

Ronald Reagan Presidential Library
Digital Library Collections

This is a PDF of a folder from our textual collections.

WHORM Subject File Code: CM010
Case file Number(s): 595095 (4)

To see more digitized collections visit:

<https://reaganlibrary.gov/archives/digital-library>

To see all Ronald Reagan Presidential Library inventories visit:

<https://reaganlibrary.gov/document-collection>

Contact a reference archivist at: reagan.library@nara.gov

Citation Guidelines: <https://reaganlibrary.gov/citing>

National Archives Catalogue: <https://catalog.archives.gov/>

doesn't necessarily mean one understands the discipline and terminology of music. In his audition before a somber jury to be accepted as a music major, he played one of his own rock and roll songs. The jury, he said, was startled. No one had ever done rock and roll before and they weren't quite sure how to score his.

Please see MUSIC A-16 Col. 5



Musician Larry Wagner, no degree, no regrets

Tribune photo by Joe Holly

Light put on defense scandal

Companies must disclose roles, SEC says

WASHINGTON (Reuters) — The Securities and Exchange Commission reminded defense contractors yesterday they must report any information about the defense procurement fraud scandal that could affect them.

The statement raised the prospect that substantive information on the probe will come to light more quickly through filings with the SEC than through federal prosecutors.

The commission said in a statement it recognized the exact subjects and scope of the government's inquiry were largely unknown.

But given the potential adverse effects, companies engaged in the defense business should review on an ongoing basis the need for appropriate disclosure, particularly in connection with their forthcoming reports of

registration statements to be filed with the commission, the SEC said.

Most of the court papers in the investigation, including search warrants and supporting affidavits, remain under seal. The chief federal prosecutor, U.S. Attorney Henry Hudson, of Alexandria, Va., has argued that premature disclosure could jeopardize an ongoing investigation.

The government has issued at least 275 subpoenas and carried out at least 42 searches in its probe of possible fraud and bribery in the \$150 billion a year Pentagon procurement market.

The investigation became public on June 14 when coordinated searches were carried out in the offices of a dozen leading defense firms, their consultants and Pentagon employees.

Without the wide file defense category would have risen by still healthy 2.1 percent. The category of non-durable goods rose 18.2 percent, reflecting in part civilian aircraft orders based Boeing Co. in a string of giant official aircraft in recent years, rose 9.4 percent. This represented a revision from a week ago to a 2.1 percent increase in durables.

Orders for non-durable goods rose 12 percent to \$104.0 billion, with over half coming in the durable goods category.

Shipments of major goods rose 1.5 percent in July, with over half coming in the durable goods category.

Unfilled orders in the durable goods category rose 2.2 percent to \$428.1 billion, a 1.1 percent increase since March 1984.

Stocks up marginally; bond market credited

From Tribune Wire Services

NEW YORK — Wall Street stocks closed slightly higher today, but much of the gain was in blue-chip issues.

The Dow Jones industrial average ended 0.71 of a point higher at 2,131.23, with advancing stocks about even with declines on light NYSE volume of 166 million shares.

Traders said the market was kept generally higher by a strong gain in Treasury bond prices, which rose sharply due to a steep decline in commodities prices as severe heat again raised drought worries in the Midwest.

"The follow-through from Thursday and Friday has been lackluster at best," said Ralph Bloch, chief market analyst with Raymond, James & Associates in St. Petersburg, Fla. "This remains a dangerous market."

On the trading floor, Tenneco was the most active issue, unchanged. American Electric Power followed, down slightly. Duke Power was third, also lower.

Texaco was ahead. The company announced it will seek potential buyers for its Canadian subsidiary.

Pillsbury was up sharply amid reports that real estate developer Donald Trump planned to increase his stake in the company.

Among the other active issues, Gillette, American Express and Armtex were down. IBM was lower.

Amdahl led the Amex actives, down more than a point. Bolar Pharmaceutical followed, off more than 2 points. Dome Petroleum was third, unchanged.

DOW JONES AVERAGES

August 2, 1988	Open	High	Low	Close	Change	Pct.	Sales
30 Industrials	2135.49	2161.45	2112.20	2131.23	+0.71	0.03	20,607,500
20 Transportation	893.07	908.54	884.41	891.51	+0.30	0.03	4,781,200
15 Utilities	182.07	184.63	181.16	182.37	+0.04	0.03	9,846,600
45 Stocks	707.46	703.70	705.36	705.36	+0.11	0.02	34,535,300
20 Bonds				88.72	+0.22		
10 Public Utilities				17.82	+0.24		
20 Industrials				88.40	+0.20		

167.3 mil. issues traded; 144 advanced, 716 declines, 707 unchanged, 521 new

1987 San Diego County taxable (Sales in thousands of dollars)

Area	Total Taxable Sales	Total Retail Sales	Percent Retail Sales	Change in %
Carlsbad	607,566	541,052	7.5%	
Chula Vista	913,444	898,208	14.6%	
Coronado	80,621	50,251	6.2%	
Del Mar	43,888	30,150	3.2%	
El Cajon	102,055	85,888	4.0%	
Encinitas	515,513	276,703	15.4%	13.1
Escondido	1,272,204	1,034,021	16.3%	13.4
Fallbrook	114,298	82,653	21.2%	19.2
Imperial Beach	42,192	37,928	5.0%	6.2
Lakeside	94,158	66,730	16.5%	14.6
La Mesa	196,896	137,212	6.6%	3.8
Lemon Grove	153,105	123,318	11.1%	9.3
National City	838,485	751,317	4.7%	3.0
Oceanside	509,510	435,281	18.3%	14.4
Romney	196,788	180,297	2.8%	0.9
Rancho Santa Fe	89,391	75,958	13.2%	11.4
San Diego City	2,200,818	5,736,080	8.6%	8.9
San Marcos	300,082	226,208	20.8%	18.9
Santee	292,750	197,917	10.7%	8.9
Solana Beach	34,847	29,897	15.0%	17.4
Spring Valley	149,552	130,318	7.7%	5.9
Vista	238,359	188,171	14.9%	13.0
Unincorporated Areas	337,671	231,078	14.3%	12.5
TOTAL COUNTY	11,892,159	12,731,660	8.4%	7.6%

Unincorporated Areas: Adjusted for inflation with the "Commodities Less Food" component of the San Diego County Index. Includes unallocated areas. Source: California State Board of Equalization.

Exh. 6.1
N

LUCE, FORWARD, HAMILTON & SCRIPPS

A LAW PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS

FOUNDED 1873

1700 THE BANK OF CALIFORNIA PLAZA

110 WEST A STREET

SAN DIEGO, CALIFORNIA 92101

(619) 236-1414

LA JOLLA GOLDEN TRIANGLE

REGENTS SQUARE II

4250 EXECUTIVE SQUARE, SUITE 700

LA JOLLA, CALIFORNIA 92037

(619) 455-0611

TELECOPIER:
(619) 232-8311

GREGORY D. ROPER
PARTNER

DIRECT DIAL NUMBER
(619) 699-2453

July 29, 1988

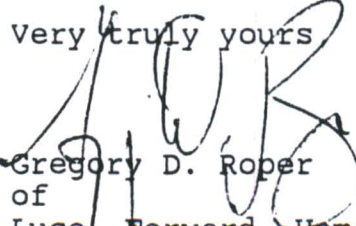
Albert O. O'Rourke, Esq.
7949 Lowery Terrace
La Jolla, CA 92037

Re: O'Rourke v. Maxwell Laboratories, Inc., et al.
San Diego Superior Court Case No. 598861

Dear Mr. O'Rourke:

Please be advised that we will represent Mr. Sacerdote in connection with the above-referenced litigation. Should you need to discuss Mr. Sacerdote's involvement in this litigation, please feel free to contact me.

