. economy, I thought you would like to see Dr. Karlheinz Kaske's recent piece in Siemens Review. Entitled "The Service Economy: A Dangerous Fiction," it identifies clearly the role of manufacturing and associated services as the backbone of industrialized societies. His thoughts have clear implications for the policy debate over technology, trade and industry underway in this country.

If we may discuss the issues in the article further with you, please feel free to contact me.

Sincerely,



Jeremiah L. Murphy
Vice President
Public Policy & Government
Affairs

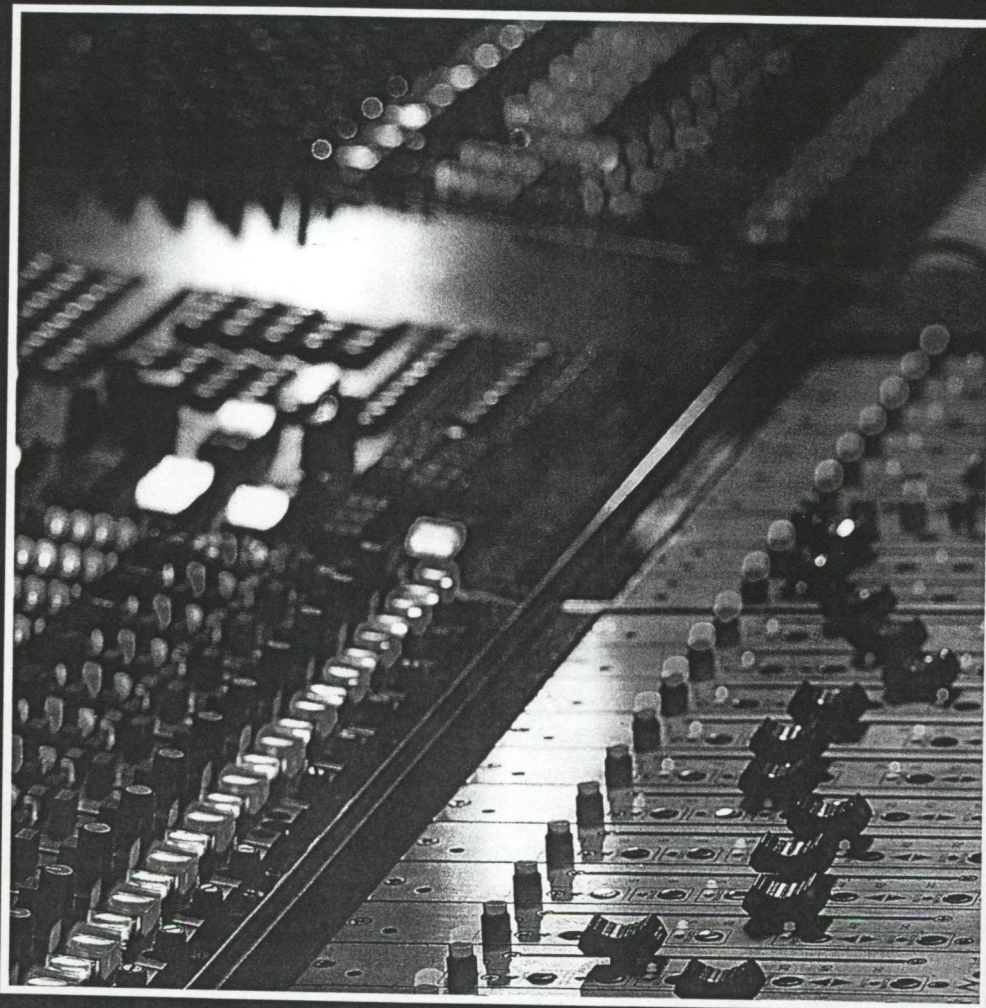
Siemens Corporation

Suite 720 701 Pennsylvania Avenue, N.W. Washington, D.C. 20004 (202) 434-4800 Fax (202) 347-4015

SIEMENS

Volume 58
September/October **5|91**

Siemens Review



Telecommunications: Pluralistic Perspectives • Hydro Technology:
Tapping the Power of Brazil • Audio Systems: A Business that's
Humming • Automation: Thriving in Tough Times • Research: The
Many Roles of HOEs • The Service Economy: A Dangerous Fiction

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9124872
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: CASAZZA, J.A.: CSA ENERGY CONSULTANTS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/18/91

SUBJECT: RE: PUBLIC POLICY, LEADERSHIP AND ELECTRIC POWER.

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
INDUSTRIAL

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November 18, 1991

Mr. D. Allan Bromley
Assistant to President for Science and Technology
Executive Office of the President
Office of Science and Technology Policy
Washington, D.C. 20506

OSTP
MAIL ROOM

Subject: Public Policy, Leadership and Electric Power

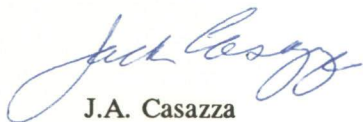
Dear Mr. Bromley:

Some time ago you were very kind to write me a letter encouraging me to continue my efforts on my program to improve government technical competence. As you know, I have been contributing my personal funds to this cause.

The efforts in this work have been continuing using Cooper Union, a small school with outstanding students as a "test bed". The latest activities are outlined in the attached press release and the material describing the program. Perhaps you would like to suggest some individuals from the Federal Government to attend this session and participate in the question and answer period which will follow the formal presentations.

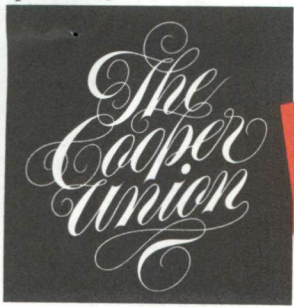
Again, thank you for your interest and your support. I believe it is only through the efforts of individuals working cooperatively that we will be able to solve many of the difficult problems which our country faces. A key to solving these problems is improving the technical knowledge of our government and obtaining the needed technical contributions when establishing policy. Those with engineering backgrounds are contributing very little at the present time.

Sincerely,



J.A. Casazza
Chairman

JAC/tjr



NEWS

The Cooper Union
for the Advancement of
Science and Art
41 Cooper Square
New York, NY 10003
Office of Public Affairs
212 353-4155

For Immediate Release
November 5, 1991

Contact: Patrick Keefe
(212) 353-4158

REQUEST FOR COVERAGE

Cooper Union Symposium: "Public Policy, Leadership and Electric Power"
Government, Energy Officials, Engineers and Planners, Public
Interest Groups To Explore Future Availability, Cost of Electricity

Tuesday, December 3

Different proposals for restructuring our nation's electric power industry are now being debated vigorously by the government and the private sector. The changes proposed can profoundly affect the U.S. economy and how the country will meet its future electric power needs.

The Cooper Union for the Advancement of Science and Art will sponsor a symposium, "Public Policy, Leadership and Electric Power," on Tuesday, December 3. The forum will be held from 2 to 5 p.m. in Cooper Union's Great Hall, located at 7 East 7th Street (at Third Avenue), New York City. For more information, or to register, call (212) 353-4396.

The symposium will provide a vital forum for government leaders and energy specialists to examine how legislation and technical leadership can affect the future cost and availability of electric power.

Through a series of individual presentations, this symposium intends to increase government and public awareness of electrical energy issues and to inaugurate strategies for ensuring effective energy policies in the future.

Participating speakers include:

- Dr. Eleanor Baum, dean of Cooper Union's Albert Nerken School of Engineering;
- Klaus Bergman, president and CEO of Allegheny Power Systems, Inc.;
- J.A. Casazza, chairman of CSA Energy Consultants;
- E.R. McGrath, chairman and CEO of Consolidated Edison Co.;
- Branko Terzic, Commissioner, Federal Energy Regulatory Commission
- John R. Pope, president of the IEEE Power Engineering Society.

More...

Speakers will examine the legislative and regulatory changes of the past decade; the pros and cons of alternative future electric power policies and their potential impact on the public; and ways of obtaining the necessary leadership in the technical community to participate in setting national policies for the future.

This symposium, the third in a series, is part of a long-range plan by The Cooper Union and its Albert Nerken School of Engineering to design The Institute on the Infrastructure. The Institute will serve as a center of expertise to assess conditions of the region's infrastructure, to offer efficient and cost-effective plans to restore public works and to aid in implementing new solutions.

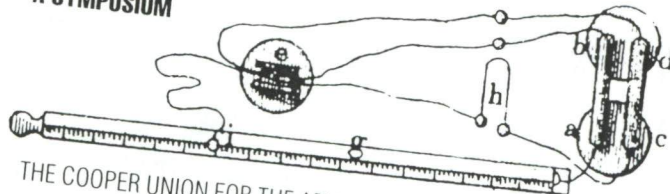
The symposium is presented jointly by Cooper Union, its engineering school, the Cooper Union Research Foundation and the college's infrastructure program office. It is sponsored by the Peter Cooper Fund for Advancing Government Technical Competence, established by J.A. Casazza, a 1944 Cooper Union electrical engineering graduate.

Established in 1859, The Cooper Union for the Advancement of Science and Art is a private college where all students receive full-tuition scholarships to study art, architecture and engineering.

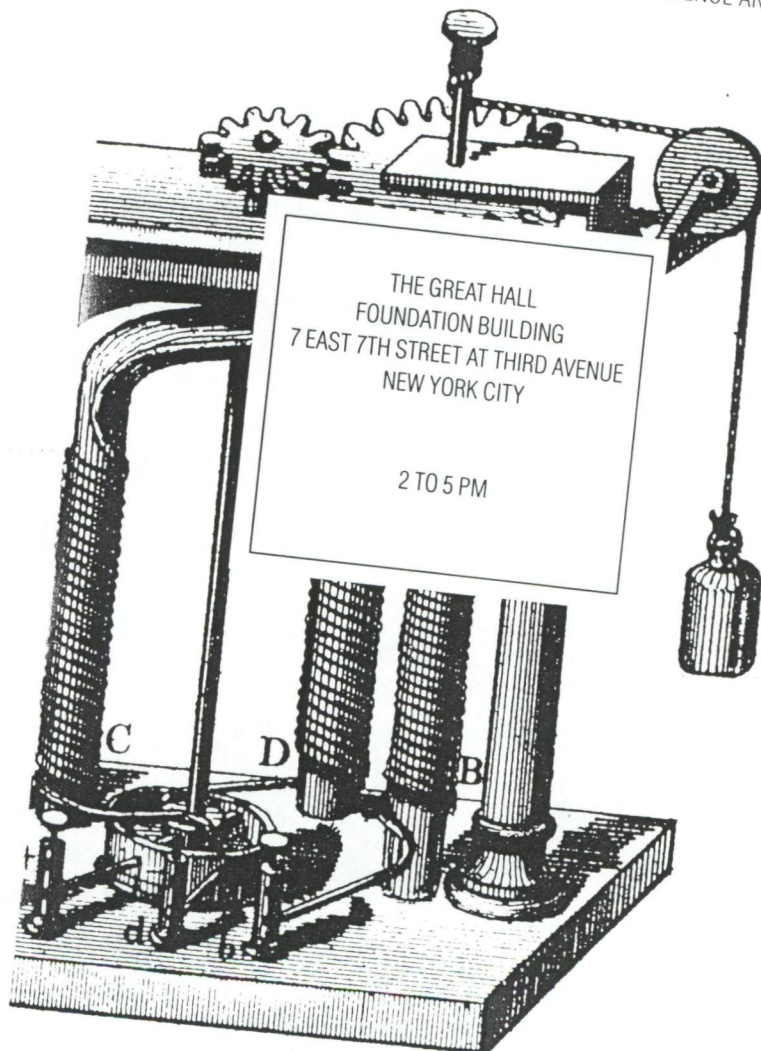
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PUBLIC POLICY, LEADERSHIP &

A SYMPOSIUM



THE COOPER UNION FOR THE ADVANCEMENT OF SCIENCE AND ART



"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9124848
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: WALKER, Jack A.: TITAN TACTICAL APPLICATIONS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/12/91

SUBJECT: A LETTER PREPARED TO BRING DR. BROMLEY UP TO DATE ON
THE MAJOR AREAS OF PROGRESS WHICH INCLUDE PRIVATE
SECTOR TEAMING FOR DEMONSTRATION AND
COMMERCIALIZATION AND THE U.S. ARMY'S SUPPORT FOR A
DEMONSTRATION.

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
INDUSTRIAL
NATIONAL SECURITY

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OSTP RECEIVED: 11/20/91 DEPT RECEIVED:
FILE: P-INDUSTRIAL
CENTRAL FILES:



4848
RECEIVED

91 NOV 19 A 9:14

12 November 1991

OSTP
MAIL ROOM

Dr. D. Allan Bromley
Science Advisor to the President
The White House
Washington, D.C. 20500

Dear Dr. Bromley:

Progress has been made in several areas of biomass/MSW conversion to energy since we talked in July. This letter has been prepared to update you on the major areas of that progress which include private sector teaming for demonstration and commercialization, and the U.S. Army's support for a demonstration.

First, there has been a commitment on the part of eight private sector companies to support the demonstration and commercialization of biomass/MSW conversion to renewable energy. The eight companies include: TVA; Patterson Industries, Inc.; Resource Conversion Systems, Inc.; Kamy, Inc.; Metropolitan Energy, Inc.; Resource Systems, Inc.; CH2M HILL; and Titan Applications. Each company has made a commitment to a specific area of the demonstration and a specific level of commitment. In many cases, a monetary commitment has been made. The rough order of financial commitments totals \$50M. An overview of these preliminary commitments is attached. The attachment also details the required uncommitted resources and possible solutions to obtain these resources. I will chair a meeting that will be held on 11 December in the TVA facility at Muscle Shoals, AL with the other seven industrial teaming partners currently committed to the commercial demonstration of the TVA process. At that time we will attempt to delineate the roles of each teaming partner, form an association, agree upon a plan, formalize commitments, and commence joint actions.

Secondly, discussions were held with LTG Henry J. Hatch, Chief of Engineers on October 22, 1991. General Hatch was very supportive and will recommend that the Army participate with regional civilian neighbors in the demonstration of biomass/MSW to renewable energy at process maturity.

Other items worth mentioning, at this time include:

- An MOA signed by TVA Vice President Shields offering an agreement between TVA and the Army to jointly pursue a demonstration of the TVA biomass/MSW conversion process was reviewed by the Army and minor changes were requested. The changes have been made and the MOA is currently back under review by OCE and the Army Staff. It is hoped that the Army will sign the MOA shortly. The Army Chief of Staff was briefed on 11 September and continues a personal interest in Army participation.

Dr. D. Allan Bromley
12 November 1991
Page 2 of 2

- An interim report containing an assessment of the TVA process by the Institute of Gas Technology for OCE concludes in general (1) that the process is technically feasible, (2) must now be evaluated in a pilot scale continuous flow plant using mixed municipal solid waste to produce ethanol and recyclables, (3) the economical facility size will be between 800 and 2000 tons/day, (4) a 400 ton/day facility will be cost competitive with conventional solid waste processing technologies, and (5) Army facilities generate between 25 and 50 tons/day of MSW, therefore they can only participate as part of a regional solution.

- Representatives of Korean industry have shown further interest in the TVA biomass/MSW conversion process and are currently seeking more detailed information. Korea is currently planning to construct eleven incineration facilities in Seoul, Korea to solve their MSW disposal problem. The TVA conversion process may be a more realistic solution to the Korean MSW problem.

- Ambassador Richard Fairbanks will present information on the TVA biomass/MSW conversion process to the US Ambassador to Korea on or about 14 November 1991.

- A meeting with Senator Samuel Nunn occurred on 5 November 1991 to seek his support for legislation in the Senate. Senator Nunn was supportive of the concept of the MSW conversion program. We hope to soon be working with Madelyn Creedon of his staff to draft appropriate Senate legislation to support the national demonstration program. We will be working concurrently with Congressman Norman Dicks and his staff on similar legislation.

I appreciate this opportunity to bring you up-to-date on activities related to the biomass/MSW conversion to energy process. Your interest and support is very much appreciated. If we may provide you with further information, please let me know.

Sincerely,



Jack A. Walker
President
Titan Tactical Applications

/pdr

cc: Mr. C. Boyden Gray
Ambassador Richard Fairbanks
Dr. Robert B. Oswald

COMMITTED

PARTICIPANT	COMMITMENT	LEVEL OF COMMITMENT	VALUE
TITAN APPLICATIONS	Overall Project Integration/Management	Committed to accept responsibility for project if funds are available.	
TVA	Technology	On-going project. Will continue to support with expertise, staff time, and research.	\$2.5 million/yr
PATTERSON INDUSTRIES, INC.	Front-End System	Verbally committed to contribute the front-end system (equipment and installation) for a demo project.	\$15-20 million for a 400-600 ton per day plant
RESOURCE CONVERSION SYSTEMS, INC.	Front-End System	Verbally committed to contribute the front-end system (equipment and installation) for a demo project.	
KAMYR, INC.	Hydrolysis/Ethanol Production System	Written commitment of equipment and expertise for the overall project.	\$16 million of a \$100 million project.
METROPOLITAN ENERGY, INC.	Combustion/Power Generation System	Written commitment of interest in providing the combustion/power generation system for a demonstration plant.	\$15-22 million for a 400-600 ton per day plant.
RESOURCE SYSTEMS, INC.	Combustion/Power Generation System	Verbal expression of interest in providing the combustion/power generation system for a demonstration plant.	
CH2M HILL	Project Engineering	Committed to providing project engineering and environmental impact analysis if funds are available.	

Total Approximate Dollars Committed \$50 Million

UNCOMMITTED/POSSIBLE SOLUTIONS

- Approximately \$50 million is uncommitted. This \$50 million is required to cover:
- Process engineering
 - Project integration
 - Environmental engineering/services
 - Ethanol plant equipment,
 - Construction,
 - Project Management
 - Plant operation (including start-up)
- Possible solutions
- Reduce size of plant (Involvement of participants committed will likely remain the same)
 - Involvement of several communities (local, state, and municipal governments) that have expressed an interest in participating in a demonstration project. 10-20% of capital costs could be obtained.

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9124925
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: CARTWRIGHT, Joseph

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/08/91

SUBJECT: RE: THE CLOSING OF ROCKWELL'S NEW CASTLE PLANT. HE
REQUESTS DR. BROMLEY'S COMMENTS.

DIRECTORATE STAFF
ASSIGNED: INDUSTRIAL ASSIGNED:

ACTION STAFF
REQUIRED: FOR DAB'S SIGNATURE ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 11/13/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS: PLEASE NOTE THAT WE RECIEVED TWO VERSIONS OF THIS LETTER.

*There seems to be no letter to Dr. Bromley. There is
nothing we can say that will satisfy the writ. I recommend
no response.*

OSTP RECEIVED: 11/22/91 DEPT RECEIVED:
FILE: P-INDUSTRIAL
CENTRAL FILES:

CLOSED

49 25

November 8, 1991

Any Suggestions???

Please comment on this information - PERSONALLY

Please don't defer (or pass the buck) - we're quite used to that!

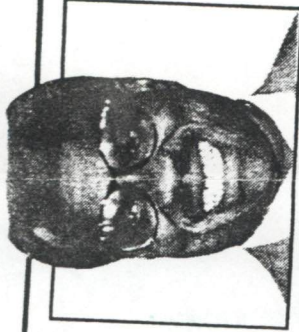
RECEIVED
91 NOV 27 4:10:58
OSTP
MAIL ROOM

We did request to testify at a Senate or Congressional hearing.