I understand that Mr. Sacerdote has not been served at this time. Any attempt at substituted service at Maxwell Laboratories on Mr. Sacerdote would not, of course, comply with the California Code of Civil Procedure. CCP §415.20 provides for substituted service at home or office, both of which are in New York for Mr. Sacerdote. If you believe you have served Mr. Sacerdote in some way that complies with the Code, please advise me immediately and provide me with a copy of appropriate proof of service. In the absence of contact from you, I will assume your understanding is the same as mine that no service has taken place.

Very truly yours

Gregory D. Roper
of
Luce, Forward, Hamilton & Scripps

GDR:kfb

Exhibit
"O"
/

12-5-84

Dr. Alan Kolb, Rorack
8888 Malboa Ave.
San Diego, Cal. 92123

Dear Alan:

Demand is herein made for two sums of money:

1. \$143,000.00 for Rorack in regard to 6,750 shares of Maxwell stock entitled to Shareholders' Dissenter Rights of \$21.25, which shares you chose not to submit to Maxwell for compensation to Rorack.
2. \$5,000.00 paid to Parker, Milliken, Clark, O'Hara & Samuelian, which was not approved by your partner, Dr. Raymond C. O'Rourke.

You will please inform me at your earliest opportunity about how you intend to pay the amounts above. Should I not hear from you, Ray and I will seek legal recourse under the terms of the Rorack Partnership. I assume Karl will explain to you that your forcing Ray to accept only 1/2 of the shares of Rorack for consideration of Shareholders' Dissenter Rights is an invalid agreement due to coercion. Furthermore, Maxwell Laboratories cannot enforce this agreement, since such was made by the partners of Rorack and there is no privity of contract between Rorack and Maxwell in this regard.

We are holding the original 13,500 shares of Rorack plus an additional 6,000 shares purchased to cover the dilution of Maxwell shareholdings caused by the S-Cubed merger, i.e., around 30 to 40%. This has caused Rorack and Dr. Raymond O'Rourke the additional expense of around \$85,000.00 to date. You will please let me know how you want you and Ray to cover this amount.

Sincerely,

A. O'Rourke

AO:j

Exhibit
P.

STERES, ALPERT & CARNE
3200-4th Ave.
San Diego, CA 92101

RORACK

Statement of Assets and Liabilities
March 1, 1980

Compilation

At Market
Value
(Estimated)

ASSETS

Cash in Bank

39.00

Receivable
Computrad

16,770.13

Investment
MLI stock - 13,500 @ 5.50

74,250.00

Total Assets

91,059.13

LIABILITIES

Note Payable - F. Clark

5,000.00 ?

Partners' Capital Accounts

86,059.13

Exhibit p2

STERES, ALPERT & CARNE
 3200-4th Ave.
 San Diego, CA 92101

RORACK

Partners' Accounts - Transactions
 for the period May 13, 1977 - March 1, 1980

Compilation

	<u>A. Kolb</u>	<u>R. O'Rourke</u>	<u>Total</u>
<u>Balances - May 13, 1977</u>	41,365.24	34,637.43	76,002.67
Gain on sale of Optical Radiation			3,872.82
Accounting Expense			(320.00)
Net gain for period	1,776.41	1,776.41	3,552.82
Money contributed	320.00		320.00
Collection of McMasters by O'Rourke		(3,663.54)	(3,663.54)
Sale of Optical Radiation by Kolb	(9,152.82)		(9,152.82)
<u>Balances - 3/1/80</u>	<u>34,308.83</u>	<u>32,750.30</u>	<u>67,059.13</u>
Less IMS stock (worthless)	625.00	625.00	(1,250.00)
Add appreciation - MLI stock	<u>10,125.00</u>	<u>10,125.00</u>	<u>20,250.00</u>
Adjusted Balances - 3/1/80	<u>43,808.83</u>	<u>42,250.30</u>	<u>86,059.13</u>

where did my \$50,000 go?



MAXWELL LABORATORIES, INC. 8835 Balboa Avenue • San Diego, California 92123 • Phone 619/279-5100 TWX 910-335-2063

July 8, 1983

Q,

Mr. Karl M. Samuelian
Parker, Milliken, Clark & O'Hara
Two Century Plaza, Suite 2600
2049 Century Park East
Los Angeles, California 90067

Dear Karl:

Enclosed is my check #3171 in the amount of \$5,000.00 in payment of the Rorack note which you transmitted to me in your letter of July 5, 1983.

Sincerely,

Alan C. Kolb

ACK:mj

Enclosure (check)



*Gina Get
1.0. 807
850 29
5.8.
92134*

DR. ALAN C. KOLB		3171
8835 BALBOA AVENUE 279-5100 SAN DIEGO, CALIF. 92123		July 8, 1983 16-351/1220
PAY TO THE ORDER OF	PARKER, MILLIKEN, CLARK & O'HARA	\$ 5,000.00
FIVE THOUSAND AND NO/100-----		DOLLARS
SAN DIEGO CORPORATE OFFICE LLOYDS BANK CALIFORNIA 201 A STREET, SAN DIEGO, CALIFORNIA 92101 RORACK Note		<i>Alan C. Kolb</i>
MEMO		
⑆ 1 220035 16 0975 00509 ⑆ 17 1 ⑆		

271-8561

P2

\$ 5,000.00 San Diego, California April 1, 1982
 On demand ~~XXXX~~, for value received, I (or we, jointly or severally) promise to pay to the
 order of PARKER, MILLIKEN, CLARK & O'HARA
 at 333 South Hope Street, 27th Floor, Los Angeles, California,
 the sum of FIVE THOUSAND and no/100----- Dollars
 in lawful money of the United States of America, with interest from April 1, 1982

at the rate of four per cent per annum until paid, payable ~~xx~~ annually ~~xxxx~~
 thereafter, in like Lawful Money, and if not paid as it becomes due, to be added to the principal and become a part there-
 of and to bear interest at the same rate.

In the event of suit to enforce payment of this note, a reasonable sum additional shall be allowed as attorney's fees
 in such suit and be made part of the judgment.

Address:

Alan C. Kolb

Alan C. Kolb

Exhibit "R"

IN THE DISTRICT COURT OF APPEAL OF THE STATE OF CALIFORNIA
FOURTH APPELLATE DISTRICT
DIVISION ONE

ALBERT O. O'ROURKE,)	
)	
Plaintiff and Appellant,)	From San Diego County
)	
vs.)	Hon. Jack R. Levitt,
)	Judge
MARC D. ADELMAN, et al.,)	
)	CA No. D 007214
Defendants and Respondents.)	SC No. 586691

Reporter's Transcript on Appeal

Wednesday, September 30, 1987

Vol II

APPEARANCES:

For the Plaintiff and Appellant:

ALBERT O. O'ROURKE
In propria persona

For Defendant Adelman and American Heart Association:

MARC D. ADELMAN
Attorney at Law
2718 Fifth Avenue
San Diego, CA 92103

Also appearing:

KARL ZOBELL
GRAY, CARY, AMES & FRYE
1200 Prospect St., Suite 575
La Jolla, CA 92037

Jean Yarnell Sulzner, CSR #2773
Official Reporter
Superior Court

Mr. Marc
Adelman

Exhibit
R 24

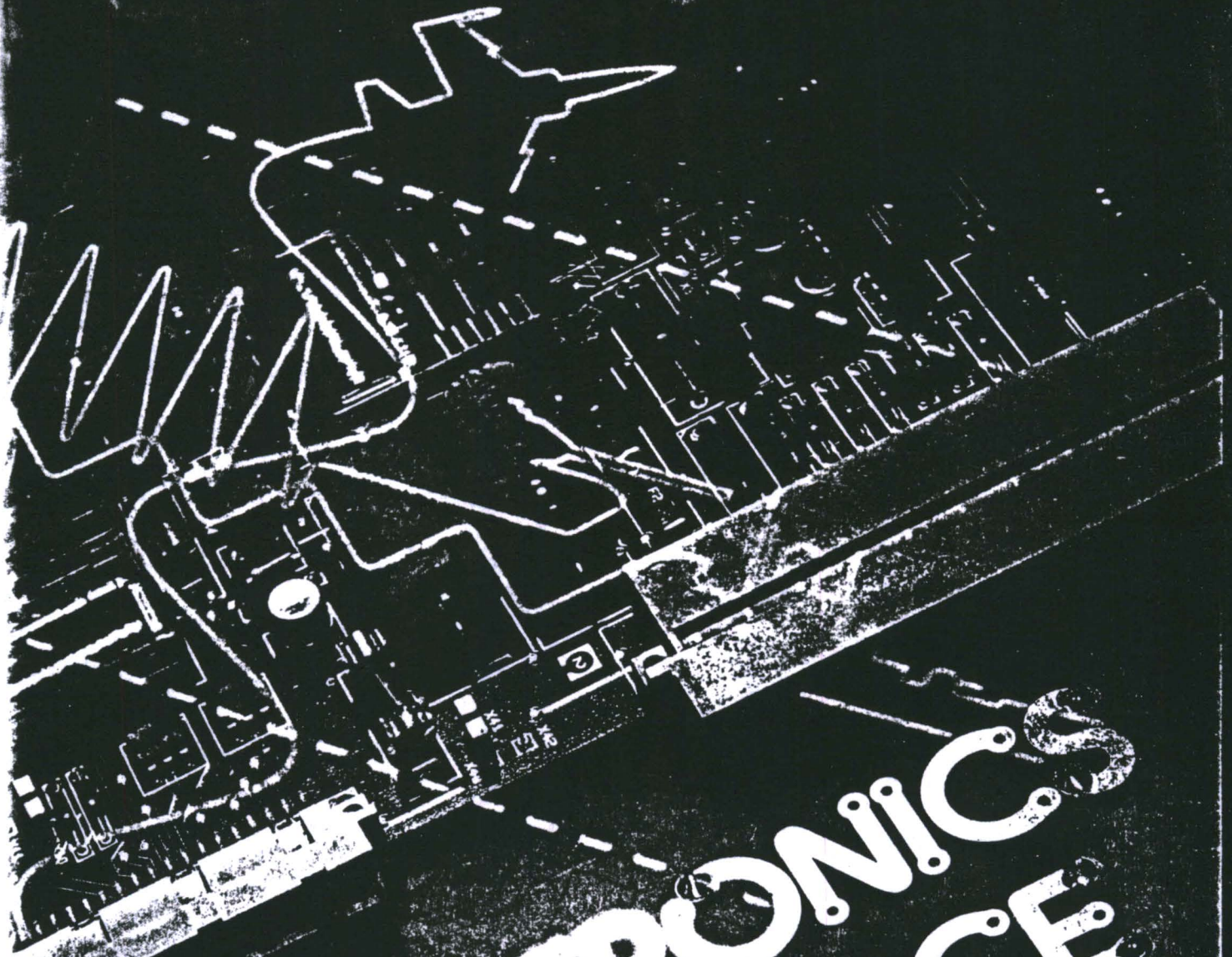
AT EVERY STAGE HE HAS WANTED TO CONTINUE THE
MATTER. HE CLAIMED THERE WERE DOZENS, IF NOT HUNDREDS
OF WITNESSES THAT NEEDED TO BE DEPOSED OR MOTIONS TO BE
MADE, AND HE OPPOSED THE PREVIOUS MOTION BASED ON THAT.
HE TOOK NO DISCOVERY. THE ONLY DISCOVERY HE ATTEMPTED
TO TAKE WAS FIVE MONTHS AFTER THE TRIAL HAD BEEN TAKEN
OFF CALENDAR, AND HE DID IT BEHIND EVERYBODY'S BACK.
HE NEVER SENT A PROOF OF SERVICE OUT, AND IT HAD TO DO
WITH SOME STOCKS. IT HAD ABSOLUTELY NOTHING TO DO WITH
THE CASE. HE ALLEGED THAT GRAY, CARY AND SECURITY PACIFIC
SHOULD HAVE PURCHASED SOME STOCKS WHICH WOULD HAVE MADE
HE AND HIS FATHER CONTROL THIS COMPANY, BUT THAT'S BEEN
(MAXWELL)
HIS ALLEGATION ALL ALONG. HE OPPOSED EVERYTHING WE'VE
DONE. THE COURT HAD TO ORDER HIS INTERROGATORIES AND ORDER
HIS DEPOSITIONS TO BE TAKEN AND ORDER HIM ON ONE OCCASION
NOT TO THREATEN OR COMMUNICATE WITH THE WITNESSES, AND
HE DID IT AGAIN, AND IN HIS PAPERS HE SAYS IT'S OKAY,
THAT HE CAN DO THAT. YOUR HONOR, THE PROBLEM IS THAT
EVERYTHING HE DOES IS UNDER PENALTY OF PERJURY. NOW I
ACKNOWLEDGE WE MADE A MISTAKE ON THE A.M. AND P.M. ON
IT, AND I'M EMBARRASSED, AND I APOLOGIZE, BUT HIS DECLARATION
IS UNDER PENALTY OF PERJURY LIKE THE ONE THAT YOU HAD
BEEN CHALLENGED, YOUR HONOR. WELL, THE COURT KNOWS THAT
ISN'T TRUE, AND HE QUALIFIES THE DEPOSITION FOR
MR. GABSCH'S LAWYER WHO SAYS THE ONLY REASON \$779 WAS
EXPENDED WAS BECAUSE MR. O'ROURKE THREATENED THE EXPERT
WITNESS. MR. O'ROURKE SAYS THAT'S NOT REALLY THE REASON,
AND HE DECLARES IT UNDER PENALTY OF PERJURY, NO BASIS

Exhibit '55'

ISSN 0722-3226

MILITARY TECHNOLOGY

- \$6.00 • £ 3.00
- DM 9.50
- HFL 12.00
- SFR 9.50
- OS 75.00 • FF 35.00
- FB 225.00
- LIRA 6.850.00
- PSTE 600.00

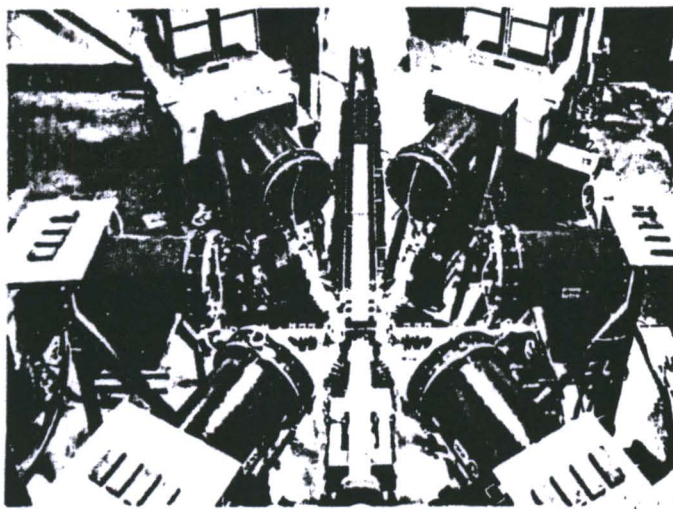


ELECTRONICS IN DEFENCE

Exhibit '55'

Exhibit 55

MLI



The CHECMATE electromagnetic launcher is able to propel projectiles to record speeds and is one of the important concepts being pursued in the SDI programme.

be an extremely simple matter to use a current coil to hurtle heavy projectiles from the Southern tip of Florida to Havana, a distance of 230 km.³ Tests were never conducted to prove the claim.