CUBBAL

Father needs to loosen Bonds with son. Page 15
ON CAMPUS

Moms find 'Empty Nest' when kids fly off. Page 23



Time to go forward

Clarence Thomas is confirmed by narrow margin
— See page

NEW CASTLE NEWS

112th Year No. 31

NEW CASTLE, PA. WEDNESDAY, OCTOBER 16, 1991

Rockwell to close

**Rockwell International
Gets \$97.9 Million Job
For Tactical Missiles**

By Jackie
New Castle News

Over the next few years, 536 cars at Rockwell International's Highway Axle plant will be built, marking the demise of yet another of Lawrence County's major employers. While the news came as a shock to many throughout the county, it is a decision by which Rockwell officials intend to stick. It was a firm management decision that was made and announced and we intend to stick by said Mike Pennington, a publications executive.



CONGRATULATIONS

Today, January 8th, 1991 Ford SQA Unit Supervisor David W. Griffith conveyed that Rockwell International's New Castle Facility has received his recommendation to once again receive Ford Motor Company's prestigious Q1 award.

Formal receipt of the plant's Q1 plaque, flag, press release and other materials of recognition will be presented to representatives of our facility at a luncheon to be scheduled for March of this year.

In his wrap up session following the Q1 teams tour of our plant Mr Griffiths comments included:

- ★ "If anyone knows what it takes (To be Q1 certified) you do."
- ★ "Ford has seen a lot of change at New Castle since you lost your Q1 certification. You've benefitted from the experience."
- ★ As you know, the Q1 system is ever changing, but still includes two important principals
 1. "The design and more importantly, the use of an effective quality system"
 - AND
 2. "A commitment to CONTINUOUS IMPROVEMENT"
- ★ "It was obvious, particularly from the fine presentations from your E.I. groups that your work force is committed to continous improvement. The E.I. presentations were Very Impressive!"
- ★ "As the market changes, Ford must continue to change to stay in business, and one way for Ford to stay in business is to work in partnership with our suppliers."
- ★ "Based on our evaluation, we're pleased to recommend you for Q1 ... Congratulations! Thank your people."

Lets all work as hard to Keep this award as we did to Earn it.

Once again, Thanks to everyone for contributing to this accomplishment.

Steve. Thompson



PLANT
MANAGER

November 8, 1991

RECEIVED

91 NOV 22 P 3:42

Any Suggestions???

OSTP
MAIL ROOM

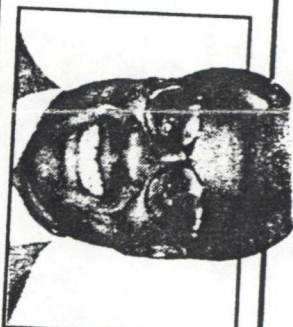
Please comment on this information.

we did request To Testify at a Senate or Congressional
hearings

CUBBAL

Father needs to loosen Bonds with son. Page 15
ON CAMPUS

Moms find 'Empty Nest' when kids fly off. Page 23



Time to go forward

Clarence Thomas is confirmed by narrow margin

— See page 1

112th Year No. 31

NEW CASTLE, PA. WEDNESDAY, OCTOBER 16, 1991

NEW CASTLE NEWS Rockwell to close 85 workers will lose jobs over next two years

By Jackie Kunzmann
New Castle News

Over the next two years, 536 jobs at Rockwell International's 11-Highway Axle plant will be lost, marking the demise of yet another of Lawrence County's major employers.

While the news came as a shock to many throughout the county, it is a decision by which Rockwell officials intend to stick. It was a firm management decision that was made and announced and we intend to stick by said Mike Pennington, a public relations executive at the plant.



Mr. Roger B. Porter
Assistant to the President
Economic and Domestic

Dear Mr. Porter:

As representatives of the U.S. at the Rockwell Plant in New Castle, Pa., we are requesting any assistance to give concerning our lobbying the Corporation for investment in state of the art technology that will be necessary for our plant to survive into the next century. We are quite appreciative of the fact that Rockwell did double our work force in the last few years, but unfortunately we're in very real danger of losing all 1000 plant jobs sometime within this decade if a \$5,000,000 to \$6,000,000 investment is not realized to compete in today's world market. These are real, family supporting jobs.

To get more to the point, we are requesting the Federal Government to investigate our situation. We believe that we have some convincing logic as to why America will never stay competitive without more of America's help, i.e. low interest loans, grants, training, Federal tax easement, etc., just as is the case of our new friends and competitors in Eastern Europe who will never become competitive without the help of America in financially aiding them to compete with us. All we're asking is for the ability to compete with the same modern state of the art technology.

Although Rockwell is heavily into defense, space and electronics, it has still to its credit maintained a presence in manufacturing, the backbone of America, giving the common man the opportunity to feed, cloth and educate their families. There can be no justification for our taxes to support the rest of the world if that support helps undermine our own dreams.

In closing, we would appreciate any help or direction you may be able to give. We would be related to voice our concerns at an investigation hearing if the opportunity should come

THE WALL STREET JOURNAL THURSDAY, OCTOBER 24, 1991 C13

Rockwell Gets NASA Extension
CAPE CANAVERAL, Fla. — Rockwell International Corp. said its Space Systems Division was awarded a three-year \$453.5 million extension of its contract for space shuttle-orbiter-logistics and Space Administration's Kennedy Space Center.
Rockwell said the extension covers the period from October 1, 1991, through September 30, 1994. Rockwell has handled logistics operations for NASA since 1980. Work will continue at Rockwell's NASA Shuttle Logistics depot here, its Space System Division's facility in Downey, Calif., and the Kennedy Space Center.

Nov 82.15
Jan92 82.15
Mar 81.50
Apr 81.50
May 81.50
Aug 81.50
Est vol 1.00
CATTLE - 1
Oct 73.10
Dec 76.70
Feb92 76.30
Apr 76.30
June 73.00
Aug 71.00
Est vol 1.00
HOGS
Oct 42.25
Dec 42.25
Feb92 40.90
Apr 40.90
June 45.90
Aug 45.90
Est vol 4.00
BELL
Oct 42.85
Dec 42.85
Feb 41.50
Apr 41.50
June 41.50
Aug 41.50
Est vol 4.00

... at the same rate for a ...
... below the Prime Rate as ...
... Journal Terms from 6 months ...
... deposit 925,000. Substantial ...
... in deposit for early withdrawal. Offer subject to change ...
... without notice. This offer is not available to brokers.

November 26, 1990

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9124730
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: LARSON, Charles F.: INDUSTRIAL RESEARCH INSTITUTE

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 11/07/91

SUBJECT: RE: TWO MORE REPLIES TO THE INSTITUTES SURVEY OF THE
NATIONAL CRITICAL TECHNOLOGIES REPORT.

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
INDUSTRIAL

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

OSTP RECEIVED: 11/12/91 DEPT RECEIVED:
FILE: P-INDUSTRIAL
CENTRAL FILES:



Industrial Research Institute, Inc.

RECEIVED

91 NOV 12 AIO: 11

November 7, 1991

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DIRECTOR

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EXECUTIVE DIRECTOR
CHARLES F. LARSON

The Honorable D. Allan Bromley
Assistant to the President for
Office of Science & Technology
Old Executive Office Building
17th Street & Pennsylvania Avenue, NW
Suite 358
Washington, DC 20506

Dear Dr. Bromley:

On October 2, 1991, I sent you several replies we had received in response to our invitation to comment on the Report of the National Critical Technologies Panel and the White House Fact Sheet.

Enclosed for your information are two more replies, from Chevron Research and Pechiney.

Sincerely,

Charles F. Larson
Executive Director

CFL:pt
Enclosures



N/REF : DRD/JP/MLC

Charles F. LARSON
Executive Director
INDUSTRIAL RESEARCH INSTITUTE
1550 M Street, NW.
1 WASHINGTON, D.C. 20005

PARIS LA DEFENSE, le 14 octobre 1991

**Subject : COMMENTS ON REPORT OF THE NATIONAL CRITICAL TECHNOLOGIES
PANEL**

Dear Chuck,

Please find hereafter some comments on report of the national critical technologies panel.

The report is very interesting and includes a lot of information of outstanding importance for the future of industry. I think nevertheless that it does not consider all the important features for the competitiveness of industry.

As clearly indicated in Appendix A, "primary consideration was given to technologies that could be incorporated into commercial products/processes or defense system within 10 to 15 years".

The long term is therefore considered from a technology push point of view, while industrial competitiveness has also to be maintained and improved in short and medium terms, primary consideration being then given to markets.

In fact the criteria retained by the panel include the latter aspect after the descriptions given in Appendix A for :

- "Industrial Competitiveness : Technologies that improve U.S. competitiveness in world markets through new product introduction and improvements in the cost, quality, and performance of existing products."
- "Size of ultimate market : Ability to exert a major economic impact through the expansion of existing markets, creation of new industries, generation of capital, or creation of employment opportunities."

Siège social : Immeuble Balzac - 10, Place des Vosges, La Défense 5 - Courbevoie, Hauts-de-Seine
Adresse postale : Cedex 68 - 92048 Paris La Défense
Tél. : (33-1) 46 91 46 91 - Télex PECH 612 013 F - Télécopie (33-1) 46 91 46 46
S.A. au Capital de 5.053.875.100 F - RCS Nanterre B 562 095 166

This aspect has perhaps not been sufficiently included in the report. It seems to me that if the objective of the report is to convince people of the importance, for the future of industry and defense, of basic technological research, it may be useful as it is. But if it is the basis of decisions to encourage research in some fields rather than in others, as it does not include all the necessary information to fix priorities, it should be completed as suggested below.

1. For long term

In each technological area described as important, an estimate of the potential economic impact should be tentatively made and compared to the technical difficulties to solve, with an evaluation of time scale. It is a difficult exercise, certainly very imprecise, but nevertheless useful to establish priorities and make decisions avoiding too large errors.

2. For short term

A useful complement of the report could be an analysis on the following line :

Existing markets and their potential evolution
Position of US on these markets



Existing industries
Position of US on these industries



Technologies used and new ones to introduce
Position of US on these technologies.

From there, conclusions could be given on research priorities for increasing the competitiveness of existing industries by improvement of technologies, but it should not be omitted that technology is only one of the factors to obtain this objective.

Though the above comments are not exactly in the line that you have recommended, I hope that they will be useful.

Sincerely yours.

Y. FARGE

Vice President
Research and development

OCT 18 1991



Chevron Research and Technology Company

A Chevron Corporation Subsidiary

100 Chevron Way, Richmond, California • Phone (415) 620-3000

Mail Address: P.O. Box 1627, Richmond, CA 94802-0627

Fax (415) 620-4647

October 7, 1991

Charles F. Larson
Executive Director
Industrial Research Institute
1550 M. Street N.W.
Washington, D.C. 20005

Mr. Larson:

As you requested in your memorandum of August 8, Chevron Research and Technology Company has reviewed the National Critical Technologies report (March 1991) in the areas of our expertise.

Attached are our comments on three areas:

- High-Performance Metals and Alloys
- Pollution Minimization, Remediation, and Waste Management
- Applied molecular Biology

The comments address the three points raised in your letter:

1. Are the sectors listed under each area of technology the most critical, or are there others more important?
2. Is the description of the U.S. competitive position relative to that of other countries accurate?
3. What can industry do to help resolve the problem areas?

For the second topic there are also additional comments on the technology description.

I hope these comments will be useful to you in composing your report to OSTP.

Sincerely,

A handwritten signature in dark ink, appearing to read "R. M. Moore".

R. M. Moore

ATTACHMENT 1

HIGH-PERFORMANCE METALS AND ALLOYS

Comments on three points requested by IRI:

1. Are the sectors listed under each area of technology the most critical, or are there others more important?

The materials technology described in the report pertained to the aerospace industry. The materials cited would have extremely limited application in the oil industry. Usage of these materials in furnaces, reactors, turbines, etc., would be highly specialized, very limited in quantity, and probably at best an order or two of magnitude higher in cost.

2. Is the description of the U.S. competitive position relative to that of other countries accurate?

Again the attachment is focused on aerospace. A general comment may be valid, however, about competitive position on new materials technology for oil industry. High technology/new materials development and marketing in the U.S. is usually from small entrepreneurial companies with limited funds; whereas foreign companies approaching us with new technologies are usually better funded with larger technical organizations. The point is unless there is some financial incentive or relief for small U.S. companies to advance oil industry materials technology, it will be difficult for the U.S. to achieve or maintain any competitive position.

3. What can industry do to help resolve the problem areas?

(a) Find ways to provide incentive to U.S. companies to develop and prove advanced materials technologies for the oil industry.

(b) Because the oil industry purchase most materials as finished products, e.g., valves, rotating equipment, vessels, instruments, etc., encourage materials development firms to include end users as well as manufacturers in their market development strategies.

ATTACHMENT 2

POLLUTION MINIMIZATION, REMEDIATION & WASTE MANAGEMENT

We have the following comments:

1. Are the sectors listed under each area of technology the most critical, or are there others more important?

The sectors listed (waste minimization, recycling/re-use, etc.) are appropriate. The discussion seems to be focussed on solid waste and avoids discussion of air and water issues which may not be appropriate unless this was the intent.

2. Is the description of the U.S. competitive position relative to that of other countries accurate?

The description of our competitive position is very weak (at least in the attached portion of the write-up, pages 113-116). The U.S. is in a very strong position, particularly in the area of control technology and site remediation, to serve growing demand by Pacific Rim, European, and other developing third world countries. Government and industry should work together to take advantage of these markets. The write-up could do more to identify these markets and technology demands.

3. What can industry do to help resolve the problem areas?

Industry could do a better job of accounting for the true cost of pollution and making sure that those who generate it pay for it as it is generated. Cooperative efforts by industry and government to evaluate new technologies and approaches are also valuable.

With regard to the technology descriptions;

1. Overall; The technologies descriptions were very general with few strategic insights. However, as was noted on page 115, a broad range of technologies will be required. Thus, this generally soft discussion may be unavoidable.
2. Page 113, the term "pollution minimization" is used to describe what others refer to as "pollution prevention" in that the target is to avoid the generation of pollution. Pollution minimization is a broader term that used in this context that generally refers to pollution reductions through optimizing all activities (prevention, recycle, treatment, and disposal). We suggest changing the term "minimization" to prevention".

3. Page 114, column 1 paragraph 1: The statement that "physical separation techniques...are not as efficient as other techniques" is an apples-to-oranges comparison. We suggest the following change: "Physical separation techniques...may leave residual contaminants that other techniques would remove".
4. Page 114, column 1, last paragraph: Supercritical water oxidation (SCWO) in our estimation is over sold in this write-up. Is is not widely demonstrated, it is expensive, and it is not likely to be applied to dilute waste due to cost. We suggest also mentioning other efforts such as improving incineration and fixation technologies.
5. Page 114, column 2, 13 lines up from bottom; Add "water and/or" so that the line reads "contaminated soils are treated with water and/or chemical".
6. Page 116, column 2, 9 lines up from bottom: It is over stated to say "almost every toxic substance requires a unique treatment." This could be said about families of toxins (i.e., heavy metals vs. chlorinated compounds vs. oil constituents). Also, it is true that each site or situation can present unique constraints requiring skill in choosing the appropriate approach given limited information. However, the challenge to industry is to find cost effective technologies which are applicable to a wide variety of toxins. Bio-treatment with adapted bacterial forms tend to offer this hope.

ATTACHMENT 3

APPLIED MOLECULAR BIOLOGY SECTION

1. Are the sectors listed under each area of technology the most critical or are there others more important?

The major sectors listed-- recombinant DNA techniques, protein engineering, monoclonal antibody production and bioprocessing-- cover the most critical areas of biotechnology. These sections give major emphasis to medical applications of biotechnology. Companies whose core business is in the medical/clinical field will provide more useful comments than an oil company on how critical most of the examples really are. For non medical applications, I would like to add examples under the recombinant DNA, monoclonal antibody, and bioprocessing sections.

Under recombinant DNA techniques, the usefulness of polymerase chain technology is too narrowly limited to a reference with respect to the human genome project when it has proven its usefulness for construction of gene probes to detect pollutant degrading genes, as well as in forensic and legal applications for DNA fingerprinting of samples. The applications of genetic engineering to produce biodegradable plastics and other biopolymers could be included under paragraph 5 in the last sentence.

Under monoclonal antibodies, no mention is made of their usefulness in developing detection kits for chemicals in blood, tissue or environmental samples. Examples would include pesticide detection kits, drug testing kits. etc.

Under bioprocessing, I would include a reference to the area of wastewater treatment and bioremediation technologies for cleaning up contaminated aquifers, groundwater, and soils along with bioprocessing to produce products.

2. Is the description of the U.S. competitive position relative to that of other countries accurate?

The description of the United States competitive position is fairly accurate, if anything it underemphasizes the potential competition from Japan. The Japanese are patenting twice as much as the United States in environmental biotechnology. Individual labs in Europe are making significant gains, but the effort remains more fragmented compared to Japanese efforts.

3. What can industry do to help resolve the problem areas?

Like the Japanese, U.S. industry could form closer alliances with key universities with emphasized research programs in technology areas aligned with the business needs of the sponsoring companies. Industry needs to continue to emphasize the need for interdisciplinary research to really move this technology from the lab bench into the real world for its potential to be realized. Increased use of student interns, post-doctoral fellowships in industry, sabbaticals for industry scientists in universities (and vice-versa), may help communicate the barriers to implementation to the university researchers and result in more focused research programs.

The government funded centers do not appear to be fostering the interdisciplinary research necessary to accomplish this. Currently, most government funding agencies (and some universities) make it difficult for faculty to obtain funding for interdisciplinary (i.e., interdepartmental) projects. There is perhaps an overemphasis in funding of the basic molecular biology research, and an underemphasis in funding of the applied research that will be required to make the technology practical in bioreactors or field settings. Industry may need to step in and take on more of the applied research funding burden.

Reinstatement of the tax credit for research and development activities would probably result in increased industry investment in programs that could help resolve the problem areas in applied molecular biology.

THE WHITE HOUSE
WASHINGTON

December 4, 1991

Dear Chuck:

Many thanks for sending us the additional comments concerning the report of the National Critical Technologies Panel and the White House Fact Sheet. These comments are extremely useful to us and provide us with that all important calibration from outside the Beltway that keeps us more or less on the rails.

As always, it is a pleasure working you.

With all best wishes,

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Allan", written in a cursive style.

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

Dr. Charles F. Larson
Executive Director
Industrial Research Institute, Inc.
1550 M Street, Northwest
Washington, D.C. 20005

"Document Control"

TYPE: INFORMATION

DOCUMENT NUMBER: 9124595

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: IVERSON, J. Richard: AMERICAN ELECTRONICS ASSOCIATION

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/25/91

SUBJECT: A THANK YOU LETTER FOR DR. BROMLEY'S ATTENDANCE AT
THE MEETING OF THE ADVANCED TECHNOLOGY COALITION
WITH GOVERNOR SUNUNU.