Kristian Birkeland, a professor of physics at the University of Oslo from 1898 to 1917, received three patents between 1901 and 1903 for his "electro-magnetic gun".⁴

In 1901, Birkeland built the first such electro-magnetic coil gun and used it to accelerate a 500g projectile to 50m/s.² With a second, larger gun, built in 1903 and now on display at the Norwegian Technical Museum in Oslo, he accelerated 10kg masses to about 100m/s. The gun has a calibre of 65mm and is 10m

Wolfram Witt
Markus Löffler

There is Maxwell but why do they not mention it? These are friends of Kolb?

The Electro-magnetic Gun — Closer to Weapon-System Status

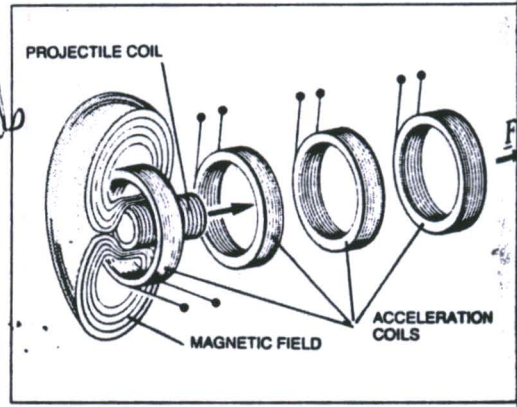


Fig. 1: The functioning principle of an electromagnetic coil gun.

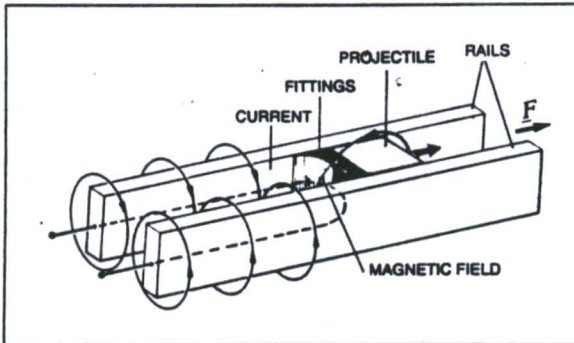


Fig. 2: The functioning principle of the rail gun.

The US' SDI programme has focussed public attention on electro-magnetically powered guns — e.g. the rail gun — and the impression has arisen, as a result, that such electro-magnetic guns are suited for space-based missile-defence systems only. In actual fact, however, the electro-magnetic gun also has a promising future as a tactical weapon system, as the following article explains.

Since the early 1980s, the electro-magnetic gun has become a more and more important part of planned future weapon-system improvements. Threat analyses point to a need for new weapon systems with increased range and improved effectiveness, and by their next generation, conventionally powered guns will probably have reached their performance limits. Muzzle energies can be further increased through the optimisation of performance parameters, but the muzzle velocities of existing high-performance weapons are already close to physical and technical limits.

The physical laws governing electro-magnetic projectile propulsion permit projectile velocities greater than those of conventionally powered projectiles — this is the substantial advantage of the electro-magnetic gun. Increased muzzle energies can also be expected. An electro-magnetic-gun weapon system would also be more survivable than a conventional gun system, and, in a crisis, independence from raw materials for propellants could be of crucial importance. Electrical power for an electro-magnetic gun can be generated from any primary energy source.

Electro-magnetic projectile propulsion was proposed as early as the nineteenth century, but the lack of a suitable means for storing electrical energy hindered its realisation. Recent developments should lead to considerable progress in electrical energy storage, and thus the feasibility of weapon systems with electro-magnetic guns has greatly increased.

Electro-magnetic Guns

The Coil Gun

The oldest form of electro-magnetic gun actually built is likely to have been the coil gun. Figure 1 shows its working principle. The gun consists of a barrel (not shown in the figure) with a series of fixed acceleration coils. When these spools are electrified sequentially, a travelling magnetic field arises that induces a current in the projectile coil. As a consequence, the travelling magnetic field exerts the Lorentz force F on the projectile-coil current and thus accelerates the projectile.

There exist numerous other versions of a coil gun. From a physical standpoint, they all function basically according to the principle of magnetic inter-action between two electrified coils.¹ Some versions use a projectile made of magnetic material, instead of a projectile coil.

It is reported that in 1845 such a coil gun was used to fling a metal rod some 20 meters.² During the Spanish-American War (1898), an American inventor claimed it would

long. A contemporary of Birkeland commented as follows on the usefulness of this device as a weapon: "[Birkeland's gun] is a rather clumsy, one could almost say, a scholarly device, which at first does not elicit a great deal of trust in its usefulness, but which through further refinement perhaps could be made useful. For the time being, it does not seem feasible to tie artillery performance to such an extensive use of electricity. Only through further inventions could the electro-magnetic gun become useful for combat. An inconvenient factor is, to be specific, the necessity of a special power supply for the gun [...] In short, the electro-magnetic gun is, currently, without doubt in an embryonic stage. But it would be premature to attempt to conclude on the basis of its imperfections that this pioneer weapon could, in future, never be developed into a useful combat weapon."³

In the late 1930s, K Justrow published far more critical remarks. They appeared in his preface to a theoretical treatise by E Rogge: "I treated the problems concerning the electro-magnetic gun in a scientific discussion in my 'Defence Technology' working group of the German Society for Defence Policy and Defence Science, because efforts in recent years to enhance the performance of firearms called attention, again and again, to the use of electric current. In particular, the US and Russian sides attached much hope to this possibility. The following essay shows [...] the impossibility of realising the proposal".⁵

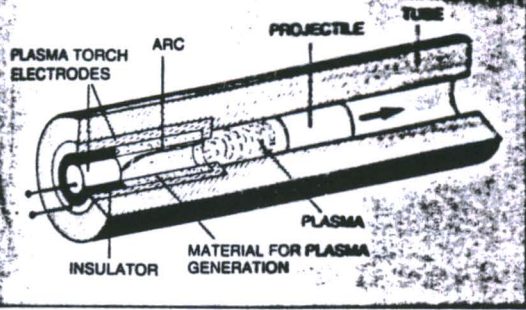
Dr. Wolfram Witt is Department Head for R&D programmes co-ordination at Rheinmetall GmbH. Dipl.-Ing. Markus Löffler is currently working at the Technology Center Nord, and is engaged in research on high-power electrical acceleration.

Nor
Häns
out st
train
screer
ings o
edly
armou
autor
and e
unsuc
a year
Sci
ful. I
cond
at W
lerate
490m
letov
appro
4.9kr
extre
woul
plicat

The f
The
form
of tv.
twee

ITION CU

NETIC F



operating principle of the electro-thermal gun.

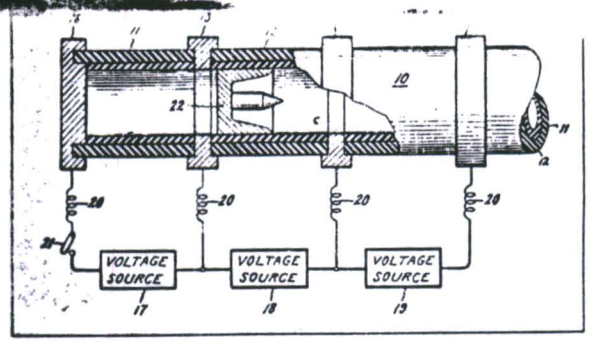


Fig. 4: The multi-stage electro-thermal gun produced by Yoler.

Nonetheless, in spring 1944, Dr Joachim Hänsler and Chief Inspector Bunzel carried out studies on the coil gun.^{6,7} At the Hillersleben training ground at Magdeburg, in a carefully screened-off garage, they conducted test firings of a small-calibre (10 mm) device, supposedly consisting of numerous coils, against armour plates. The power sources included automobile batteries, condensers (capacitors) and electrical generators. But the tests were unsuccessful and were discontinued after half a year.

Scientists in the 1970s were more successful. In tests with a single-stage coil gun, conducted in 1970 at the Ernst Mach Institute at Weil/Rhein, Haß and Zimmermann accelerated a 1.3g metal ring to a velocity of 490m/s. In 1976, in the Soviet Union, Bondaletov and Ivanov accelerated a metal ring of approximately the same mass to a velocity of 4.9km/s.^{8,9} The metal ring was subjected to an extremely rapid acceleration, so rapid that it would probably be intolerable for weapon applications.

The Rail Gun

The rail gun, shown in figure 2, is a further form of the electric gun. In principle, it consists of two parallel rails; the projectile glides between them. When a current source is con-

nected to the rails, the current flows through one rail to the projectile, through a conducting armature at the base of the projectile to the other rail, and back in the other direction through the other rail. The current creates a magnetic field that acts with the Lorentz force "F" on the current flowing through the armature, and, thus, accelerates the projectile.

This type of gun was publicised through several spectacular tests in the US. The rail gun, like the coil gun, can be built in one of numerous versions.¹⁰

The inventor of the rail gun was a Frenchman, André Louis-Octave Fauchon-Villeplée, who obtained three patents in 1920.¹¹

Fauchon-Villeplée laid the groundwork for his rail gun, which was investigated under commission to the "Ministre de L'Armement et des Fabrications de Guerre", between 1916 and 1918. Unfortunately, the gun was not tested properly.⁶ Neither the electric current through the rail nor the velocity of the projectiles fired was measured. In 1936, an employee of the Yugoslavian Ministry of War repeated the tests, in the same manner.

In 1944 and 1945 Hänsler, who, as mentioned above, had already investigated the coil gun, conducted tests with a 20 mm, 2m-long rail gun designated LM 2. Initially, the tests took place in Berlin; later tests were conducted in a railway tunnel in the vicinity of Klais in Upper Bavaria.⁶ The LM 2 accelerated 10g aluminium cylinders with an average acceleration of 3×10^8 ms to 1,080m/s. When two rail guns connected in series were used, a velocity of 1,210m/s was achieved.

Hänsler's gun fell into the hands of US troops toward the end of the Second World War. In 1946, the Armour Research Foundation was commissioned by the Army Ordnance Department to evaluate Hänsler's work. The studies were terminated with the result that the energy supply problem was insoluble.¹²

Following this, individual tests were conducted to investigate the general principle of the rail gun. In 1958, Artsimovich, a Russian, reported that very high projectile velocities could be achieved with the rail gun.¹³ He succeeded in accelerating plasmas of very low mass to velocities over 100m/s. In 1965, Brast

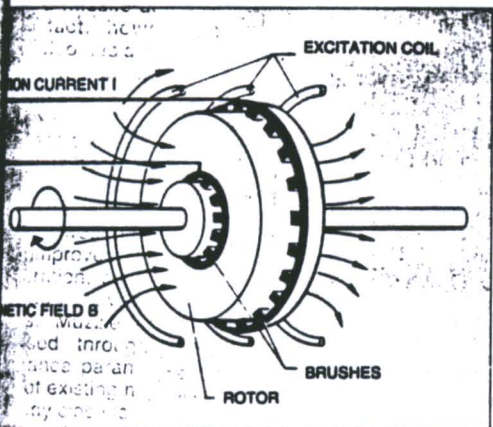


Fig. 5: The principle of the homopolar generator.

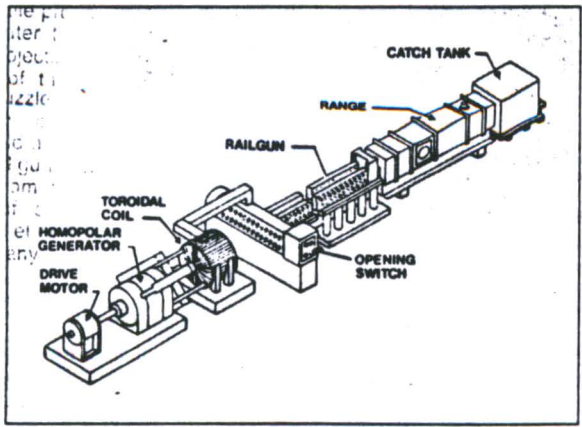


Fig. 6: Schematic view of the Westinghouse system with rail-gun.

ELTA

Multi-Mode Fire Control Radars

Derived from ELTA's new generation combat aircraft radar, the new EL/M-2000 multi-mode radar family locates, tracks and counters threats with accuracy and reliability. Take the lightweight EL/M-2011 as an example. Upgrading light attack, close air support and advanced trainer aircraft, it delivers all-altitude, all-aspect, look-up and look-down detection as well as essential air-to-ground ranging capabilities.

Hundreds of ELTA airborne radars are in operation today. Designed by pilots for pilots.

See us at AFCEA

The Innovative Response

ELTA Electronics Industries Ltd
a subsidiary of ISRAEL AIRCRAFT INDUSTRIES LTD
Electronics Division

Ashdod Israel: P.O. Box 330, Ashdod 77102, Tel: (08)530333. Telex: 381807, 381874 ELTA IL.
New York: Israel Aircraft Industries Inc., Tel: (212)620-4410. Telex: 230-125180 ISRAIR.
Brussels: IAI European Marketing Office., Tel: (2)5131455. Telex: 62718 ISRAVIB.

We accelerated 37mg nylon projectiles
s.

Electro-Thermal Gun

fund basic type of electrically powered
the electro-thermal gun. Its working
is shown in fig. 3. It also exists in
versions; in the simplest case, the
consists of a conventional barrel with
leading to a plasma burner
on the breech end of the weapon.

age across the plasma burner's
es creates an arc that vaporises ma-
such as poly-ethylene, situated between
electrodes. The vaporised material is
eated until it becomes a high-pressure
which accelerates the projectile.

first considerations for building such a
were made by O Muck, who disclosed
s, in early 1945, in a secret document
Reich's Minister for Armament and War
ion. Muck, an associate of Häsler,
cupied chiefly with the problems of
supply for electro-magnetic guns. The
vented his proposal from being studied

ulti-stage arrangement, such as that
in fig. 4, was registered for a patent by
General Electric), in 1956.^{15,16} In the
ear, Bloxson applied for a patent for a
in which helium gas was heated by an
arc.¹⁷ In experiments, he used this gun
enerate nylon spheres, 3mm in diameter,
ocity of 2.990m/s.¹⁸

I do not wish to discuss the trivial objection
so often repeated in this context by those
hopelessly oriented toward the past, namely,
that power requirements will preclude a solution
to the problem of the electro-magnetic gun.

[...] conventional guns have the same power
requirements. It goes without saying that such
power requirements, in electrical terms, have
an order of magnitude equivalent to the power
produced by large power-generating plants.
No one would try to make the large amounts of
power a conventional gun requires for 1/100s
available on a continuous basis. Why should
one be so naive as to do this for an electric
gun?!

[...] An obvious approach is to attempt en-
ergy storage in accordance with one of the fol-

lowing four procedures: electro-static, electro-
magnetic, electro-chemical and mechanical.
Technical manifestations of these four proce-
dures are, respectively, the condenser [capa-
citor], the impulse transformer, the storage
battery and the impulse generator.