DIRECTORATE
ASSIGNED:

STAFF
ASSIGNED:

ACTION
REQUIRED:

STAFF
ACTION:

SENDER'S DUE DATE:

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DATE COMPLETED:

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DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley
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OSTP RECEIVED: 10/29/91
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American Electronics Association

4595
AEA

5201 Great America Parkway, Santa Clara, California 95054. Telephone: (408) 987-4200
1225 Eye Street, N.W., Suite 950, Washington, D.C. 20005. Telephone: (202) 682-9110

October 25, 1991

RECEIVED
91 OCT 29 AIO: 44

OFFICE OF THE
DIRECTOR

The Honorable D. Allan Bromley
Assistant to the President for Science
and Technology
Old Executive Office Building
Room 360
17th and Pennsylvania Avenue, NW
Washington, DC 20506

Dear Dr. Bromley:

Thanks for joining us in the meeting of the Advanced Technology Coalition with Governor Sununu on October 23, 1991. This coalition of companies, trade associations, professional societies, and labor unions has supported the technology initiatives of the Administration.

We are pleased that you concur on our view that the Administration's economic growth initiative should be technology and productivity growth.

We were very pleased that you expressed a willingness to experiment with methods of encouraging companies to commercialize the technology that we as a nation develop. The Technology Preeminence Act contains such a provision, and we appreciate your indication that the Administration is willing to test the concept.

We will be following up in the future with some of your other suggestions and look forward to the restoration of economic competitiveness in the United States.

Sincerely,

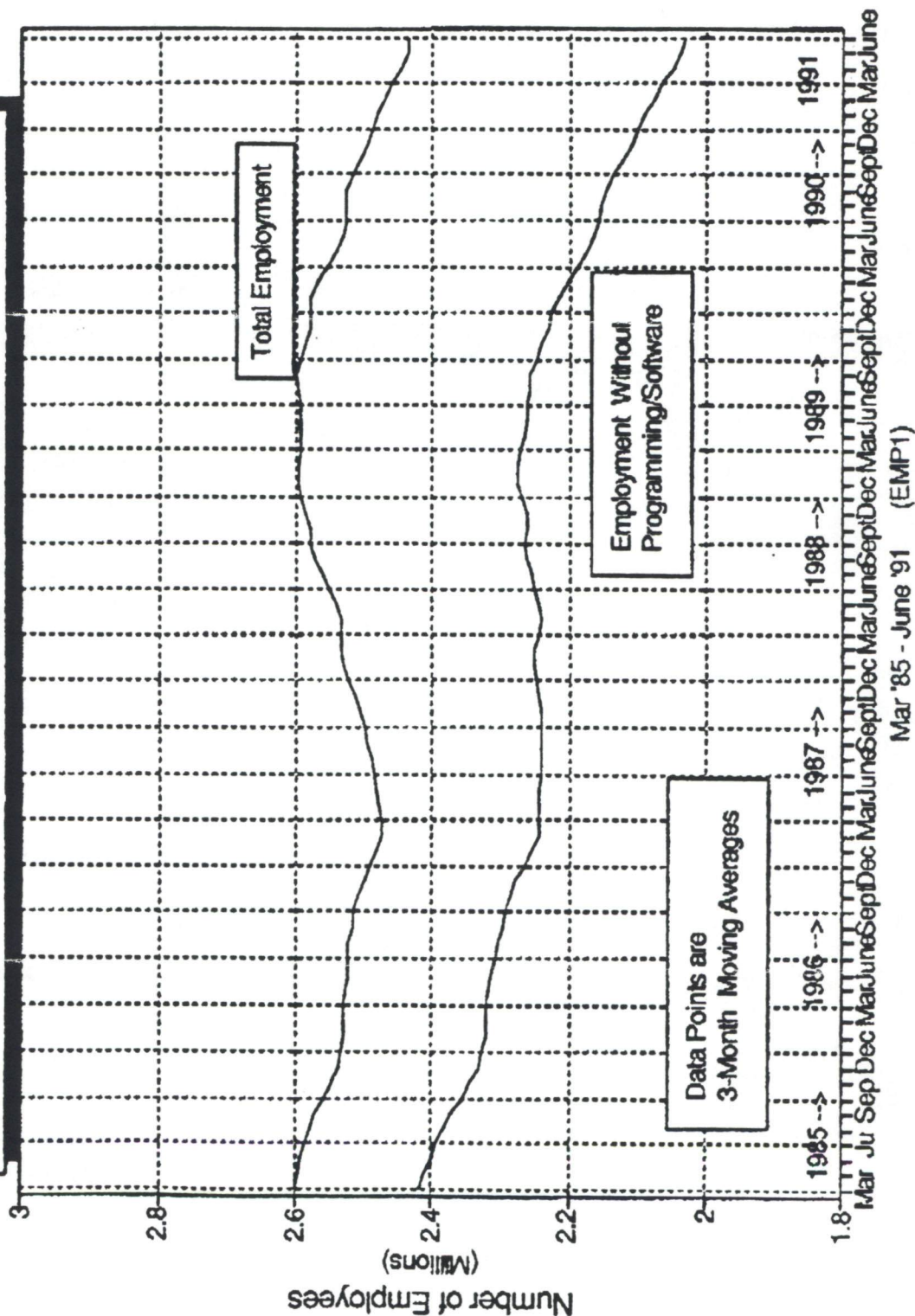


J. Richard Iverson
President and CEO

JRI:efs

Employment, U.S. Electronics Industry

(AEA Estimates based on BLS Data)



"Document Control"

TYPE: INFORMATION
ORIGINATOR: 02

DOCUMENT NUMBER: 9124597
DIRECTORATE STATUS

FROM: BALZHISER, Richard E.: EPRI

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/23/91

SUBJECT: RE: THE APPOINTMENT OF DR. ROBERT L. HIRSCH TO THE
POSITION OF VICE PRESIDENT OF THEIR WASHINGTON D.C.
OFFICE.

1/15
CB -
DAB met w/
the EPRI gentlemen
1/14/92!
Please close out.
Thanks,
Marian

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DAB
When EPRI calls,
do you want to
meet with HIRSCH??
OK. Set up
Shuro Bob
Hirsch from
his DE
says.



Electric Power
Research Institute

4591
RECEIVED
Richard E. Balzhiser
President and Chief Executive Officer

91 OCT 29 410:44
October 23, 1991

Dr. D. Allan Bromley
Asst. to the President for Science & Technology
Director, Office of Science & Technology Policy
Old Executive Office Bldg.
Washington, DC 20506

OFFICE OF THE
DIRECTOR

Dear Allan:

Over the past year of reorganization and change within EPRI, I have noted just how many of the scientific and technical issues with which we are dealing contain sensitivity with regard to the public policy process. In recognition of this reality, and with the support of our Board of Directors, I have upgraded the position responsible for EPRI's Washington Office to an officer-level function, and I have selected Dr. Robert L. Hirsch to join EPRI immediately as Vice President, Washington Office.

In this new position, Bob will direct EPRI's Washington Office but will also assume responsibility for planning and implementing our many liaison relationships, including federal energy agencies, scientific, technical, academic and environmental organizations, plus the industry trade associations. This new function provides an opportunity to broaden our interactions at the senior management level. I'll be working directly with Bob to coordinate activities between EPRI and the Office of Science & Technology Policy. In this connection, I would like to call on you personally to introduce Bob and discuss his role in assuring an effective working relationship exists between OSTP & EPRI.

In the meantime, the attached press release provides more information about Bob's previous experience in both the public and private sectors. His record of achievements, experience and relationships gives me reason to be optimistic about a close and productive relationship between our organizations.

Allen, my sincere thanks for your keynote talk at the recent Electricity Beyond 2000 Conference. It was a superb beginning to one of the best meetings I've ever attended.

Sincerely,

Richard E. Balzhiser

REB:par

3412 Hillview Avenue, Post Office Box 10412, Palo Alto, CA 94303
Telephone (415) 855-2141

Contact: Richard G. Claeys, EPRI, Palo Alto, CA (415) 855-2251
(415) 855-2035 (24-hour voicemail)

EPRI NAMES ROBERT L. HIRSCH WASHINGTON OFFICE VICE PRESIDENT

Palo Alto, Calif. -- October 16, 1991 -- An executive with 30 years of experience in energy research, technology development and energy policy is assuming an expanded new role with the Electric Power Research Institute (EPRI).

Dr. Robert L. Hirsch, 56, has joined EPRI as vice president, Washington Office. His new officer position includes direction of EPRI's Washington D.C. office, plus program planning and liaison activities with federal agencies, trade associations, scientific, academic, technical and environmental organizations. Dr. Hirsch will be based in Washington, D.C., reporting directly to Dr. Richard E. Balzhiser, EPRI's president and chief executive officer.

"Every scientific and technical issue we face contains a public policy dimension," Dr. Balzhiser said. "Bob Hirsch's achievements in technology development and implementation, plus his long experience with the public policy process, qualify him well for this important assignment."

Dr. Hirsch joins EPRI from ARCO Oil & Gas Company, Dallas, Texas, where he has served since 1983 as vice president and manager, research and technical services. He has also been chief executive officer of ARCO Power Technology Inc., an ARCO subsidiary based in Washington, D.C., since 1986.

(more)

ROBERT HIRSCH

2-2-2-2

Prior to his ARCO affiliation, he spent six years with Exxon Corp., as deputy manager of the science and technology department, New York; general manager of exploratory research (petroleum refining), Florham Park, N.J.; and manager of the Baytown, Texas, synthetic fuels research laboratory. Dr. Hirsch's previous private sector assignments included nuclear engineering at Atomics International, Canoga Park, Calif., and fusion research at ITT Industrial Laboratories, Fort Wayne, Ind.

During his nine years of government service, Dr. Hirsch was with the U.S. Energy Research & Development Administration, first as director of the magnetic fusion energy program, then as assistant administrator for solar, geothermal and advanced energy systems, a presidential appointment. He was also a staff member with the Atomic Energy Commission from 1968-72.

Dr. Hirsch holds a B.S. in mechanical engineering and a Ph.D. in Nuclear Engineering/Physics from the University of Illinois. He received a M.S. in nuclear engineering from the University of Michigan. He holds 14 patents and has published extensively in peer-reviewed journals and books. He is a fellow in the American Academy for the Advancement of Science and has been active on several petroleum, natural gas and energy research committees, including six years on the Department of Energy Research Advisory Board and various National Research Council study panels.

Dr. Hirsch is married and has three grown children.

EPRI, founded in 1972, manages technical research and development programs for the U.S. electric utility industry to improve power production, distribution and use. Some 680 utilities are members of the Institute.

#

Photo of Dr. Hirsch available by request. Please call Terry Ryals at (415) 855-2733.

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TYPE: INFORMATION DOCUMENT NUMBER: 9124267
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

FROM: YAMAGATA, Ben: CLEAN COAL TECHNOLOGY COALITION

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/02/91

SUBJECT: A THANK YOU FOR VISITING AND DISCUSS CLEAN COAL
TECHNOLOGIES.

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CLEAN COAL TECHNOLOGY COALITION

1050 Thomas Jefferson Street, N.W. Seventh Floor, Washington, D.C. 20007

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Chairman: R.E. Disbrow
President and COO
American Electric Power Service Corp.

(202) 342-3368
Facsimile
(202) 338-2361
(202) 338-2416

Executive Director:
Ben Yamagata

91 OCT 2 AM 1:29

September 30, 1991

OFFICE OF THE
DIRECTOR

Dr. D. Allan Bromley
Science Advisor to the President
The White House
Washington, D.C. 20500

Dear Dr. Bromley:

On behalf of Ray Harry of the Southern Company and Robert Beck of the Edison Electric Institute, I want to thank you for taking time to visit with us about clean coal technologies.

I was particularly pleased to know that your office recognizes the beneficial export potential of these emerging technologies. We agree with you that the United States should take the initiative, in light of continuing discussions about global climate change, in promoting the use of those clean coal technologies that are able to achieve high conversion efficiencies thus lessening carbon dioxide emissions.

As I mentioned during our meeting, the electric utility industry and the Clean Coal Technology Coalition are actively advocating programs that will promote the introduction of these new technologies in other countries intending to use coal. One such incentive program has been included in legislation currently under consideration by the House of Representatives Subcommittee on Energy and Power of the House Energy and Commerce Committee. The proposal, originally introduced by Congressmen Bruce, Oxley and others, would permit the on-going clean coal program to locate clean coal technology projects in lesser developed nations so long as U.S. firms, utilizing U.S. technologies, propose and participate in such projects. Creating this type of technology transfer program would enable the United States to confirm our commitment to the use of coal in an environmentally responsible manner. As important, such a program would better insure that these technologies, supported in development by U.S. taxpayer dollars, would be made available by U.S. firms rather than our international competitors. This type of program also would evidence U.S. leadership in global environmental issues.

If we can be supportive of your efforts or if we can provide your office with assistance or information, I would be happy to oblige.

Sincerely,



Ben Yamagata
Executive Director

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TYPE: INFORMATION

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ORIGINATOR: 02

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FROM: SMITH, Esther T.: WASHINGTON TECHNOLOGY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 10/01/91

SUBJECT: PROVIDING COPIES OF THEIR SPECIAL SUPPLEMENT ON
CRITICAL TECHNOLOGIES, PUBLISHED AS A QUICK
REFERENCE GUIDE.

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WASHINGTON TECHNOLOGY

The Business Newspaper of Technology

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31 OCT 15 AM 11:33

OFFICE OF THE
DIRECTOR

Oct. 1, 1991

The Honorable Allan Bromley
Office of Science and Technology Policy
The White House
Washington, DC 20506

Dear Dr. Bromley:

Washington Technology is pleased to present you with copies of our special supplement on Critical Technologies, published as a quick reference on this vital subject to coincide with the recent conference on Technology Policy for Global Competitiveness sponsored by the National Center for Advanced Technologies and the American Institute for Aeronautics and Astronautics.

The National Center for Advanced Technologies Key Technologies are summarized along with a status report. Equally important is an industry-critical grouping which identifies critical technologies by industry and market value. Another page includes a description of the sponsoring organizations.

We have received many compliments on the convenient content and format of this reference, which was produced through the support of BDM International, Booz Allen & Hamilton, Science Applications International Inc. and Westinghouse.

We hope that these copies will be useful to you and your staff.

Yours very truly,



Esther T. Smith
Editor



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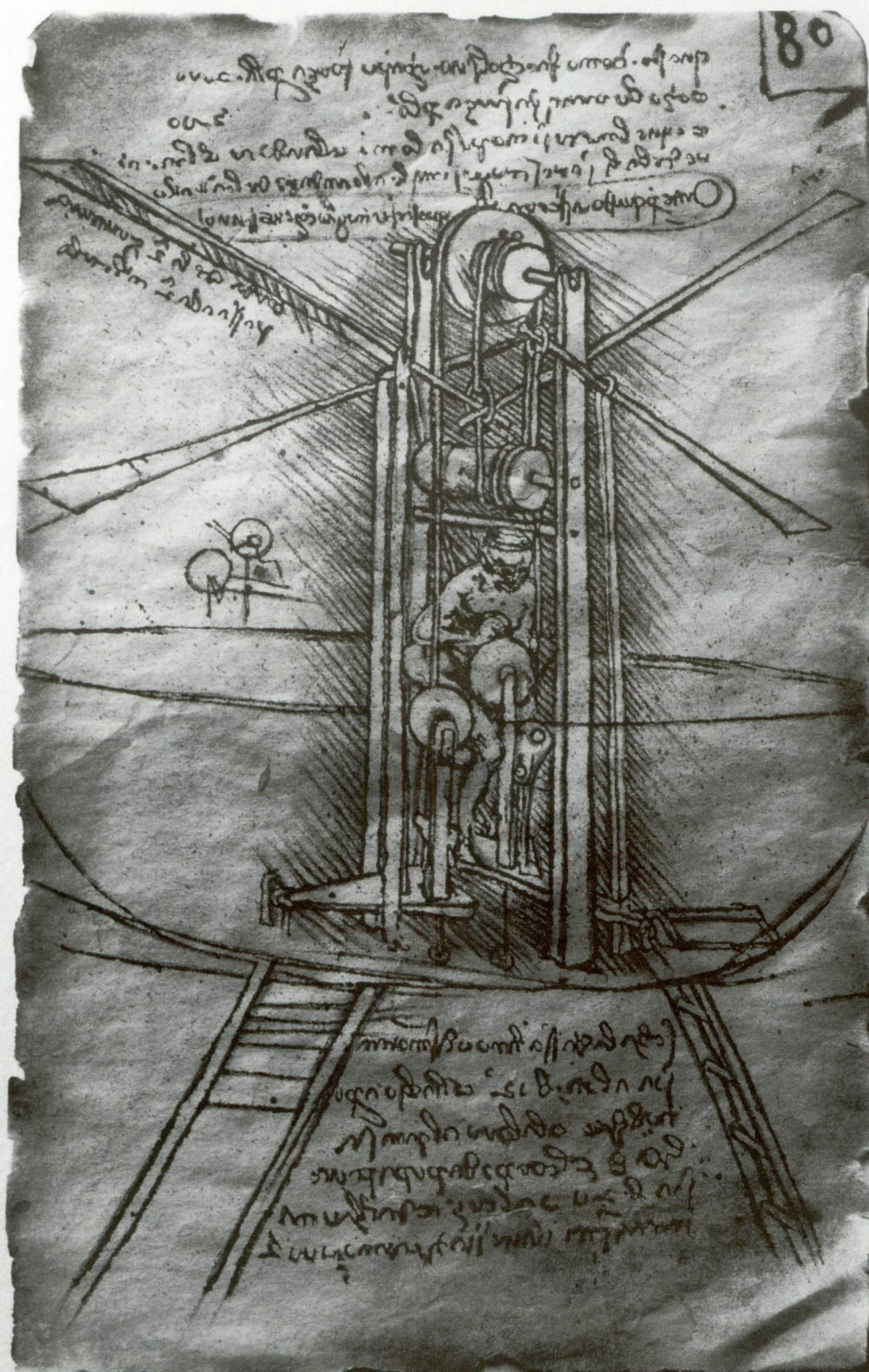
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In the 15th century, few would have accepted the idea of a helicopter-like device. Maybe that's why da Vinci wrote his notes in reverse.

12 Symposium Sponsors

Strong voices in the effort to forge a national consensus on technology policy for global competitiveness

COSPONSORS

American Institute of Aeronautics and Astronautics

Joseph Shea, President

Key to remaining competitive is a strategy on investing in critical technology. Industries that invest wisely will prosper; the unwise will quickly lose market share.

If the U. S. is to remain globally competitive, an essential change in corporate culture must occur. We must strive for cooperation between companies at the basic technology level, rather than maintain proprietary competition in all arenas.

History shows that technological innovation contributes to our nation's wealth. Only thusly can we maintain technological superiority and economic health of our nation.

National Center for Advanced Technologies

John Swihart, President

If America is to keep and increase its competitive edge, it must get high-quality products to the marketplace first, ahead of foreign competitors.

The solutions proposed by NCAT do not involve the government bailing out an industry that cannot compete. The process we outline is industry-led, with equal cooperation from government and academia.

This is not a government-sponsored industrial policy. The industry picks winners by deciding where to put money into product development. If there are winners and losers, that will be the result of how well a company can put the technology to work in products.

American Defense Preparedness Assoc.

Lt. Gen. Lawrence F. Skibbie (Ret.), President

Key to a viable and responsible industrial base is global competitiveness, and key to competitiveness is leading-edge, world-class technology. If we are to compete efficiently, then we must have a coherent technology policy which will not only focus and apportion our efforts but also promote long-term investment. Our leading-edge technology must be applied to both products and processes. Only if we excel in both will we maintain our world position.

American Electronics Assoc.

Gary Tooker, Chairman

In 1985, U.S. firms held almost two-thirds of the world electronics market. Now they hold only half. To reverse this our industry must cooperate internally and with government more effectively, and the government must ensure that the U.S. remains a seedbed for critical technologies.

The private sector must face intensified foreign competition, but government has to promote generic technologies, shift federal R&D to commercially relevant critical technologies, and ensure that U.S. high-tech firms are not disadvantaged in global markets.

American Society of Mechanical Engineers

Nathan H. Hurt Jr., President

Industry must lead in meeting the challenge of global competition, but government has a critical role in establishing technological goals and reforming regulatory and legal policies for technology development. Very important are policies that foster investment in the development and application of new technology.

More needs to be done—quickly. Time is a competitive weapon used by our competitors. The U.S. must pick up the pace to compete.

Council on Competitiveness

George M.C. Fisher, President

Foreign competitors have seriously eroded the U.S. edge in critical technologies, casting doubt on our future standard of living. National policies do not adequately deal with these concerns.

Thus, federal R&D for critical technologies should be increased dramatically, and the government needs to reorient its tax programs to stimulate private investment. Industry associations must work together, and management must improve worker skills and production processes.

Electronic Industries Assoc.

Peter F. McCloskey, President

Investment in R&D is a critical component of overall competitiveness, and identifying critical and dual-use technologies can make comprehensive R&D more effective. The examination of R&D systems and their decision-making processes can reap major dividends in making government, industrial and university research efforts ever more effective. Our technology policy must provide a balance between pushing the boundaries of human knowledge and advancing our competitiveness in the community of nations.

Institute of Electrical and Electronics Engineers

Eric Sumner, President

All modern nations have a substantial partnership between government and industry to protect nascent industries until they can compete. All engage in government-sponsored precompetitive R&D.

Picking winners is the rule for success. The government should pick winners where a market does not yet exist, or where investment is so large no one company can start up, especially with mature, powerful competition. Europe understands this; so does Japan. North America had better join in this powerful and fruitful approach.

National Assoc. of Manufacturers

Jerry Jasinoski, President

Manufacturing is a making a comeback, but it's spotty. The successes of Westinghouse, Motorola, Xerox, IBM and other world-class manufacturers need to reach the shop floor of every manufacturer if the U.S. is to compete effectively. Technology policy is important, but even the best policy won't lead anywhere by itself. It needs to be in a larger framework to produce a general policy environment conducive to investment and innovation.

National Security Industrial Assoc.

Wallace H. Robinson Jr., President

It is clear a consensus is needed for a National Technology Policy to balance economic and defense considerations.

The emergence of multiple critical technologies lists indicates the need for a Science and Technology Strategy to get these technologies into advanced systems and leading-edge products.

Finally, strong and insightful leadership on the part of both industry and government is required to guide the process.

ASSOCIATE SPONSORS

Aerospace Industries Assoc.

Don Fuqua, President

The NCAT/AIA "Key Technologies for the Year 2000" program promises to make technology development more affordable by taking advantage of a national cooperative program.

Support for chemistry entails close industry cooperation with government, policy adjustments are necessary. We will continue losing competitive ground if we insist on "business as usual" in technology development. We need a new policy structure to make the new technical approach work.

American Chemical Society

S. Allen Heiniger, President

Commitment to a technology policy of long-range planning and investment is essential for global competitiveness.

Support for chemistry should be an important element. A strong chemical sciences and chemical engineering base will advance many of the key technologies.

The nation must focus its efforts in the future on improvements in translating scientific knowledge into industrial reality if we are to remain a world-class industrial power in the global marketplace.

9 Industry Sectors

Chosen by the Council on Competitiveness as a broad cross section offering insights into the strengths and weaknesses of U.S. technology development and international competitiveness

Aerospace

World Market: \$200 billion (est.)

U.S. Shipments: \$120 billion (1990)

Employment: 814,000 (1990)

R&D to Sales: 4.1% (1989)

Status: World leader since World War II, but increasingly challenged by foreign airframe and component producers. Trade surplus of \$28 billion in 1990.

Key Technologies: Advanced materials, electronics, propulsion.

Chemical & Allied Products

World Market: \$960 billion (1989)

U.S. Shipments: \$292 billion (1990)

Employment: 832,000 (1988)

R&D to Sales: 3.8% (1989)

Status: Worldwide operations for thousands of products from bulk chemicals to high-tech electronic materials. Trade surplus of \$15.8 billion in 1990.

Key Technologies: Ceramics, composites, polymers, plastics, electronics, optoelectronics, biomaterials.

Computers & Software

World Market: \$194 billion (1990)

U.S. Shipments: \$100 billion (1990)

Employment: 587,000 (1989)

R&D to Sales: 9% (1989)

Status: U.S. equipment and software firms still the dominant producers, but balance of trade has deteriorated substantially and world share has fallen drastically from 81% in 1983. Trade deficit of \$500 million in 1990.

Key Technologies: Microprocessors, computer architecture, software, networks and communications.

Construction

U.S. Market: \$445 billion (1990)

Employment: 6,700,000 (1990)

Foreign Contracts by U.S. Firms: \$38.3 billion (1989)

U.S. Contracts to Foreign Firms: \$15.5 billion (1989)

R&D to Sales: 0.02% (est.)

Status: Competitive in the international construction services market but share is slipping, from 45% of all international contracts in 1980 to 28% in 1989.

Key Technologies: Advanced materials, sensors, computer-aided design and engineering, artificial intelligence, expert systems.

Drugs & Pharmaceuticals

World Market: \$150 billion (1989)

U.S. Shipments: \$54.9 billion (1990)

Employment: 178,000 (1990)

R&D to Sales: 12% (1990)

Status: Still commands major share of world market, but U.S. consumers were 20% of that market in 1988. Historically maintained trade surplus, but it shrunk to \$1.1 billion in 1990 as global market has soared.

Key Biotechnologies: Recombinant DNA, cell fusion, bioprocessing, increasing use of supercomputers and huge databases for modeling.

Electronic Components & Equipment

World Market: \$150 billion (est.)

U.S. Shipments: \$62.6 billion (1990)

Employment: 520,000 (1990)

R&D to Sales: 6.5% (1989)

Status: Long an area of strength, market after market has been lost, though leadership remains in microprocessor design, if not manufacturing.

Key Technologies: Computer-aided design and engineering, process equipment and controls, and electronic materials.

Metal-Processing Machine Tools

World Market: \$38 billion (1988)

U.S. Shipments: \$6.8 billion (1990)

Employment: 47,500 (1990)

R&D to Sales: 2% (1989)

Status: U.S. share of world production has fallen from 50% in 1955 to 10% now, and imports have taken half the U.S. market, producing a 1990 trade deficit of \$800 million.

Key Technologies: Advanced materials, electronic controls and sensors, software, lasers, structural dynamics.

Motor Vehicles

World Market: \$560 billion (1989)

U.S. Shipments: \$215 billion (1989)

Employment: 855,000 (1990)

R&D to Sales: 3.4% (1989)

Status: The largest U.S. manufacturing industry, with General Motors and Ford still the world's top two automakers. Despite U.S. market share of imports—28.5% in 1989—overseas production by U.S. companies still exceeds imports in the U.S., which created trade deficit of \$44.2 billion in 1990.

Key Technologies: materials, electronics, process systems and controls, computer-aided design and engineering.

Telecommunications

U.S. Domestic Service Revenues:

\$166 billion (1990)

U.S. International Service Revenues:

\$8 billion (1990)

Equipment Sales: \$18.5 billion (1990)

Employment: 997,000 (1990)

R&D to Sales: 4.7% (1989)

Status: Historically U.S. has had best infrastructure in the world, but other advanced nations are modernizing systems more quickly. Increasing convergence of computer, video, telecommunications, and network technologies is creating rapid change.

Key Technologies: Software, fiberoptics, broadband switching, database architecture.

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11 Critical Technologies

Targeted for rapid development by the
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Rocket Propulsion

Criticality: More efficient engines can lift larger payloads for earth-orbit space stations and construction of moon and Mars exploration vehicles. Applications in all other space activities as well.

Status: Plan of recommended action completed. NASA is using NCAT's plan as the basis for a space propulsion study to be completed in about six months.

Advanced Sensors

Criticality: Performance-enhancing devices with uses in navigation and surveillance, and many others areas of application.

Status: Working draft complete. Final plan of recommended action available within 60 days.

Ultra-Reliable Electronic Systems

Criticality: Underlie almost all segments of the commercial economy and play a crucial role in defense sectors. Performance, cost-effectiveness and reliability are direct benefits.

Status: Working draft complete. Draft plan of recommended action available within 60 days.

Advanced Composites

Criticality: Lighter, stronger materials based on polymers, ceramics and carbon compounds reduce weight and improve fuel efficiency in all manner of aircraft. Applications in space as well as below the sea.

Status: Final plan of recommended action completed. Department of Defense and NASA are both using the plan as a basis for their respective technology development programs.

Computational Science

Criticality: Together with software development, underlies and enables most industries and critical technologies. An area long dominated by the U.S. but now under assault by foreign competitors.

Status: 40- to 60-page "roadmap" circulating for comment, working draft next, final draft by summer 1992.

Software Development

Criticality: Together with computational science, underlies and enables most industries and critical technologies. An area traditionally dominated by the U.S., but less so recently.

Status: 40- to 60-page "roadmap" published in January 1989, final draft by summer 1992 or before.

Superconductivity

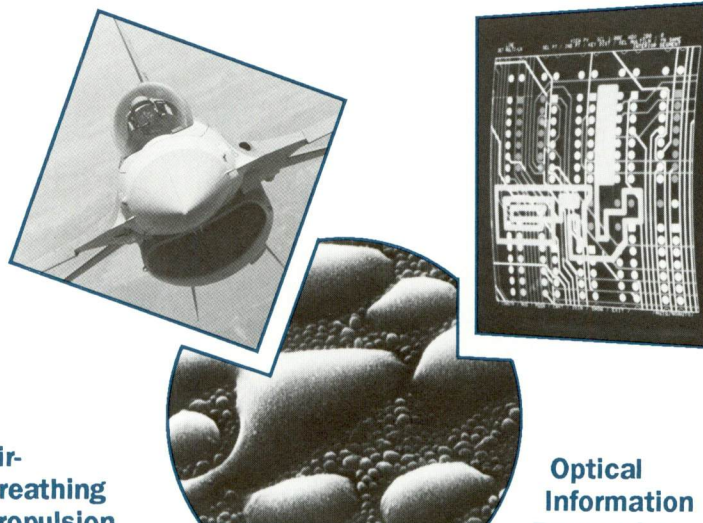
Criticality: The continuous flow of electrical current without energy loss will allow great advances in magnets, motors, generators and sensors, as well as magnetic levitation and magnetic-resonance imaging.

Status: Preliminary stages of developing a 40- to 60-page "roadmap."

Advanced Metallic Structures

Criticality: Gaining with realizations that composite materials cannot solve every structural load-support challenge. Still vital in the aerospace industry for manufacturing new generations of jetliners for the airline industry and for military uses.

Status: Preliminary stages of developing a 40- to 60-page "roadmap." To be combined eventually with Advanced Composites.



Air-Breathing Propulsion

Criticality: Applications include more powerful and reliable gas-turbine engines for defense and commercial use, more efficient fanjet and ramjet engines, and a new generation of engines for the hypersonic, transatmospheric National Aerospace Plane.

Status: Working draft complete. Final plan of recommended action available within 60 days.

Optical Information Processing

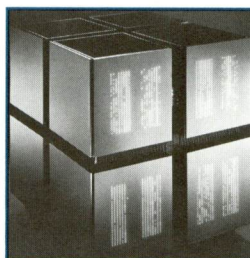
Criticality: Foundation for huge increases in the speed at which computers operate and in the amounts of data they can store and process. Fundamental to advances in communications networks.

Status: 40- to 60-page "roadmap" published December 1989, final plan due in fall of 1991.

Artificial Intelligence

Criticality: Foundation for knowledge engineering needed for process control in "smart manufacturing" and in computers handling ever-larger transaction-processing in real time.

Status: Working draft complete. Draft plan of recommended action available within 60 days.



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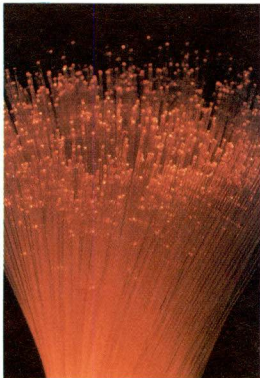
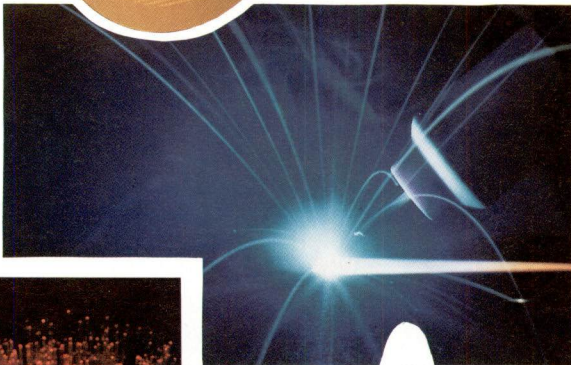
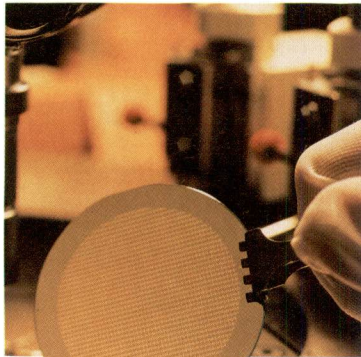
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Techworld
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Critical technologies are

the backbone of the nation's competitiveness efforts, bringing issues and people together to retain international strength in a cross section of industries.

The Aerospace Industries Association introduced the first list, of eight, in 1987, and what followed is a flood culminating in the inevitable List of the Lists included in the Council of Competitiveness' "Gaining New Ground" report issued in March.

The interest and attention are understandable. Critical technologies are those generic methods and processes—often needing intensive research and development—that precede and underlie successful commercial manufacturing. They involve high risk but offer synergies of scale and matching returns.

There is widespread agreement such technologies do not get enough attention in the United States.

To date there are critical technology lists from the Departments of Commerce and Defense, the Computer Systems Policy Project and the White House Office of Science and Technology Policy. OSTP's list of 22 technologies is deemed the grandfather because it traces common threads among all lists.

In 1989 the AIA formed the National Center for Advanced Technologies as a nonprofit educational foundation to urge government-industry development of the list of critical technologies, now grown to 11.

They have made progress: The NCAT list is the one government and industry most often cite.

The center seeks further consensus through its third conference in September, "Technology Policy for Global Competitiveness."

"We've got to sharpen our pencils," says NCAT president John Swihart, "and work on a few key technologies and mature them to field world-class products using the best technology."

The National Center's goal is to double industry productivity by pooling resources and halving the time it takes to commercialize a technology and bring competitive products to market.

NCAT's 11 Critical Technologies

Page 3

9 Key Industries at the Council on Competitiveness

Page 5

12 Symposium Sponsors Speak

Page 6

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ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: LIPSKI, Frank: FAZER ADVANCED VEHICLE TECHNOLOGY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 09/27/91

SUBJECT: A COPY OF HIS PATENT FOR A NEW PRODUCT AND A REQUEST
FOR INFORMATION REGARDING THE NECESSARY STEPS TO
TAKE.

DIRECTORATE STAFF
ASSIGNED: INDUSTRIAL ASSIGNED:

ACTION STAFF
REQUIRED: AS NECESSARY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 10/14/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: D. Allan Bromley

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CLOSED

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

October 29, 1991

Dear Mr. Lipski:

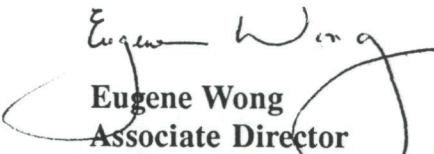
Thank you for your letter of September 27. As our office is not equipped to evaluate and promote inventions, we cannot provide you with the information or help that you seek.

You may find the following office useful to you:

Office of Energy Related Inventions
National Institute of Standards and Technology
Gaithersburg, Maryland 10899

(301) 975-5500

Sincerely yours,


Eugene Wong
Associate Director
for Industrial Technology

Mr. Frank Lipski
Fazer Advanced Technology
14634 Fonseca Street
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4257

FAZERTM

**ADVANCED
VEHICLE
TECHNOLOGY**

14634 Fonseca Street, La Mirada, CA 90638 (714) 670-0730 • (213) 869-5708

September 27, 1991

Dr. Allen Bromley
Assistant to the President

Old Executive Office Building
17th Street and Pennsylvania North West
Washington D.C. 20500

Dear Dr. Bromley;

Enclosed please find a copy of my recently awarded Patent for a product which will revolutionize the engine as we now know it today. I have also enclosed a copy of a technical report by members of the Society of Advanced Engineers regarding the results of tests related to my concept.

I wish to bring my new concept to your attention because I believe this discovery is timely and may require over-seeing by air-quality committees when the Patent is licensed by a manufacturer. This concept has pollution reduction and fuel-economy enhancement capabilities justifying research and development of this product.

Without knowing which is the next step I should take, your secretary suggested I introduce you to this matter initially by sending the enclosed documents. I hope they will prove interesting to you and that I will hear from you at your next earliest convenience.