[...] Existing condensers, as far as their en-
ergy contents per unit volume are concerned,
are not particularly favourable. After years of
work, our associate O Muck discovered ap-
proaches which, if they are followed through
experimentally, could increase the energy
contents per unit volume by several orders of
magnitude.

[...] The impulse transformer is very fa-
vourable, in terms of volume.

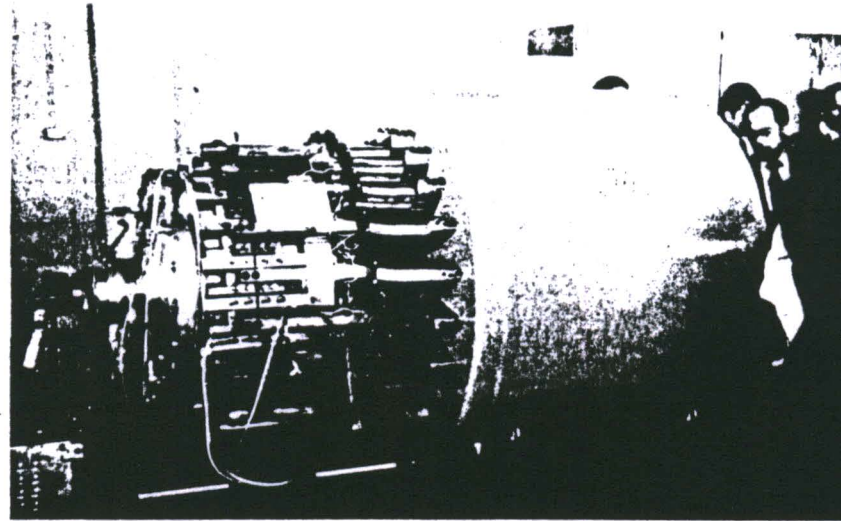


Fig. 7: Homopolar generator of compact design (left) with induction coil (right). The coil is designed for a rail-gun.

Problem of the Power Supply for Electro-magnetic

s conducted as late as the 1960s with
different types of electro-magnetic guns
that they can achieve higher muzzle
velocities than conventional guns. But tests
were not able to demonstrate muzzle energies
suitable for weapon applications, since the
available power sources were still lacking.

It is noteworthy that Häsler recognised
aspects of this problem. He wrote: "The
development of the electro-magnetic gun can
be divided into two parts:

1. development of the projectile accel-
eration machine, or, as can be said in analogy
to the conventional gun, of the barrel;
2. development of the energy-storage de-

vice. To power the energy-storage device must
be currents of the order of a million kilowatts, and
required currents are of the order of a
hundred amperes.

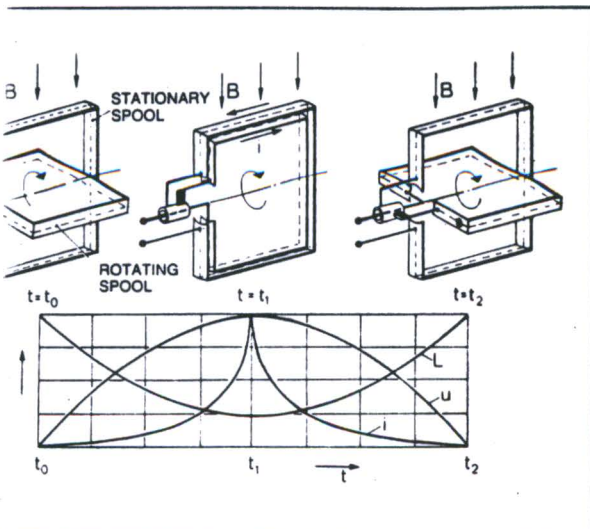


Fig. 8: The functioning principle of a compulsator.

ELTA EW

See us at AFCEA

The Silent Partner

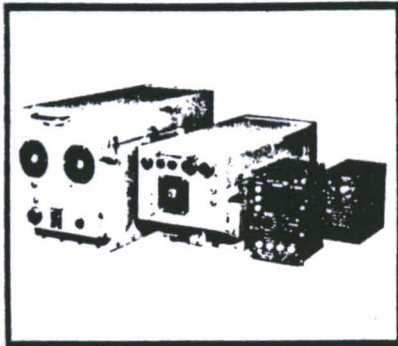
ELTA's AEW and Airborne
Signal Systems can make
you a silent "partner" to
your enemy's C³I activities.
Essential for long range
detection and acquisition of
crucial, accurate, real-time
intelligence. Vital for all
your strategic and tactical
decisions. Decades of
combat-proven experience
enable ELTA to custom-
tailor comprehensive and

cost-effective Airborne EW
— using its unique Total
System Approach.
ELTA EW. Depend on it.
We do.



Ashdod Israel: P.O.Box 330, Ashdod 77102, Tel: (08)530333. Telex: 381807, 381874 ELTA IL.
New York: Israel Aircraft Industries Inc., Tel: (212)620-4410. Telex: 230-125180 ISRAIR.
Brussels: IAI European Marketing Office., Tel: (2)5131455. Telex: 62718 ISRAVIB.

RATTLER Power Management Radar Jammer



The threats of enemy search, tracking, and surveillance radar pose formidable challenges to air, naval, and ground forces.

RATTler is a sophisticated battle-proven jammer system capable of meeting the demands of today's dense EW environment.

When an emitter is received and identified as a threat, RATTler goes into operation, either automatically through an existing computer or manually via its control unit. Voltage-controlled oscillator sources determine the jamming frequencies, which are produced by the low-power microwave jamming source. The low-power RF outputs are transferred to the amplifier and wide-band power is transmitted via the antenna to jam the enemy radar. Three distinct threats may be jammed simultaneously.

Up to 16 RATTler systems can be connected on the same 488 data bus for simultaneous computer-controlled operation. The system's design emphasizes modularity and compatibility, and is built and tested in accordance with all relevant MILSPEC standards.



Rafael Armament Development Authority

P.O.B. 2082 Haifa 31021, Israel
Tel: (4) 706965. Tlx: 471508 VERED IL
Fax: 04 794657.

U.S.A.

Tel: (202) 364-5571. Tlx: 25-904152
Fax: 202-364-5529.

Bonn

Tel: (228) 823 265. Tlx: 885491 ISRA D
Fax: 228-823353.

Singapore

Tel: (65) 734-9120
Tlx: RS55125 RAFSIN. Fax: 734-8861.

... experiment has been completely successful.

Our main energy source was the storage battery. From all commercially available types, we selected the one with the largest power delivery per unit volume. Using ideas of Kapitza, we succeeded in developing a laboratory version of a storage battery improved by a factor of 10 to 20.

[...] The impulse generators must provide current surges of about 1.6 million amps.

[...] Modern impulse generators are "further developments" of those designed for continuous performance. Their self-induction is, thus, far too great for them to be able to provide such impulses. Although the stored energy is several times that required, the electrical system can deliver only a fraction of the required power.

[...] The impulse generator, in the form of the uni-polar machine [see fig. 5], is currently the best power storage medium in terms of volume required. But in this area as well, we have embarked upon a development according to a new principle, since the self-induction of the conventional machines is too large.