Very Truly Yours;



Frank Lipski

FL;lk

FAZER

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United States Patent [19]

Lipski

[11] Patent Number: 5,046,466

[45] Date of Patent: Sep. 10, 1991

[54] SPARK-IGNITION ENGINE

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La Mirada, Calif. 90638

[21] Appl. No.: 585,497

[22] Filed: Sep. 20, 1990

[51] Int. Cl.⁵ F02P 15/08

[52] U.S. Cl. 123/310; 123/169 MG

[58] Field of Search 123/310, 169 EL, 169 MG,
123/638; 313/123, 140

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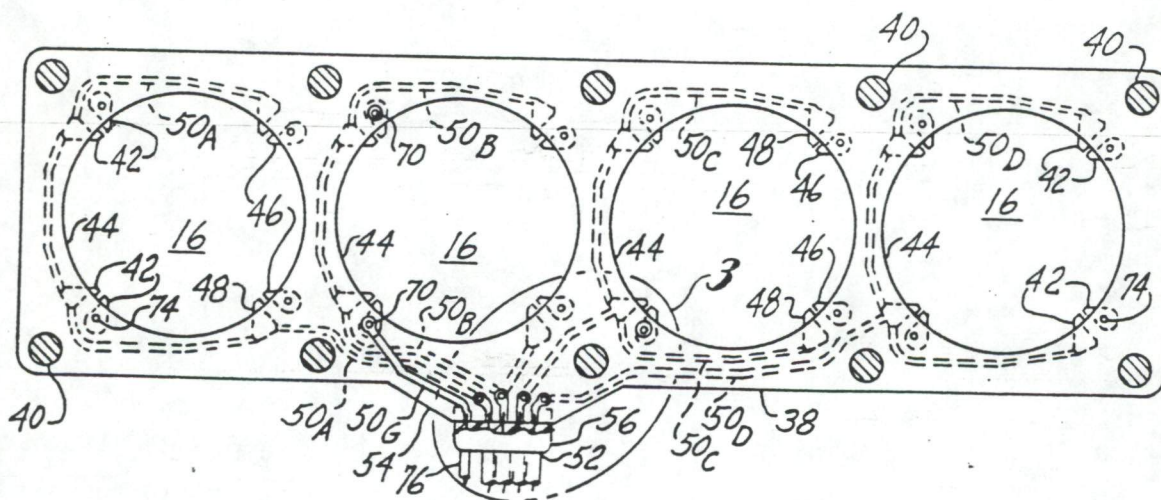
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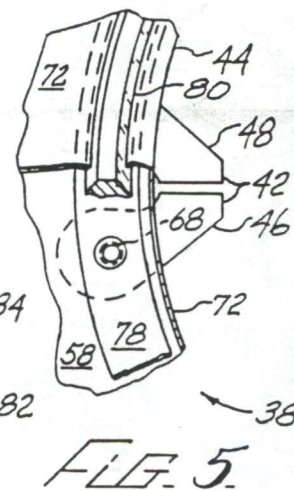
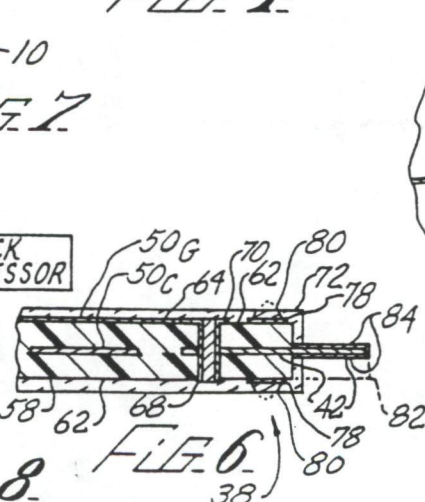
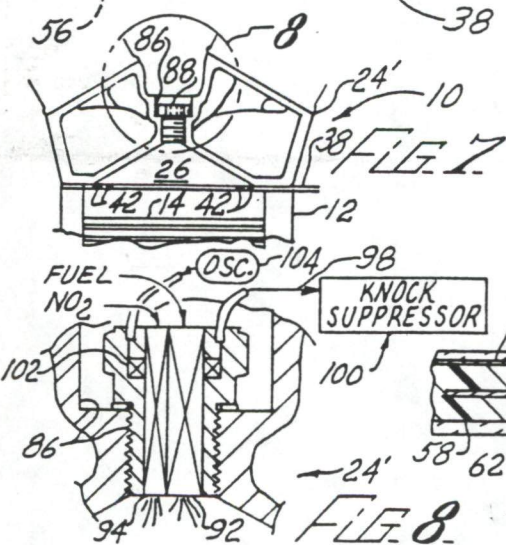
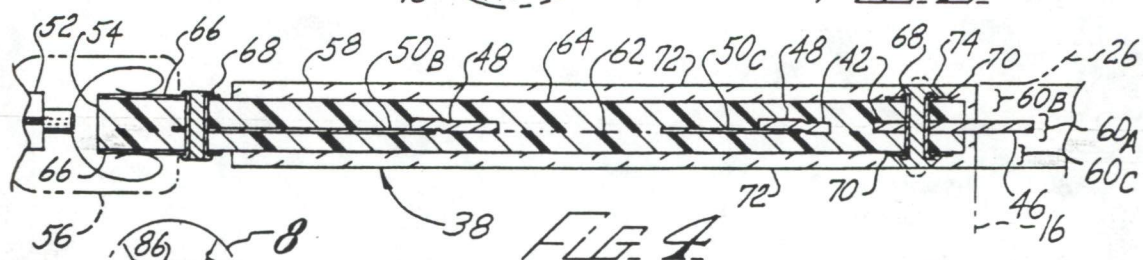
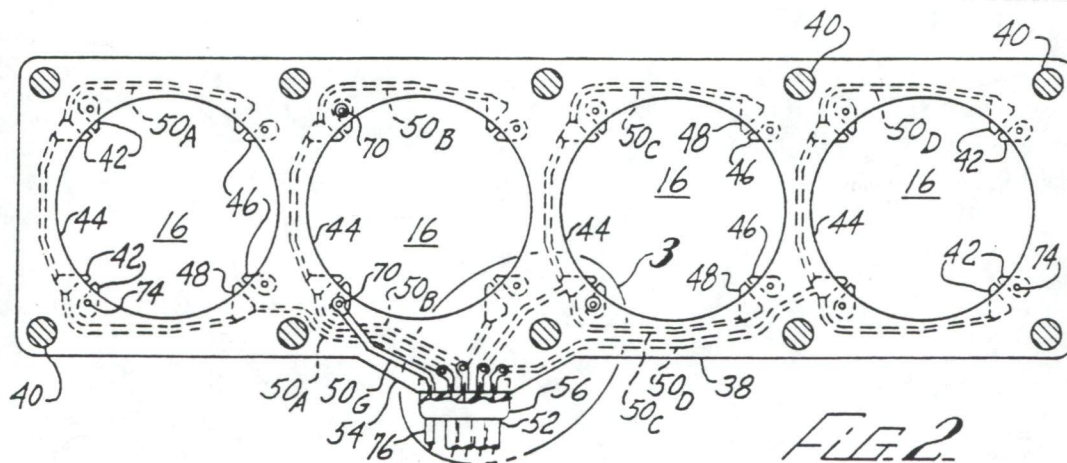
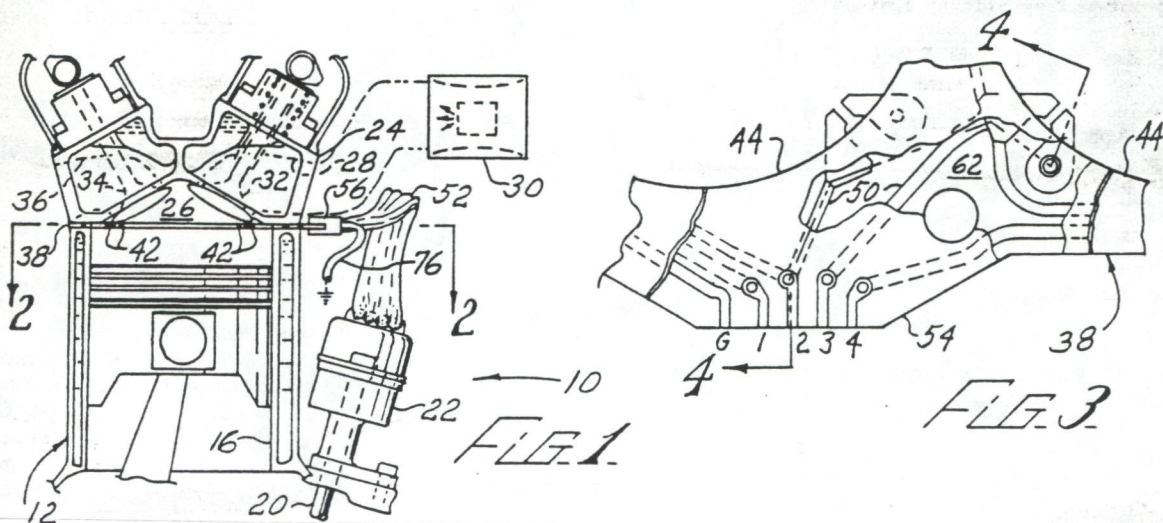
Primary Examiner—Tony M. Argenbright
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[57] ABSTRACT

A spark-ignition engine is disclosed that incorporates a relatively unlimited number of spark sources within each combustion chamber, without conventional spark plugs being required. The engine includes a planar circuit module clampingly located between a cylinder assembly and a head assembly of the engine. The module includes an electrically insulative substrate; a pair of electrode members; a foil circuit on the substrate for connecting the electrode members to a pulser that generates a high voltage intermittent electric signal for producing spark ignition of the fuel within a combustion chamber of the engine; first and second seals for connecting the substrate to the cylinder assembly and the head assembly. Also disclosed is a kit for replacing spark plugs in an internal combustion engine, the kit including the circuit module and in one version, injector assemblies for use in place of the spark plugs.

32 Claims, 1 Drawing Sheet





SPARK-IGNITION ENGINE

BACKGROUND

The present invention relates to spark-ignition internal combustion engines such as engines that typically power vehicles and other machinery using gasoline or similar fuel.

Spark-ignition internal combustion engines have moderate compression ratios, combustion being initiated by electric arcing rather than by charge heating as in Diesel engines. Spark-ignition engines are less expensive to produce and provide higher specific power output than Diesel engines, being also quieter and smoother running. However, a major shortcoming of conventional spark-ignition engines is the need for spark plugs, which are expensive to produce and often break down, requiring replacement. Aside from this obvious disadvantage, there are other disadvantages with spark-ignition engines. For example:

1. The combustion chamber is difficult to cool because of the close proximity of one or more spark plugs with intake and exhaust ports and associated valve train components;
2. Breathing efficiency is limited by valve area, which is in turn limited by the space taken up by the spark plugs;
3. Other openings in the combustion chamber, such as for injector nozzles and the like, are difficult to provide because of the competing need for spark plug openings;
4. Combustion is inefficient and accompanied by the production of unwanted atmospheric pollutants because ignition originates only from the locations of one or at most a pair of spark plugs per cylinder; and
5. The engines are expensive to produce because of the complicated tooling required to form the combustion chamber with adequate provisions for cooling in the presence of valving and spark plugs that are in close proximity.

Others have attempted to avoid some of these difficulties by locating spark electrodes about the circumference of each cylinder, using conductors imbedded within a head gasket or in specially provided cylinder rings. See, for example, Smits U.S. Pat. Nos. 2,775,234 and 2,948,824, Morrison U.S. Pat. Nos. 2,904,610, and Lowther U.S. Pat. No. 4,330,732. Unfortunately, none of these methods are believed to be commercially successful in that they require unconventional engine layout, excessive head gasket thickness, etc., and/or they are excessively expensive to produce, unreliable and short-lived.

Thus there is a need for a spark-ignition engine that does not require conventional spark plugs, that is inexpensive to produce, relatively free from the production of atmospheric pollutants, reliable, durable and easy to maintain.

SUMMARY

The present invention is directed to a spark-ignition engine that meets this need, incorporating a relatively unlimited number of spark sources within each combustion chamber, without conventional spark plugs being required. In one aspect of the invention, the engine includes cylinder means having at least one piston movable therein; head means for forming a combustion chamber in fluid communication with the piston, the

head means being removably connected to the cylinder means; gas flow control means whereby intake air is admitted into the combustion chamber for compression by the piston and subsequently expelled from the combustion chamber as exhaust gas by the piston; fuel flow means for controllably admitting fuel into the combustion chamber, the fuel being mixed with the intake air; pulse means for generating a high voltage intermittent electric signal, the signal being synchronized with movement of the piston; and a planar circuit module clampingly located between the cylinder means and the head means, the module including an electrically insulative substrate; a pair of electrode members; circuit means on the substrate having foil conductor members for connecting the electrode members to the pulse means for producing spark ignition of the fuel within the combustion chamber; first seal means for sealingly connecting the substrate to one of the cylinder means and the head means; and second seal means for sealingly connecting the substrate to the other of the cylinder means and the head means. As used herein, "foil" means a material having a thickness of less than approximately 0.010 inch. The foil conductor members advantageously permit the circuit module to be made sufficiently thin to be used directly in place of a conventional head gasket.

The circuit module can have a plurality of the pairs of electrode members, and each pair can include a first electrode member and a second electrode member, the electrode members being located in a plane. The foil conductor members can form a circuit layer of the circuit module, the circuit means also having an insulating material for electrically isolating at least one of the first and second electrode members from the cylinder means and the head means.

Preferably the electrode members are formed integrally with the conductor members for facilitating fabrication of the module by low-cost electronic production methods. The insulative substrate is typically formed with an opening therein between the combustion chamber and the piston, the electrode members being supportively connected to the substrate and preferably extending into the opening for promoting effective charge ignition without deleterious ionization of the substrate. Preferably the electrodes are covered with a plated conductive coating substantially covering the portions of the electrodes that extend into the opening for enhanced durability of the module at high combustion temperatures. The conductive coating can include nickel or platinum.

The engine can be multi-cylindere, the cylinder means having a plurality of pistons, the head means including a corresponding plurality of combustion chambers, the circuit module preferably having a plurality of the pairs of electrode members in association with each of the combustion chambers for enhanced combustion efficiency. At least one electrode of each pair of the electrodes associated with each cylinder can be electrically isolated from the electrodes of the other cylinders for sequential charge ignition in the respective cylinders. The electrode pairs for each combustion chambers can be connected in parallel.

Preferably the insulative substrate is formed with an opening therein between the combustion chamber and the piston for supportively connecting the electrode members to the substrate and extending into the opening. The engine can also include means for electrically

connecting one of the electrodes to at least one of the cylinder means and the head means by the clamped location of the circuit module therebetween.

Preferably an insulative coating forms the first seal means for enhancing the electrical isolation of the conductor members from grounded parts of the engine. The insulative coating can include fibrous ceramic. The first seal means can further include a metallic ring member rigidly and sealingly connected to the substrate, the ring member being deformed by the clamping between the cylinder means and the head means. The ring member can include a bead portion and a trace portion for forming a circuit layer portion of the circuit module and providing a base for the bead portion.

The engine can further include a plug opening into the combustion chamber from outside the head means of the type for receiving a spark plug, and a plug member for sealingly closing the plug opening. Preferably the plug member includes main injector means for feeding the fuel into the combustion chamber. The plug member can also include auxiliary injector means for feeding an auxiliary fluid into the combustion chamber and strain sensor means for providing a strain signal for indicating fluid pressure within the combustion chamber.

In another aspect of the present invention a kit is provided for replacing spark plugs in an internal combustion engine having a cylinder assembly having at least one piston movable therein, a head assembly removably connected to the cylinder assembly and forming a combustion chamber in fluid communication with the piston, a gas flow controller admitting intake air into the combustion chamber for compression by the piston and subsequently expelling the air from the combustion chamber as exhaust gas by the piston, a fuel flow controller for admitting fuel mixed with the intake air into the combustion chamber, and a pulser for generating a high voltage intermittent electric signal synchronized with movement of the piston. The kit includes one plug member for sealingly replacing each spark plug of the engine, and a planar circuit module for clamping between the cylinder assembly and the head assembly, the module including an electrically insulative substrate; a pair of electrode members; circuit means on the substrate for connecting the electrode members to the pulser for producing spark ignition of the fuel within the combustion chamber; first seal means for sealingly connecting the substrate to one of the cylinder assembly and the head assembly; and second seal means for sealingly connecting the substrate to the other of the cylinder assembly and the head assembly. The plug member can provide one or more injector units, a pressure sensor, and/or ultrasonic transducer for promoting enhanced combustion.

DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description, appended claims, and accompanying drawings, where:

FIG. 1 is a partial sectional elevational view of a spark-ignition internal combustion engine according to the present invention;

FIG. 2 is a sectional plan view of the engine of FIG. 1 on line 2—2 thereof;

FIG. 3 is a detail plan view of the engine of FIG. 1 within region 3 of FIG. 2;

FIG. 4 is a fragmentary sectional elevational view of the engine of FIG. 1 on line 4—4 in FIG. 3;

FIG. 5 is a fragmentary sectional plan view as in FIG. 2, showing an alternative configuration of the engine of FIG. 1;

FIG. 6 is a sectional elevational detail view within region 6 of FIG. 4, showing another alternative configuration of the engine of FIG. 1;

FIG. 7 is a sectional elevational view as in FIG. 1 showing an alternative configuration of the engine; and

FIG. 8 is sectional detail view within region 8 of FIG. 7, showing a further configuration of the engine of FIG. 1.

DESCRIPTION

The present invention is directed to a spark-ignition internal combustion engine that avoids the use of conventional spark plugs. With reference to FIGS. 1-4 of the drawings, an engine 10 has a block or cylinder assembly 12 having one or more pistons 14 slidably movable within corresponding cylinders 16, the pistons 14 being operatively connected to a conventional crankshaft (not shown). The crankshaft is geared directly or indirectly to a distributor shaft 20 of an ignition distributor 22. A cylinder head 24 covers the cylinder assembly 12, the head 24 having a plurality of combustion chambers 26 formed therein, each of the combustion chambers 26 having an associated intake port 28, fuel feed means 30, intake valve 32, exhaust valve 34, and exhaust port 36.

According to the present invention, a circuit module 38 that is clamped between the head 24 and the cylinder assembly 12, by conventional head bolts 40 or the like, incorporates a plurality of electrode members 42 therein, the electrode members 42 extending within one or more cylinder openings 44 of the module 38, each of the openings 44 corresponding to one of the cylinders 16. In an exemplary configuration of the module 38 as shown in the drawings, the electrode members 42 are arranged in pairs, each pair including a ground electrode 46 and a hot electrode 48. As shown in FIG. 2, the module 38 also incorporates a plurality of foil conductor traces 50 for electrically connecting the hot electrodes 48 through a wiring harness 52 to the distributor 22. For this purpose, the module 38 includes an edge plug portion 54 that mates with an edge socket assembly 56 of the harness 52, the edge plug portion 54 extending from between the cylinder assembly 12 and the head 24. As also shown in FIG. 2, a multiple cylinder configuration of the module 38 typically has separate and isolated conductive paths to the hot electrodes 48 for each cylinder 16 of the engine 10, the traces 50 being designated 50A, 50B, 50C, and 50D, respectively, for corresponding ones of the cylinders 16. Further multiple pairs of the electrodes 42 are spaced about each of the openings 42 for enhancing engine efficiency and reducing undesirable exhaust pollution by providing multiple spark sources. Moreover, the location of the electrodes 42 proximate the outer extremities of the combustion chambers 26 avoids pre-ignition and/or detonation by providing the spark sources closest to regions most subject to such preignition and/or detonation.

As best shown in FIGS. 3 and 4, the module 38 includes a substrate 58 and one or more circuit layers 60, designated 60A, 60B, and 60C in FIG. 4. The circuit layers 60 form a printed circuit that includes the foil conductor traces 50, the layers 60 extending between the cylinder assembly 12 and the head 24. As used

herein, the term "printed circuit" means a foil conductive pattern that is formed on an insulative substrate by graphical means such as by selective plating or etching of a conductive material, and includes but is not limited to single and multi layer circuit boards. The term "foil" means a material having a thickness of less than approximately 0.010 inch. As shown in FIG. 3, the circuit layer 60_A is formed on a first substrate layer 62 of the substrate 58, a second substrate layer 64 being fused or otherwise formed on the first substrate layer 62, in a conventional manner known to those skilled in multi-layer printed circuit fabrication, for electrically insulating the circuit layer 60_A within the substrate 58.

A material suitable for use forming the substrate 58 is commercially available as FR4 fire retardant polymer. Typically, the traces 50 are formed as etched and/or plated copper.

In an exemplary configuration of the module 38 as depicted in FIGS. 1-4, the electrodes 42 are formed as discrete members that are bonded within the substrate 58, in electrical contact with the respective circuit traces 50. The electrodes 42 can be formed or stamped from a suitable high-temperature material such as nickel, platinum or tungsten. The circuit traces 50 extend within the plug portion 54, each trace 50 being electrically connected to a plurality of finger traces 66 that extend on opposite sides of the plug portion 54, by means of a feed-through 68, the feed-through 68 being formed by a conventional plated-through hole, an eyelet or the like. Likewise, the ground electrodes 46 are each electrically connected to one or a pair of ground pads 70 that are formed on outside surfaces of the substrate 58, by a counterpart of the feed-through 68.

The module 38 is also formed to include a pair of outside layers 72 for sealingly connecting the head 24 to the cylinder assembly 12 when the parts are clamped together by the head bolts 40. Preferably the outside layers 72 are formed of an electrically insulating material for enhancing the electrical isolation of the traces 50_{A-D} from each of the cylinder assembly 12 and the head 24. A suitable material for the outside layers 72 is a fibrous ceramic, which is known and commercially available for use as a high-temperature sealant.

As further shown in FIG. 4, the feed-throughs 68 are typically filled with solder, the solder associated with the grounded electrodes 46 being formed as button members 74, the button members 74 extending initially outside of the outside layers 72 for contacting the cylinder assembly 12 and the head 24. When the module 38 is assembled in the engine 10, the button members 74 become flattened flush with the outside layers 72.

As further shown in FIGS. 1-3, the conductor traces 50 include a ground trace, designated 50_G, for electrically connecting the ground electrodes 46 to an external ground through a ground lead 76 of the wiring harness 52. The trace 50_G provides a convenient ground return from the module 38 during testing, either before or after the module 38 is installed in the engine 10. Another use for the trace 50_G is as a ground return to the distributor 22 (or other ignition circuit component) that is independent of a conventional chassis or engine ground, such as for avoiding certain ground current paths in a vehicle powered by the engine 10.

With further reference to FIG. 5, an alternative configuration of the module 38 has one or more ring traces 78 that form portions of the ground trace 50_G and at least some of the ground pads 70. The ring traces 78, which can be formed in the same manner as the traces

50, extend in close proximity to each of the cylinder openings 44, each of the traces 78 providing a suitable base for a continuous bead member 80, the bead member 80 functioning as a counterpart of the button members 74 (grounding the electrodes 46 to the engine 10 as described above), and also providing a durable and effective seal between the substrate 58 and the cylinder assembly 12 or the head 24. Preferably each of the openings 44 has a pair of the ring traces 78 and corresponding bead members 80 for sealing opposite sides of the substrate 58. In this configuration, the outside layers 72 provide sealing for conventional water and/or oil passages and the like, in addition to providing enhanced electrical isolation for the traces 50_{A-D}. Typically, the bead members 80 are approximately flush with the outside layers 72, preferably protruding slightly as shown in FIG. 5. In this preferred configuration, the bead members 80 are flattened slightly by the clamping between the cylinder assembly 12 and the head 24, promoting an effective seal of the substrate 58 against combustion pressures. A suitable material for the bead members 80 is believed to be solder or other alloy of lead or tin.

With further reference to FIG. 6, an alternative configuration of the module 38 of FIG. 6 has the ring traces 78 and the bead members 80 electrically isolated from the ground electrodes 46, for permitting the ground trace 50_G to be separately grounded from the cylinder assembly 12 and the head 24. For this purpose, the ring trace 78 passes between the ground pad 70 for each of the ground electrodes 46 and the associated cylinder opening 44, the ground trace 50_G connecting the ground pads 70.

As further shown in FIG. 6, the electrodes 42 are preferably formed integrally with the associated conductor traces 50 of the circuit layer 60_A. For this purpose, the first substrate layer 62 can temporarily extend within the openings 44 for supporting the electrodes 42 during formation thereof as indicated at 82 in FIG. 6. Once the electrodes 42 are formed, such as in a printed circuit process described above, the temporary extension 82 would be removed, such as by machining. A protective conductive coating 84 is applied to each of the electrodes 42 within the openings 44, such as by electro plating. Suitable materials for the conductive coating 84 include nickel and platinum, which are able to withstand the high temperatures of combustion within the engine 10. Preferably the outside layers 72 are applied subsequent to the conductive coating 84 for protectively covering the extremities of the coating 84 adjacent to the substrate 58.

The foil conductors of the present invention advantageously permit the circuit module 38 to be made very thin. For example, operational prototypes of the module 38 have been made and tested, the substrate 58 having a total thickness of approximately 0.06 inch. It is believed that significant reductions in thickness are also possible.

With further reference to FIG. 7, the head 24 can be configured without spark plug openings into the combustion chambers 26 as shown in FIG. 1, or with such openings as indicated at 86, the head having the openings 86 being designated 24' in FIG. 7. In the configuration of FIG. 1, the head 24 is advantageously simplified by the absence of the plug openings 86, facilitating low cost production thereof. More importantly, the absence of the openings 86 promotes improved heat transfer from the combustion chambers 26, and typically permits enlargement of the ports 28 and 36 as well as the valves

32 and 34 for increased volumetric efficiency of the engine 10. In the configuration of FIG. 7, conventional spark plugs (not shown) can be left installed in the head 24'. Preferably however, the plug openings 86 are seal-
 5 ingly closed by solid plug members 88, for avoiding spark plug fracture and/or potential hot spots within the combustion chambers 26.

With further reference to FIG. 8, the conventional spark plug openings 86 of the head 24' can be advantageously utilized for mounting an injector assembly 90
 10 that projects into the associated combustion chamber 26. As shown in FIG. 8, the injector assembly includes a main injector 92 for injecting fuel directly into the combustion chamber 26, the timing of the injection not being limited by the operation of the valves 32 and 34.
 15 The main injector 92 is not described in detail in that such devices are known to those skilled in the art. The present invention, however, provides the advantages of direct fuel injection to be available in conventionally configured spark-ignition engines upon replacement of the spark plugs by the circuit module 38, described
 20 above. Further, the injector assembly preferably includes an auxiliary injector 94 for injecting an auxiliary fluid into the combustion chamber 26. The auxiliary fluid can include water, which is known to provide cooler running and reduced likelihood of pre-ignition or detonation (knocking) in typical applications. The auxil-
 25 iary fluid can also include a nitrogen oxide, which is known to reduce exhaust pollution. Further, the injector assembly 90 can incorporate a strain sensor 96 for feeding a strain signal 98 to a control system 100, the control system 100 automatically adjusting operation of the distributor 22 and/or the fuel feed means 30, for
 30 example, in response to sensed pressure loadings within the combustion chamber 26. Typically, the control system 100 would be used for avoiding detonation and/or pre-ignition by fuel mixture enrichment, for example. Moreover, the injector assembly 98 can include an ultrasonic transducer 102 for operation by a suitable
 35 power oscillator 104, improved combustion efficiency and reduced exhaust pollution being effected by the projection of ultrasonic radiation into the combustion chamber 26.

Although the present invention has been described in considerable detail with reference to certain preferred versions thereof, other versions are possible. For example, at least some of the pairs of the electrode members 42 associated with one of the combustion chambers 26 can be connected in series. Also, separate conductor
 40 traces 50 can be connected to subsets of the hot electrodes 48 of one cylinder 16 for providing a staggered spark interval. Further, the at least some of the foil conductor traces 50 can be formed by stamping from a foil sheet. Therefore, the spirit and scope of the ap-
 45 pended claims should not necessarily be limited to the description of the preferred versions contained herein.

What is claimed is:

1. An internal combustion engine comprising:

- (a) cylinder means having at least one piston movable
 50 therein;
- (b) head means forming a combustion chamber in fluid communication with the piston, the head means being removably connected to the cylinder means;
- (c) gas flow control means whereby intake air is ad-
 55 mitted into the combustion chamber for compression by the piston and subsequently expelled from

the combustion chamber as exhaust gas by the piston;

- (d) fuel flow means for controllably admitting fuel into the combustion chamber, the fuel being mixed with the intake air;
- (e) pulse means for generating a high voltage inter-
 5 mittent electric signal, the signal being synchro-
 nized with movement of the piston; and
- (f) a planar circuit module clampingly located be-
 10 tween the cylinder means and the head means, the
 module comprising:
 - (i) an electrically insulative substrate;
 - (ii) a pair of electrode members;
 - (iii) circuit means providing a plurality of foil con-
 15 ductor members on the substrate for connecting
 the electrode members to the pulse means for
 producing spark ignition of the fuel within the
 combustion chamber;
 - (iv) first seal means for sealingly connecting the
 20 substrate to one of the cylinder means and the
 head means; and
 - (v) second seal means for sealingly connecting the
 substrate to the other of the cylinder means and
 the head means.

2. The engine of claim 1, further comprising a plural-
 25 ity of the pairs of electrode members of the circuit module.

3. The engine of claim 2, wherein each pair of the electrode members comprises a first electrode member and a second electrode member, the first and second electrode members being located in a plane.

4. The engine of claim 3, wherein the conductor members form at least one circuit layer of the circuit module, the circuit means further comprising an insulat-
 30 ing material for electrically isolating at least one of the first and second electrode members from the cylinder means and the head means.

5. The engine of claim 4, wherein the electrode members are formed integrally with the conductor members.

6. The engine of claim 5, wherein the insulative substrate is formed with an opening therein between the combustion chamber and the piston, the electrode mem-
 40 bers being supportively connected to the substrate and extending into the opening.

7. The engine of claim 6, further comprising a plated conductive coating on the electrodes, the conductive coating substantially covering the portions of the elec-
 45 trodes that extend into the opening.

8. The engine of claim 7, wherein the conductive coating comprises nickel.

9. The engine of claim 7, wherein the conductive coating comprises platinum.

10. The engine of claim 2, wherein the cylinder means includes a plurality of pistons in corresponding cyl-
 50 inders and the head means includes a corresponding plu-
 rality of combustion chambers, the circuit module in-
 cluding a plurality of the pairs of electrode members in
 association with each of the combustion chambers.

11. The engine of claim 10, wherein at least one elec-
 55 trode of each pair of the electrodes associated with any
 cylinder is electrically isolated from the electrodes of
 the other cylinders.

12. The engine of claim 2, wherein at least some of the electrode pairs associated with one of the combustion
 60 chambers are connected in parallel.

13. The engine of claim 1, wherein the insulative substrate is formed with an opening therein between the combustion chamber and the piston, the electrode mem-

bers being supportively connected to the substrate and extending into the opening.

14. The engine of claim 1, including means for electrically connecting one of the electrodes to at least one of the cylinder means and the head means by the clamped location of the circuit module therebetween.

15. The engine of claim 1, wherein the first seal means comprises an insulative coating.

16. The engine of claim 15, wherein the insulative coating comprises fibrous ceramic.

17. The engine of claim 15, wherein the first seal means further comprises a metallic ring member rigidly and sealingly connected to the substrate, the ring member being deformed by the clamping between the cylinder means and the head means.

18. The engine of claim 17, wherein the ring member comprises a trace portion and a bead portion, the trace portion being formed as a circuit layer portion of the circuit module, the trace portion providing a base for the bead portion.

19. The engine of claim 1, wherein the engine further comprises a plug opening into the combustion chamber from outside the head means of the type for receiving a spark plug, and a plug member sealingly closing the plug opening.

20. The engine of claim 19, wherein the plug member comprises main injector means for feeding the fuel into the combustion chamber.

21. The engine of claim 19, wherein the plug member comprises auxiliary injector means for feeding an auxiliary fluid into the combustion chamber.

22. The engine of claim 19, wherein the plug member comprises strain sensor means for providing a strain signal, the strain signal being indicative of fluid pressure within the combustion chamber.

23. A kit for replacing spark plugs in an internal combustion engine, the engine including a cylinder assembly having at least one piston movable therein, a head assembly removably connected to the cylinder assembly and forming a combustion chamber in fluid communication with the piston, a gas flow controller admitting intake air into the combustion chamber for compression by the piston and subsequently expelling the air from the combustion chamber as exhaust gas by the piston, a fuel flow controller for admitting fuel mixed with the intake air into the combustion chamber, and a pulser for generating a high voltage intermittent electric signal synchronized with movement of the piston, the kit comprising one plug member for sealingly replacing each spark plug of the engine, and a planar circuit module for clamping between the cylinder assembly and the head assembly, the module comprising:

(a) an electrically insulative substrate;

(b) a pair of electrode members;

(c) circuit means providing a plurality of foil conductor members on the substrate for connecting the electrode members to the pulser for producing spark ignition of the fuel within the combustion chamber;

(d) first seal means for sealingly connecting the substrate to one of the cylinder assembly and the head assembly; and

(e) second seal means for sealingly connecting the substrate to the other of the cylinder assembly and the head assembly.

24. The kit of claim 23, further comprising a plurality of the pairs of electrode members of the circuit module.

25. The kit of claim 24, wherein each pair of the electrode members comprises a first electrode member and a second electrode member, the first and second electrode members being located in a plane.

26. The kit of claim 25, wherein the conductor members form at least one circuit layer of the circuit module, the circuit means further comprising an insulating material for electrically isolating at least one of the first and second electrode members from the cylinder assembly and the head assembly.

27. The kit of claim 24, wherein the cylinder assembly includes a plurality of pistons and the head assembly includes a corresponding plurality of combustion chambers, the circuit module including a plurality of the pairs of electrode members in association with each of the combustion chambers.

28. The kit of claim 24, wherein at least some of the electrode pairs associated with one of the combustion chamber are connected in parallel.

29. The kit of claim 23, wherein the insulative substrate is formed with an opening therein between the combustion chamber and the piston, the electrode members being supportively connected to the substrate and extending into the opening.

30. The kit of claim 23, wherein the first seal means comprises an insulative coating and a metallic ring member rigidly and sealingly connected to the substrate, the ring member being deformed by the clamping between the cylinder means and the head means.

31. The kit of claim 30, wherein the ring member comprises a trace portion and a bead portion, the trace portion being formed as a circuit layer portion of the circuit module, the trace portion providing a base for the bead portion.

32. An internal combustion engine comprising:

(a) cylinder means having a plurality of pistons movable in corresponding cylinders thereof;

(b) head means forming a plurality of combustion chambers in fluid communication with the pistons, the head means being removably connected to the cylinder means;

(c) gas flow control means whereby intake air is admitted into the combustion chambers for compression by the pistons and subsequently expelled from the combustion chambers as exhaust gas by the pistons;

(d) fuel flow means for controllably admitting fuel into the combustion chambers, the fuel being mixed with the intake air;

(e) pulse means for generating a high voltage intermittent electric signal, the signal being synchronized with movement of the pistons; and

(f) a planar circuit module clampingly located between the cylinder means and the head means, the module comprising:

(i) an electrically insulative substrate formed with a plurality of openings therein between the combustion chambers and the pistons;

(ii) a plurality of pairs of electrode members in association with each of the combustion chambers, each pair of electrode members comprising a first electrode member and a second electrode member, the electrode members being in a plane and supportively connected to the substrate and extending into the opening;

(iii) circuit means on the substrate for connecting the electrode members to the pulse means for producing spark ignition of the fuel within the

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combustion chambers, the circuit means comprising a plurality of foil conductor members, the conductor members forming a circuit layer of the circuit module, the circuit means further comprising an insulating material for electrically isolating at least one of the first and second electrode members from the cylinder means and the head means, at least one electrode of each pair of the electrodes associated with any cylinder being electrically isolated from the electrodes of the other cylinders;

- (iv) first seal means for sealingly connecting the substrate to one of the cylinder means and the head means, the first seal means comprising an

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insulative coating and a metallic ring member rigidly and sealingly connected to the substrate, the ring member being deformed by the clamping between the cylinder means and the head means, the ring member comprising a trace portion and a bead portion, the trace portion being formed as a circuit layer portion of the circuit module, the trace portion providing a base for the bead portion; and

- (v) second seal means for sealingly connecting the substrate to the other of the cylinder means and the head means.

* * * * *

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Multipoint Spark Ignition for Lean Combustion

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Toyota Motor Corporation

International Fuels and Lubricants
Meeting and Exposition
Tulsa, Oklahoma
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Multipoint Spark Ignition for Lean Combustion

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Toyota Motor Corporation

ABSTRACT

Effects of multipoint spark ignition on combustion duration, fuel consumption and lean misfire limit are discussed in this paper.

A plate, which consists of 12 spark gaps in each cylinder, and a new CD ignition system have been developed for accomplishing the multipoint spark ignition. This plate was installed between cylinder block and head in a 4 cylinder engine.

Compared with a single gap, the results of 12 gaps showed a reduced combustion duration by about 50%, a 5% decrease in fuel consumption and an extended lean misfire limit by about 3 air-fuel ratio numbers. Furthermore, the multipoint spark ignition on both sides of the combustion chamber was more effective than only on one side. With this system, HC emission can be reduced as well.

The results of this study showed that, compared to those obtained with swirl, this multipoint spark ignition was more effective on improving fuel consumption.

IT IS WELL KNOWN THAT an S.I. engine operation with lean air-fuel mixture is an effective technique for improving fuel economy.

Since lean operation is restricted by lean misfire limit in a conventional engine, it is a difficult task to realize an engine operation with lean burn strategy under present emission standards. In order to extend the lean misfire limit, a lot of techniques for reducing the combustion duration, such as induction swirl, torch cell, dual spark plugs and stratified charge have been studied (1).

A multipoint spark ignition with several spark gaps in the combustion chamber is one of the most effective techniques for reducing the combustion duration and extending the lean misfire limit. W.G. Rado et al. (2) showed that the 3 gap multigap spark plug improves the fuel economy and extends the lean misfire limit. E.J. Durbin et al. (3) showed that 10 gap multiple electrode spark plug reduces the combustion duration and the cyclic variation in a single cylinder engine. These results indicate that the increasing flame kernel's size with multigap spark plug improves the reliability of ignition. H. Kuroda et al. (4) also showed that the fast burn with heavy EGR achieved by dual spark plugs reduces the cyclic variation, extends the lean misfire limit and improves the fuel economy. However, previous studies of multipoint spark ignition in multicylinder engines haven't been done extensively.

In this paper, a multipoint spark ignition system, which consists of 12 spark gaps and a new CD ignition system, has been developed and installed in a 4 cylinder engine. The effects of the multipoint spark ignition on the combustion duration, the fuel consumption and the lean misfire limit are investigated and discussed.