[...] The direction of future developments with electro-magnetic guns is clear, on the basis [...] of the experiments conducted. Like earlier researchers, we have become convinced that electro-magnetic guns can be realised with the current level of technology, if development is supported generously.¹⁶

Progress

Since then, developments in the area of power supply have progressed steadily. In the early 1970s, the first opportunity was created, at the Australian National University in Canberra, for demonstrating the potential of an electro-magnetic rail gun.^{19,20}

A two-story homo-polar generator, which Sir Mark Oliphant had developed for experiments in high-energy physics, was made available for experiments with rail guns. The generator's flywheel was capable of storing a rotational energy of 500 MJ, deliverable in current surges of up to 1.6 MA. Dr Richard Marshall, Mr John Barber, a doctoral candidate, and additional researchers, connected this extremely powerful current source to a rail gun 5m long. At first, the generator was unable to deliver the necessary power to the rail gun. After installing a coil and an additional switch in the system, Marshall and Barber finally succeeded in accelerating a 3.3g poly-carbonate mass to a velocity of 5.9km/s. The average acceleration was over 10 ms.

After this, numerous tests with rail guns were conducted. At first, these tests were conducted in the context of nuclear fusion and shock wave experiments. In 1982, a team under the direction of R Hawke, from the Lawrence Livermore National Laboratories, in cooperation with a team under M Fowler, presented a small-calibre (12.7mm), 5m rail gun that could accelerate 2.2g masses to velocities of about 10km/s.²¹ The power source was a so-called magnetic-flow compression generator, which transforms the energy stored in explosive substances into electrical energy.

These results, outstanding in comparison to those achieved in earlier tests, made researchers extremely optimistic. It was expected that velocities of 150km/s, which would be required for nuclear-fusion experiments, could be achieved with 0.1g projectiles.²² For conventional guns, the basic projectile-velocity limit is governed by the thermo-dynamic parameters of the powder gases. For electro-magnetic guns, the limit was seen to be governed by the limiting factors of the material characteristics of the barrel and the projectile. The theoretical velocity limit was seen to be the speed of light.²³ These assumptions led to the electro-

magnetic gun becoming a fixed part of the SDI programme.

Further tests brought a sobering note: the velocities actually attainable fell considerably short of goals. The Soviet, A Shvetsov, who had accelerated 1.3g masses to about 5km/s, found, in 1983, that it would be very difficult to attain projectile velocities considerably greater than those already achieved.²⁴ In 1985, R Hawke and his team terminated their tests, without success: they had not been able to accelerate 1g masses to velocities greater than 7km/s — their predicted goal had been 15km/s.²⁶

The electro-magnetic gun became increasingly interesting, however, with regard to its tactical use in the framework of "conventional" weapons technology. The prime reason for this was the work of Marshall and Barber, which led to considerable technological progress in the US in the area of power supply.

In 1980, Westinghouse built a laboratory-model rail gun that attracted great attention. The Westinghouse rail gun, which was powered by a 17.5MJ homo-polar generator (see fig. 6), was used to accelerate a projectile weighing approximately 300g to a velocity of over 4km/s, which corresponds to a muzzle energy of 2.8MJ.¹⁹ This was proof that the electro-magnetic gun could generate high muzzle energies as well as high muzzle velocities. In addition, it was a showcase for the progress that had been made in the area of power storage, especially with homo-polar generators, "compulsators" (see below) and capacitors.

A compact homo-polar generator (fig. 7) was used whose weight/stored power ratio was considerably improved over that of the above-mentioned systems. The "self-excited air-core homo-polar generator" should provide a further weight reduction.

A new type of generator, the "compulsator", is a derivation of the conventional alternating-current generator.²⁷ Its salient characteristic is an additional stationary coil connected in series to the rotating coil (fig. 8). The additional coil periodically changes the self-inductance of the arrangement. If the stationary spool is situated in the magnetic field B the inductivity, L, reaches its minimum value at $t = t$ exactly at the point at which the induced voltage, u, is at its maximum. The result is a very powerful current discharge when the circuit to the power consumer is opened.

The compulsator's ability to deliver very powerful current discharges periodically, in accordance with its rotational frequency (e.g. 50 Hz), makes it particularly attractive as an energy source for electro-magnetic guns, which must have a high rate of fire.²⁸ In addition, the duration of the current surges is of the order of 0.3 to 2 ms, which is within the time required for a projectile to pass through the barrels of small and medium-calibre weapons. As a consequence, the compulsator eliminates the need for a coil and switch for pulse formation.

Progress in capacitor technology has also been considerable. Within the last 10 years, the energy densities of capacitors have been increased by a factor of about 50.

Rechargeable high-performance batteries, such as lithium-cell batteries, could become a serious competitor to homo-polar generators and capacitors. A specific energy of 125kJ/kg is considered a good value for such capacitors, but, as early as 1978, a concept for a battery with 700 kJ/kg was published.²⁹

Recent work has also focussed on improving the rail gun itself, especially the barrel and the projectile armature. A new switch for the MA region is being developed, and the effi-

ciency of the overall system is being increased.

In comparison with the rail gun, the coil gun and electro-thermal gun are still in their infancy. Recently, a successful test with a coil gun was reported in which a 1kg projectile was accelerated to over 1km/s. An electro-thermal gun accelerated a 50g projectile mass to a velocity of 1.8km/s. At Rheinmetall, an electro-thermal gun accelerated 3g projectiles to 2km/s.³⁰

Applications for Electro-magnetic Guns

Now that it is becoming clear that electro-magnetic guns are useful for tactical applications, the question arises of which applications would be useful. Hänslér also wrote on this point:

"It is not conceivable that the electro-magnetic gun should become a competitor for the conventional gun within the velocity range covered by the conventional gun. On the other hand, there are applications for the electro-magnetic gun in which the conventional gun would be a failure, because its initial projectile velocity is too low.

[...] Modern warfare absolutely requires higher projectile velocities for certain purposes. This question is particularly urgent for anti-aircraft guns, which have not been able to keep in step with the velocity and altitude increases of attack aircraft. Aircraft developments in the areas of velocity and altitude proceed apace. Increasing the initial velocity of projectiles will increase both range and hit probability for the engagement ranges encountered thus far.

air defence. The increasing numbers of airborne systems, their increasing velocities — especially in low-level flight — and stealth technology present major challenges to a defender. One of the basic requirements for an air-defence system is that it be able to react rapidly.

Muzzle-velocity increases can reduce the durations of engagement sequences and thus enhance effectiveness against rapidly moving targets. Fig. 9 shows a comparison of a conventional gun (muzzle velocity 1,300m/s) with an electro-magnetic gun (assumed muzzle velocity 4,000m/s). The figure assumes that initial engagement ranges are identical, i.e. that both systems have the same acquisition equipment.

Muzzle-velocity increases can bring additional advantages. All barreled weapons not firing terminally-guided munitions require extremely precise fire control, involving calculation of predicted target position, for an interval of several seconds, corresponding to the projectile time of flight. Assuming the very favourable case of a target flying straight ahead (linear fire control hypothesis), the transverse target miss distance caused by a fire-control error is proportional to the time of flight of the projectile. A muzzle-velocity increase from 1,300 to 4,000m/s provides an approximately 60% miss-distance reduction. For realistic target behaviour, involving, for example, transverse accelerations — often not detectable by fire control systems — miss distances depend on the square of the time of flight. In such cases, an electro-magnetic gun with a high muzzle velocity can reduce the influence of the fire control error by 80 to 90%.

Such clear predictions are not possible for anti-armour engagements, since terminal-bal-

In order to achieve this goal, intensive search and development work will be required for almost all aspects of the electro-magnetic gun, including the power supply and projectiles. New materials will play a very important role. Thus the electro-magnetic gun, in addition to its expected military importance, should also prove to be a strong impetus for technological progress and innovation, with a considerable spin-off effect in the civilian sector.