EXPERIMENTAL APPARATUS AND PROCEDURE

MULTIPOINT SPARK IGNITION SYSTEM - The first step in this study was to accomplish an experimental multipoint spark ignition engine. The multipoint spark ignition in a 4 cylinder engine is made possible by using an ignition plate,

*Numbers in parentheses designate references at end of paper

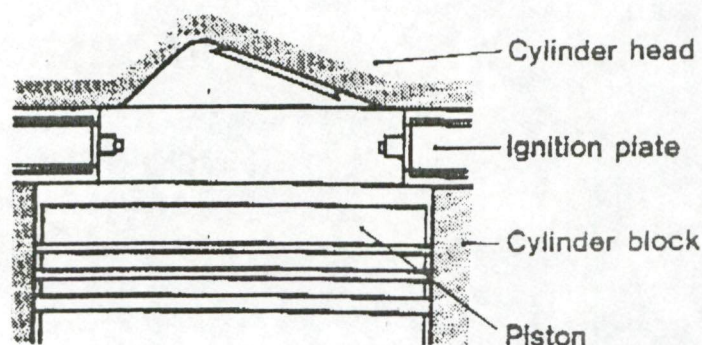
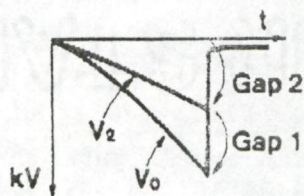
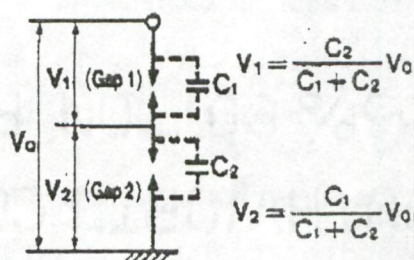


Fig. 1 - Cross section of multipoint spark ignition engine

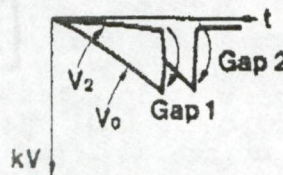
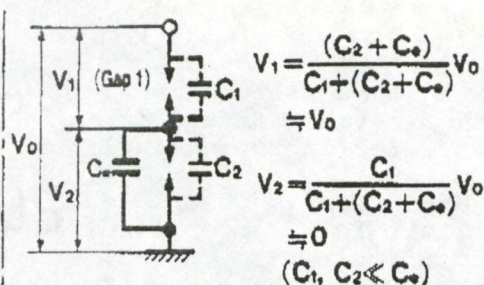
which consists of 12 series spark gaps in each cylinder, installed between cylinder block and head, as shown in Fig. 1. However, the breakdown voltage of series spark gaps proportionally increases according to spark gap increase in numbers. The increased breakdown voltage of series spark gaps was analyzed in order to decrease its voltage. In this paper, it is explained on an equivalent circuit of two spark gaps, which is the simplest series gaps, as shown in Fig. 2. Spark gaps are regarded as capacitances before electrical breakdown occurs.

Fig. 2-a shows a usual series spark gaps without the capacitance of intermediate electrode between Gap 1 and Gap 2. In this case, the whole voltage V_0 , applied to the series gaps, divides as follows:

$$V_1 = \frac{C_2}{C_1 + C_2} V_0, \quad V_2 = \frac{C_1}{C_1 + C_2} V_0$$



(a)



(b)

Fig. 2 - Equivalent electrical circuit of 2 series gaps

where C_1 : Capacitance corresponding to Gap 1
 C_2 : Capacitance corresponding to Gap 2
 V_1 : Voltage across Gap 1
 V_2 : Voltage across Gap 2
 V_0 : Whole voltage

Since capacitance C_1 is equal to C_2 if both gaps have the same length, the appearing voltage V_1 is equal to V_2 . When either V_1 or V_2 rises to the breakdown voltage, both gaps break down electrically at almost the same time. For this reason, these series gaps require twice the breakdown voltage of a single gap.

In comparison with Fig. 2-a, Fig. 2-b shows series gaps with a capacitance C_e of the intermediate electrode between Gap 1 and Gap 2. In this case, the whole voltage V_0 , applied to this series gaps, divides as follows:

$$V_1 = \frac{(C_2 + C_e)}{C_1 + (C_2 + C_e)} V_0, \quad V_2 = \frac{C_1}{C_1 + (C_2 + C_e)} V_0$$

If capacitance C_e is sufficiently larger than C_1 or C_2 , most of the whole voltage appears across Gap 1. Then, the appearing voltage V_2 nearly equals zero. When V_1 rises to the breakdown voltage, Gap 1 breaks down electrically. Then, V_2 is nearly equal to V_0 since the arc sustaining voltage is generally much smaller than the breakdown voltage. Gap 2 breaks down successively. For this reason, these series gaps require slightly more breakdown voltage than a single gap.

When the spark gaps increase in numbers, the breakdown voltage is also treated in the same way. Therefore, it becomes possible to restrict the breakdown voltage of series gaps using the

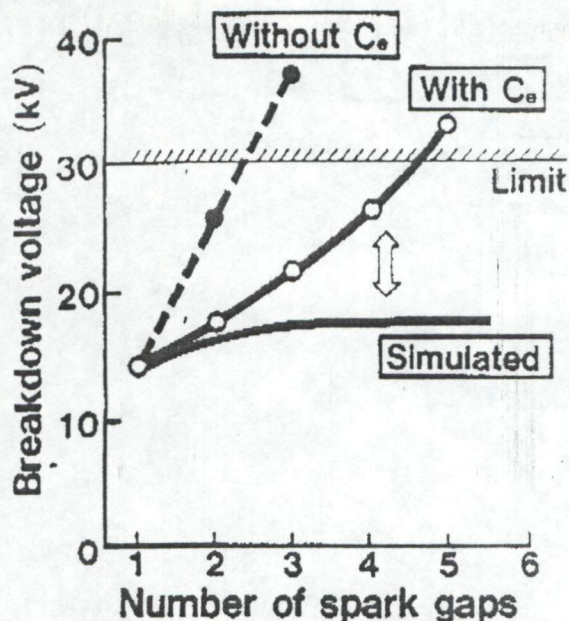


Fig. 3 - Effect of intermediate electrode capacitance

capacitance of intermediate electrode.

In spite of the above, the results in Fig. 3 show that the breakdown voltage of series gaps with capacitance using a production type ignition system departed significantly from the simulation based on an equivalent circuit with more than 3 spark gaps. Because these series gaps break down successively, the arc current of breakdown gaps is sustaining with charging of C_e until next gap breaks down. When the secondary voltage rises slowly using the production type ignition system, charging of C_e is completed before all spark gaps breakdown electrically. Then, the arc current is interrupted and some charging voltage remains in C_e . Therefore, it requires higher voltage than the first time when these

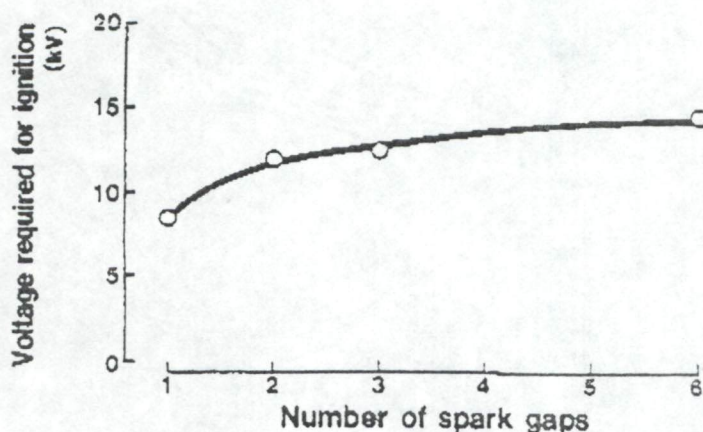


Fig. 4 - Breakdown voltage required for multipoint spark ignition using the ignition plate and the new CD ignition system

series spark gaps break down again. We concluded that these series spark gaps with capacitance required an ignition system generating a fast rise rate of the secondary voltage, such as CDI.

In order to minimize the loading of ignition system in this study, the value of C_e/C_1 was adjusted to about 10. Since the measurement of C_1 showed about 0.3pF, a multipoint spark ignition plate with 3pF capacitance had to be designed. Using this plate and a new CD ignition system, the breakdown voltage required for ignition is shown in Fig. 4. The breakdown voltage of the system could be kept as the simulation, under the withstand voltage limit, based on an equivalent circuit.

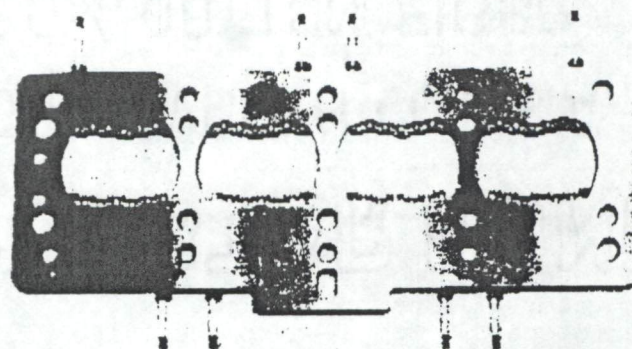


Fig. 5 - 12 point spark ignition plate designed for a 4 cylinder engine

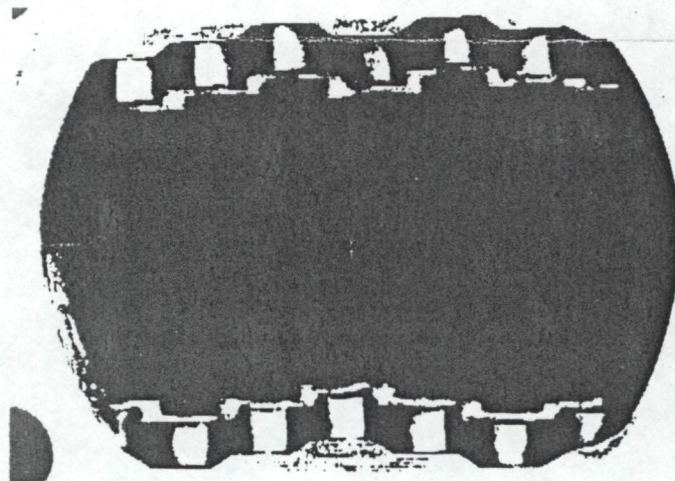


Fig. 6 - Close up picture of the electrode array in each cylinder at the arc sustaining condition

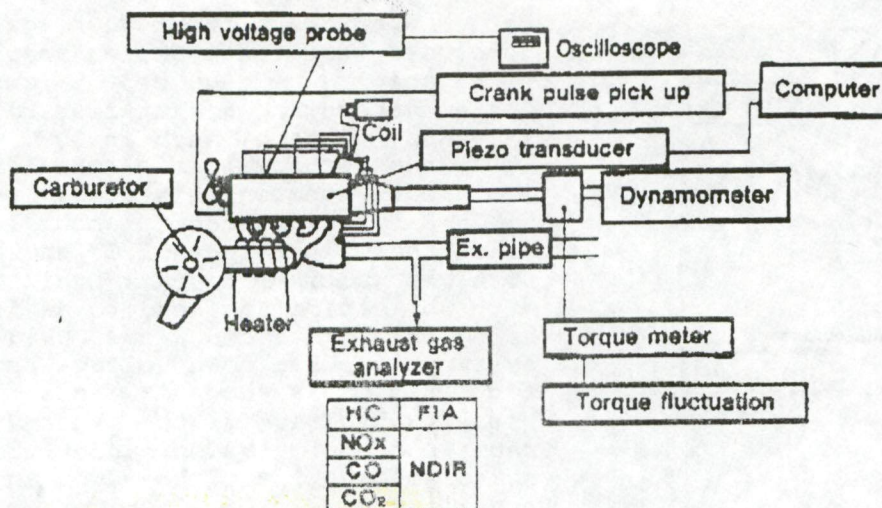


Fig.7 - Experimental apparatus

Fig.5 shows the 12 point spark ignition plate designed for a 4 cylinder engine. Fig.6 shows a close up picture of the electrode array in each cylinder at the arc sustaining condition. The intermediate electrode configuration shows a T shape. These electrodes are insulated electrically with ceramic tubes and form the capacitance.

Using this system, the breakdown time for all spark gaps is about 1.5 microseconds. Compared to about 100 microseconds corresponding to 1° crank angle at 1800rpm, the breakdowns are considered to occur almost simultaneously.

PROCEDURE - Using this 12 point spark ignition plate and the new CD ignition system, an experimental evaluation of the multipoint spark ignition was conducted on a 4 cylinder, 4 stroke engine having a displacement of 1.6 liter.

Table 1 - Engine Specifications

Engine Displacement	1587cc
Cylinder Arrangement	4-L
Bore x Stroke	81 x 77mm
Compression Ratio	9.0:1
Valve Timing	
Intake Open	7° BTDC
Intake Close	45° ABDC
Exhaust Open	41° BBDC
Exhaust Close	11° ATDC
Combustion chamber configuration	Wedge

Fig.7 shows an outline of experimental apparatus. Engine specifications are shown in Table 1. In order to eliminate the effect of ignition energy on fuel consumption, DC power supply was used to drive the ignition system. Engine operating condition was fixed at 1800rpm-30Nm and spark timing of 0.98MBT (2% torque down timing from the best torque).

In order to eliminate the variation of air-fuel ratio from cycle to cycle, the engine has a carburetor, equipped with an air bleed tube made from sintered metal, and a long inlet manifold in which the mixture is heated to forward the vaporization. (5)

Statistical measurements of pressure histories were carried out using a piezo-electric transducer in continuous 400 cycles.

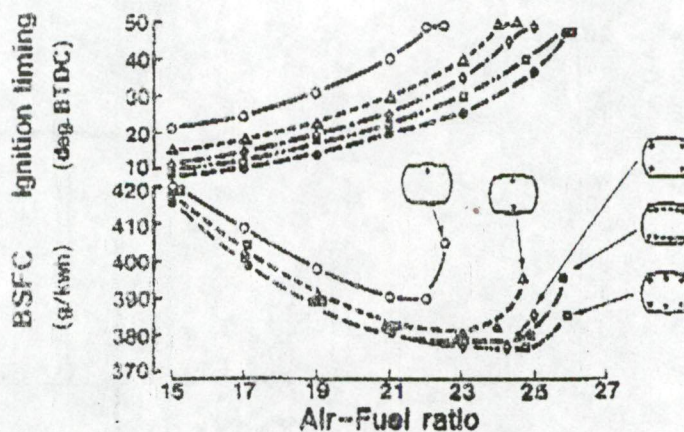


Fig.8 - Effects of spark gap numbers on MBT and fuel consumption

RESULTS AND DISCUSSION

EFFECTS OF SPARK GAP NUMBERS - The effects of spark gap numbers on MBT spark timing and fuel consumption are shown in Fig. 8. In this study, the lean misfire limit (L.M.L) is defined as air-fuel ratio at which the fuel consumption begins increasing. Compared to a single gap, the results of 12 gaps showed a retarded MBT spark timing and a 5% improvement in fuel consumption. It is a consequence of the reduced combustion duration with 12 gaps. Moreover, 12 gaps show that a lean misfire limit was extended by about 3 air-fuel ratio numbers.

However, the results of more than 4 gaps, show that the fuel consumption and the lean misfire limit were almost same in spite of a retarded MBT due to the reduced combustion duration.

Fig. 9 shows the torque fluctuation

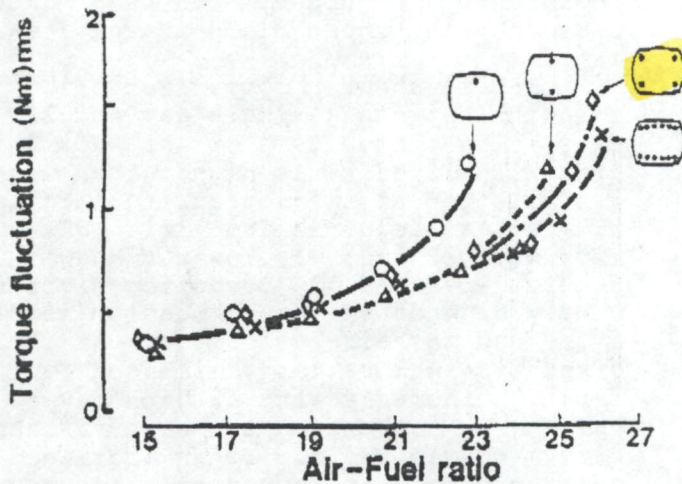


Fig. 9 - Effects of spark gap numbers on torque fluctuation

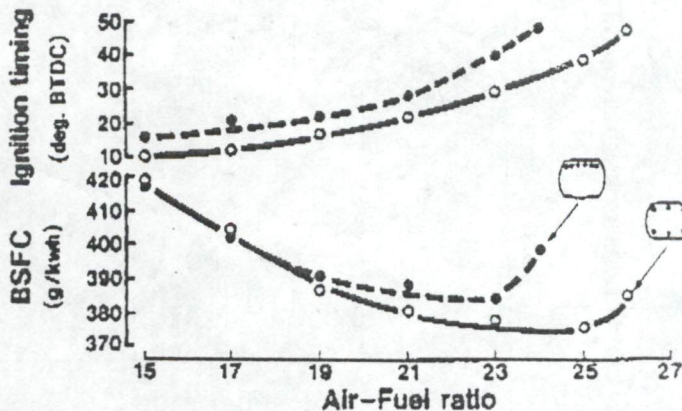


Fig. 10 - Comparison of spark gaps arrangement

in increasing spark gaps in numbers. There is no difference in stable combustion region near stoichiometric mixture ratio. However, in lean mixture, the torque fluctuation decreased as spark gaps increased in numbers. It is a consequence of the reduced combustion variation from cycle to cycle. (6)

On the other hand, Fig 10 shows a comparison of spark gaps arrangement with the same gap numbers. Even with the same numbers, spark gaps on both sides of combustion chamber reduced the combustion duration and improved the fuel consumption and the lean misfire limit more than on one side.

From these results, in respect of fuel consumption and lean misfire limit, we concluded that 4 spark gaps, 2 spark gaps on each side of combustion chamber, are sufficiently.

COMBUSTION COMPARISON OF MULTIPOINT SPARK IGNITION BETWEEN ONE AND TWO SIDES - Fig. 11 shows the heat release rate obtained from the pressure indicator analysis. In this figure, the vertical axis represents the heat release rate and the horizontal represents the heat release fraction:

Fig. 11 shows that spark gaps on one side of chamber had the same heat release rate as on both sides in early stage of combustion. However, spark gaps on one side showed that the rate decreased as the fraction increased, and had the same rate as a single gap in the latter half of combustion. These phenomena can be explained as follows.

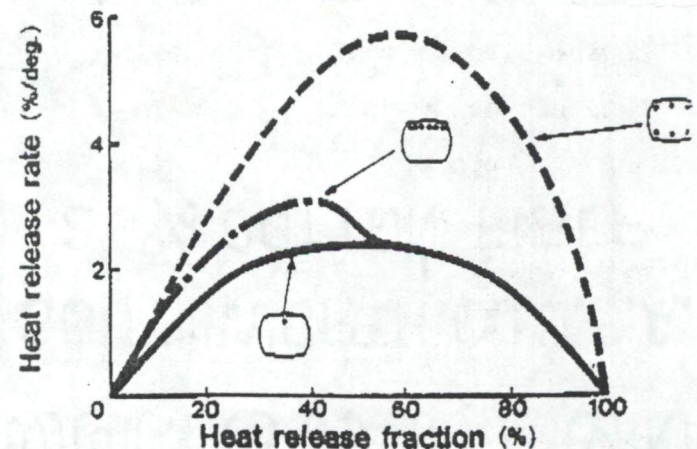


Fig. 11 - Comparison of heat release rate between one and two sides

In spark gaps on one side of chamber, as the flame propagates across the chamber, the flame front area decreases due to an interference between flames from adjacent spark gaps. All flames come together like a single gap in the latter half of combustion. In comparison to gaps on one side, gaps on both sides of chamber have a higher rate throughout the combustion period due to a confined flame interference. Moreover, an increase of the rate in the latter half of combustion is caused by compressed unburned mixture in the chamber center according to flame propagation from wall to center.

In respect of the burning rate, we concluded that spark gaps on both sides of combustion chamber are more effective than on one side.

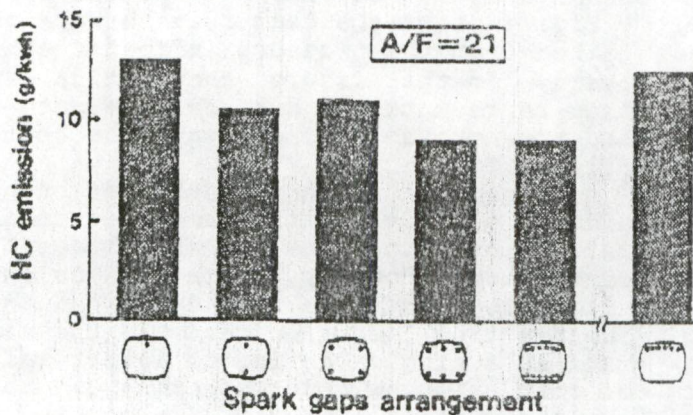


Fig. 12 - Comparison of HC emission with an air-fuel ratio of 21

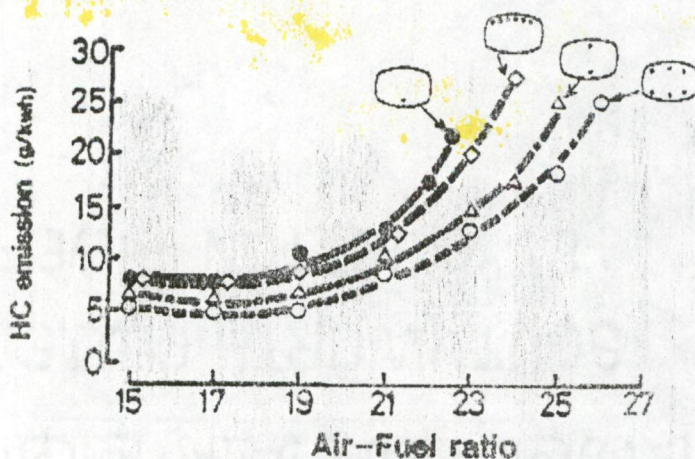


Fig. 13 - Comparison of HC emission as a function of air-fuel ratio

EMISSIONS - HC emission with an air-fuel ratio of 21 is shown in Fig. 12. These results show that spark gaps on both sides of chamber reduced HC emission by about 30% while gaps on one side didn't reduce according to spark gap increase in numbers.

Fig. 13 shows HC emissions as a function of air-fuel ratio. These results also show that HC emission with spark gaps on both sides was lower than on one side at any air-fuel ratio numbers.

These results can be explained as follows:

Since the flame is quenched with the opposite wall in case of one or several gaps on one side of chamber, HC emission may be formed in this quench area.

On the other hand, this HC emission decrease with gaps on both sides of chamber may be due to a reduced quench area caused by the flame propagation from wall to center, and due to a reduced incomplete flame propagation area, which occasionally occurs at such lean mixture, caused by the short flame travel distance.

Fig. 14 shows a comparison of NOx emission between a single gap and 12 gaps. These results show that NOx emission with 12 gaps was higher than with a single gap at a fixed air-fuel ratio. However, at lean misfire limit, NOx emission with 12 gaps was lower than with a single gap. The NOx formation significantly depends on the combustion temperature and the air-fuel ratio. At a fixed air-fuel ratio, the reason for this NOx increase with 12 gaps may be the higher combustion temperature than with a single gap due to an increased heat release rate caused by a reduced combustion duration with 12 gaps.

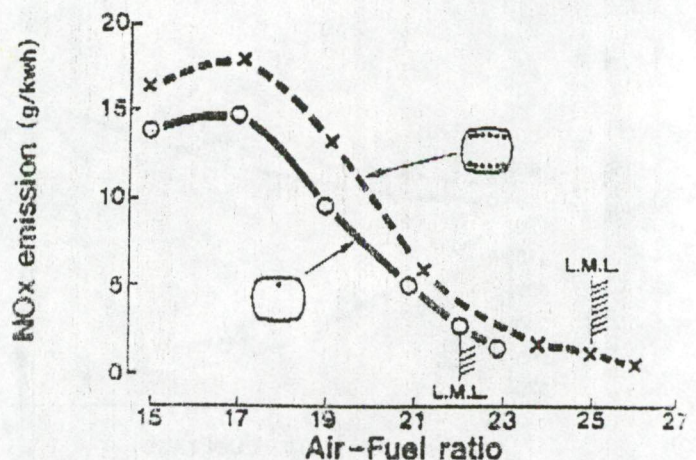


Fig. 14 - Comparison of NOx emission

However, at such leaner mixture, the NOx formation ordinarily decreases to lower level. Since 12 gaps extended the lean misfire limit by 3 air-fuel ratio numbers, NOx emission with 12 gaps is considered to be lower than with a single gap at lean misfire limit. Therefore, it is considered that a reduced combustion duration with 12 gaps doesn't increase NOx emission as much as an extended lean misfire limit with 12 gaps decreases it.

In respect of emissions, particularly HC emission, we concluded that spark gaps on both sides of combustion chamber are more desirable than on one side.

EFFECT OF COMBUSTION DURATION ON FUEL CONSUMPTION - Fig.15 shows an ignition delay and a combustion duration calculated from pressure indicator analysis. In this study, the ignition delay is defined as the crank angle duration from the ignition to the crank angle, corresponding to 10% of total heat released

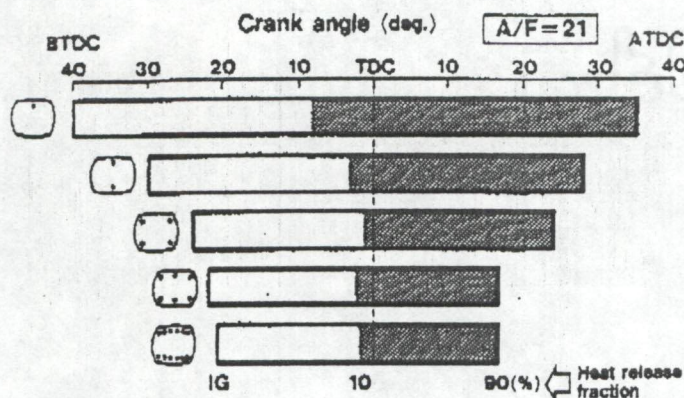


Fig.15 - Comparison of combustion duration and ignition delay

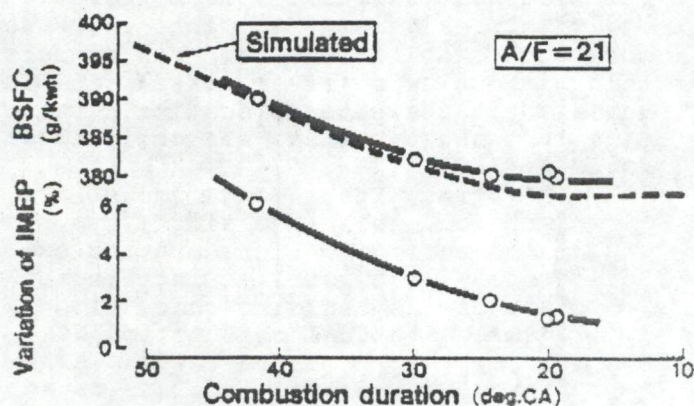


Fig.16 - Effect of combustion duration on fuel consumption and IMEP variation

and the combustion duration as the duration between the crank angle, corresponding to 10% and 90% of total heat released.

These results show that both, the ignition delay and the combustion duration, were reduced according to spark gap increase in numbers. These results agreed exactly with a retarded MBT, as shown in Fig.8. The results of 12 gaps showed a reduced ignition delay and combustion duration by about 50%. But these effects of spark gaps on reducing ignition delay and combustion duration become weaker according to spark gap increase in numbers.

Further discussions are carried out about an effect of combustion duration on fuel consumption, which is considered to be one of the most important factors affecting the fuel consumption, as shown in Fig.16. The results show that the fuel consumption decreased as the combustion duration was reduced. However, even if the combustion duration was reduced to less than 25° crank angle, the fuel consumption didn't decrease further. This result agreed exactly with the prediction simulated from engine friction, inlet air and exhaust gas conditions.

These results can be explained as follows: When the combustion duration is reduced to about 25 degrees, the combustion completes at an almost constant volume near TDC. If the combustion duration is reduced to less than 25 degrees, an improvement of thermal efficiency is considered to be small. This explains why the fuel consumption doesn't improve with more than 4 gaps as shown in Fig.8.

In respect of the improving fuel consumption we concluded that a reduced combustion duration with only 2 spark gaps on each side of combustion chamber is sufficiently effective.

On the other hand, the variation of indicated mean effective pressure (IMEP) from cycle to cycle improved as the combustion duration was reduced with increasing spark gaps. This result also agreed with the torque fluctuation as shown in Fig.9. This is due to the reduction of both, ignition delay and combustion duration, and the increase of ignition probability with a multipoint spark ignition. (6)

In respect of the improving combustion variation from cycle to cycle, we concluded that the multipoint spark ignition is more effective.

COMPARISON BETWEEN MULTIPOINT SPARK IGNITION AND INDUCTION SWIRL - Since 12 spark gaps didn't extend the lean misfire limit leaner than air-fuel ratio of 25,

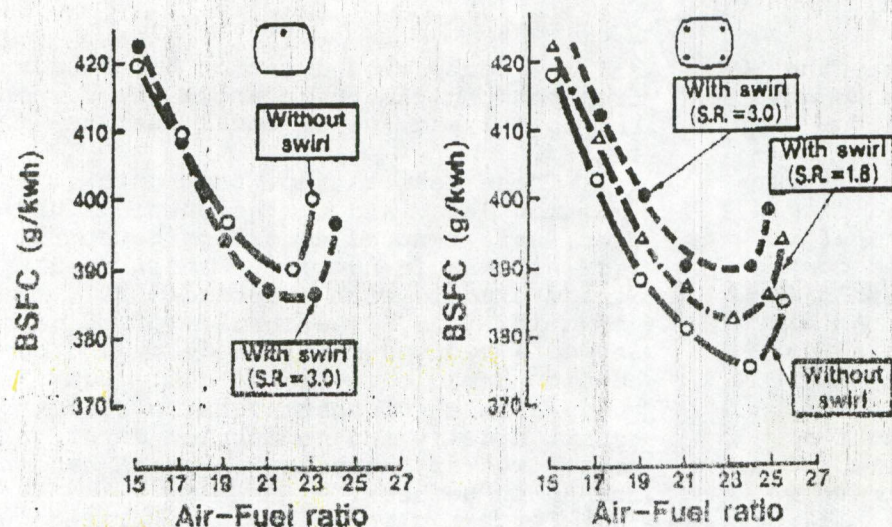


Fig. 17 - Comparison of fuel consumption between with and without swirl at single and 4 gaps

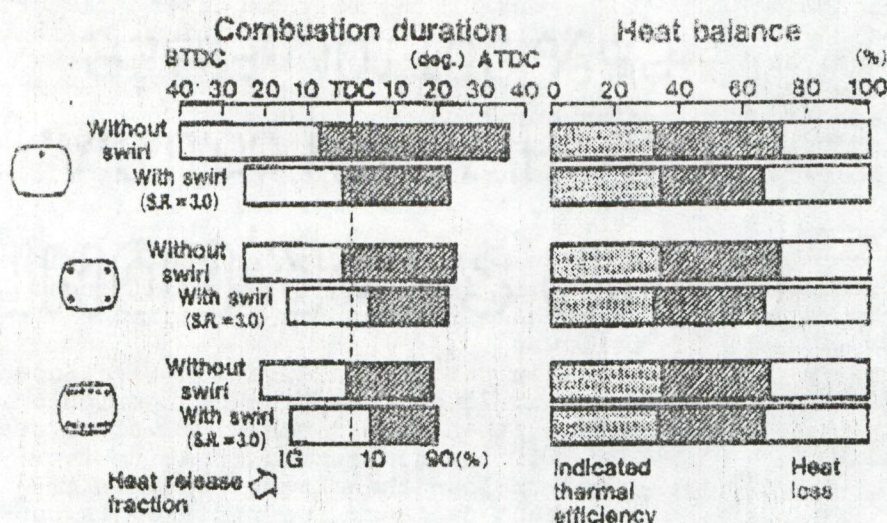


Fig. 18 - Comparison of combustion duration and heat balance between with and without swirl (at the air-fuel ratio of 21)

a combination of multipoint spark ignition and induction swirl was tested. Fig. 17 shows comparison of the multipoint spark ignition with and without swirl. (7) (8)

In the case of a single gap, the results with swirl showed a decreased fuel consumption by about 1.5% and an extended lean misfire limit by about 1 air-fuel ratio number. However, at near stoichiometric ratio, the fuel consumption increased slightly.

In the case of 4 spark gaps, the results with swirl showed almost the same lean misfire limit and a 4% increase in fuel consumption. These results also showed that the fuel consumption increased according to the swirl ratio (S.R.) increase.

Fig. 18 shows the combustion duration and the heat balance at the air-fuel ratio of 21. These results showed that both, combustion duration and ignition delay, were reduced with swirl.

Compared to a single gap without swirl, 12 gaps with swirl showed a 50% reduced ignition delay and a 55% reduced combustion duration.

In this heat balance, the heat loss is defined as the difference between the fuel lower calorific value and the total released heat calculated from pressure indicator analysis. Heat loss increased more with swirl at the same gap numbers than without swirl at increased gaps in numbers, at the same combustion duration.

From these results we concluded as follows:

- (1) An engine with a long combustion duration, such as a single gap, reduces the combustion duration extremely with swirl. Since the effect of the reducing combustion duration on fuel consumption is large, the indicated thermal efficiency is improved in spite of an increased heat loss, as shown in Fig. 18. Therefore, the fuel con-

sumption decreases.

- (2) An engine with a short combustion duration, such as 4 spark gaps, also reduces the combustion duration with swirl. However, since the effect of the reducing combustion duration on fuel consumption is slight, the indicated thermal efficiency becomes worse due to an increased heat loss, as shown in Fig.18. Therefore, the fuel consumption increases.

For this reason, the result of a single gap with swirl showed an increased fuel consumption due to an increased heat loss at near stoichiometric mixture with a short combustion duration. Therefore, 4 spark gaps without swirl were more effective on improving fuel consumption than a single gap with swirl, with the same combustion duration.

On the other hand, these results also showed that 12 spark gaps with swirl didn't extend the lean misfire limit leaner than the air-fuel ratio of 26 even if the combustion duration was reduced extremely. Since the multipoint spark ignition reduces the combustion duration on the whole, but has the same ignitability in each gap as a single gap, it considered to extend the lean misfire limit, defined as the air-fuel ratio at which the fuel consumption begins increasing caused by an increased combustion duration. Moreover, since the multipoint spark ignition retards MBT spark timing by reducing combustion duration, it is also considered to improve the ignition limit, defined as the failure of flame initiation, and the propagation limit, defined as the incomplete flame propagation, due to a higher temperature of the cylinder charge when the spark fires with piston near TDC. However, it is not enough to conclude that either, ignition limit or propagation limit is the air-fuel ratio of 26. It is necessary to study combustion limit further. (9)(10)

CONCLUSIONS

The multipoint spark ignition in a 4 cylinder engine have been developed and discussed the effects of it on the combustion duration, the fuel consumption and the lean misfire limit. These results lead to the following conclusions:

- (1) The multipoint spark ignition system has been developed, using a plate, which consists of 12 spark gaps with an intermediate electrode capacitance, and a new CD ignition system with a higher rising rate of secondary voltage.
- (2) The multipoint spark ignition re-

duces the combustion duration by 50%, decreases the fuel consumption by 5% and extends the lean misfire limit by 3 air-fuel ratio numbers. Moreover, it reduces the combustion variation from cycle to cycle.

- (3) In the multipoint spark ignition, arrangement of spark gaps on both sides of combustion chamber is important for improving fuel consumption and lean misfire limit.

Reducing the combustion duration to a degree as 4 spark gaps, 2 spark gaps on each side of combustion chamber, is sufficiently effective on improving fuel consumption.

- (4) The multipoint spark ignition on both sides of combustion chamber also reduces HC emission more than only on one side.

- (5) Even if the multipoint spark ignition combined with swirl reduces the combustion duration extremely, then:

- (a) The lean misfire limit is not extended leaner than the air-fuel ratio of 26.
- (b) The fuel consumption inversely increases due to an increased heat loss.

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10. G.H.Shiomoto, R.F.Sawyer and B.D. Kailly, "Characterization of the Lean Misfire Limit." SAE Paper 780235

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Center for Strategic & International Studies
Washington, DC

September 10, 1991

Dr. D Allan Bromley
Assistant to the President for
Science & Technology
Old Executive Office Building
17th & Pennsylvania Avenues, NW
Washington, DC 20515-0536

Excellent book

Dear Dr. Bromley:

I am pleased to send you a copy of Nuclear Power: The Promise of New Technologies, the latest paper in the CSIS Significant Issue Series. The foreword and preface frame the issues discussed in the body of the report and the authors' conclusions are presented in chapter 6.

In this report Charles K. Ebinger, John P. Banks, and Margaret S. Morgan have examined the role of second generation nuclear technology in the broader context of current U.S. and global energy, electricity, economic, technological, regulatory, and environmental trends. The authors conclude that the passive safety features of second generation nuclear technologies, in combination with their smaller plant sizes and simpler designs, can overcome many of the problems associated with nuclear power development in the past. They believe that second generation technologies have tremendous potential to provide safe, environmentally sound, and economically competitive electricity supplies to the United States and the international community.

We at the Center for Strategic and International Studies believe the possibilities examined in the enclosed report deserve thoughtful consideration and wide discussion in view of the critical energy choices facing the country.

If you have any questions or comments, please call Dr. Ernest Graves at (202) 775-3220.

Sincerely,

A handwritten signature in blue ink, appearing to read "R. Murphy".

Enclosure

Richard W. Murphy
Director of Government Relations

THE WHITE HOUSE
WASHINGTON

December 2, 1991

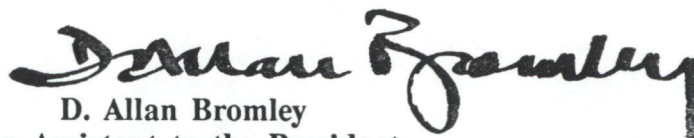
Dear Mr. Murphy:

Many thanks for sending me a copy of your book **Nuclear Power: The Promise of New Technologies**. I found this to be extremely interesting and helpful because I believe that the nuclear power option offers the only hope of providing the large blocks of electrical energy that our society will need in the future. I am very much interested in the development of advanced new technologies in the area that can provide greater assurance to our public of the desirable aspects of nuclear energy and allay some of the all too understandable fears that have developed among the public as result of media coverage of the issues involved.

Let me congratulate you and all involved on this very significant contribution to the current discussions and to public understanding of the issues involved. If and when you produce additional reports in this area I should very much appreciate receiving copies.

With all best wishes,

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. Richard W. Murphy
Director of Government Relations
Center for Strategic & International Studies
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Washington, D.C. 20006