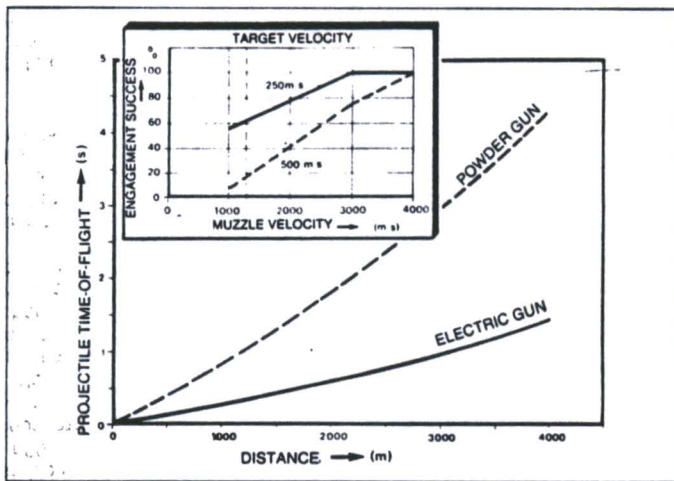


Fig. 9: Graphical representation of the influence of projectile and target velocity on engagement success in air defence.

[...] (Ballistic) considerations lead, without doubt, to the [...] 4cm, fin-stabilised arrow projectile with an initial velocity of at least 2,000m/s. We have a projectile form with the required ballistic characteristics in the 'Peenemünde arrow projectile'. In this context, the question arises immediately of what the largest initial velocity would be, for reasons of external ballistics. Theoretical investigations have shown that it lies in the vicinity of 3,000 to a maximum of 4,000m/s. Still greater initial velocities, because of increasing air resistance, provide hardly any further benefit. Thus 2,000m/s is considered an initial goal, and 3,000 to 4,000m/s a desirable ultimate goal in the development of an anti-aircraft gun.

[...] (The) availability (of this anti-aircraft gun) will determine — assuming approximately equal gives for both opposing parties — whether the war is won or lost.¹⁶

No one would question the airborne threat, and, as a consequence, the need for effective

ballistic requirements will change as armour changes. In addition, a clear, generally valid relationship between increased impact velocity and improved armour-piercing performance cannot currently be defined for non-homogeneous armour — only for homogeneous armour and, in part, for simple spaced armour. Nonetheless, it can generally be expected that a gun with higher muzzle velocities would also provide advantages for anti-armour engagements.

Perspectives

Work on all critical components of the electro-magnetic gun is proceeding rapidly in the US and is now beginning in other countries as well. Progress to date with regard to the accelerator, the energy storage and the impulse formation make it appear likely that weapon systems of the generation after next (shortly after the turn of the century) will be equipped with an electro-magnetic gun.

References

- [1] H. Kolm, K. Fine, F. Williams, P. Mongenau: "Electromagnetic guns, launchers and reaction engines", Proc. 1st Pulsed Power Conference, 1979.
- [2] A. Egeland, E. Leer: "Professor Kr. Birkeland: His Life Work", IEEE Trans. Pl. Sc., PS-14 (6) 1986, S. 666—667.
- [3] Wille: "Waffenlehre", 3. Auflage, Berlin 1905, p. 181—182.
- [4] K. Birkeland: "Verfahren zum Schleudern von Geschossen mittels elektromagnetischer Kraft", Kaiserliches Patent, Patent Nr. 139768 vom 25.9.1901.
- [5] E. Rogge: "Probleme um die elektromagnetische Kanone", Zeitschrift für das gesamte Schieß- und Sprengwesen, Mai 1939.
- [6] J. Hänslér: "Ein Beitrag zum Problem des elektrischen Geschützes", and trials reports 1 bis 3, Gesellschaft für Gebäu m. b. H., Klaus. Obb., September 1944 to January 1945.
- [7] K. Kunder: Private report of 1943—1944 of the Heeres-Waffenamt in Hillersleben.
- [8] W. Haß, G. Zimmermann: "Untersuchungen zur elektromagnetischen Beschleunigung von Projektilen", Ernst-Mach Institut, Arbeitsgruppe Kurzzeitphysik, Weil am Rhein, 1970.
- [9] Bondalevov, E. Ivanov: "Ultrahigh axial acceleration of conducting rings", Sov. Phys. Techn. Phys., 22 (2) 1977.
- [10] J. Salge, M. Löffler, U. Braunsberger, R. Synofzik: Integrated magnetic acceleration and energy storage system Dig. Techn. Papers, 5th IEEE Pulsed Power Conference, 1982, S. 548—551.
- [11] A. Fauchon-Villeplée: "Elektrische Kanone", Reichspatentamt, Patent Nr. 376391 vom 10.7.1920.
- [12] J. Radnik, A. Bak: "Investigation of electromagnetic launcher for high-speed projectiles. Final Report", Armour Research Foundation of Illinois, Institute of Technology, 1958.
- [13] L. Artimovich, S. Luk'ianov, I. Podgorny, S. Chuvpilo: "Electrodynamic acceleration of plasma bunches", Sov. Phys. JETP, 6 (1) 1968, S. 1—5.
- [14] D. Brast, D. Sawle: "Feasibility study for development of a hypervelocity gun", MB Associates, San Ramon, Ca., USA, Contr. No. NA 58-11205, 1965.
- [15] Y. Yoler: "Method and means for propagating a mass", US-Patent Nr. 2783684 vom 5.5.1957.
- [16] Y. Yoler: "Mass accelerator", US-Patent Nr. 279035 vom 30.4.1957.
- [17] D. Blossom jr.: "High velocity gun system", US-Patent Nr. 2899864 vom 18.8.1959.
- [18] D. Blossom jr.: "Use of capacitor discharges to produce high velocity pellets", J. Appl. Phys. 29 (7) 1958, S. 1049—1051.
- [19] H. Kolm, P. Mongenau: "An alternative launching medium", IEEE Spectrum, April 1982, S. 30—36.
- [20] S. Rashleigh, R. Marshall: "Electromagnetic acceleration of macroparticles to high velocities", J. Appl. Phys. 49 (4) 1978, S. 2540—2542.
- [21] R. Hawke, A. Brooks u.a.: "Results of railgun experiments powered by magnetic flux compression generators", IEEE Trans. on Magnetics, MAG-18 (1) 1982, S. 82—93.
- [22] R. Hawke: "Devices for launching 0.1 g projectiles to 150 km/s or more to initiate fusion", Atomkernenergie/Kern-technik, Bd. 38, 1981, Lfg. 1.
- [23] H. Fair jr.: "Electromagnetic propulsion: A new initiative", IEEE Trans. on Magnetics, MAG-18 (1) 1982, S. 4—6.
- [24] A. Shvetsov, V. Titov u.a.: "Invention of a railgun accelerator for solid projectiles powered from an explosive MHD generator", Fizika Goreniya i Vzryva 20 (3) 1984, S. 111—115.
- [25] R. Hawke: "Railgun research and development", Energy and Technology Review, Lawrence Livermore National Laboratory, 1985.
- [26] R. Hawke, W. Nellis u.a.: "Summary of EM launcher Experiments Performed at LLNL", IEEE Trans. on Magnetics, MAG-22 (8) 1986, S. 1510—1515.
- [27] W. Weldon: "Pulsed Power Packs a Punch", IEEE Spectrum, March 1985, S. 59—66.
- [28] M. Spann u.a.: "A Rapid Fire, Compulsor-Driven Railgun System", IEEE Trans. on Magnetics, MAG-22 (8) 1986, S. 1753—1756.
- [29] C. Liang, A. Joshi, N. Hamilton: "Solid-State Storage Batteries", J. Appl. Electrochem. 8, 1978, S. 445—454.
- [30] J. Salge, T. Weise, M. Löffler, W. Witt: "Plasma-Pulse-Acceleration Experiments", Publications of the 6th Pulsed Power Conference, 29.8.—1.7.1987, 3.11.1987, S. 10—12.



Exhibit
TT

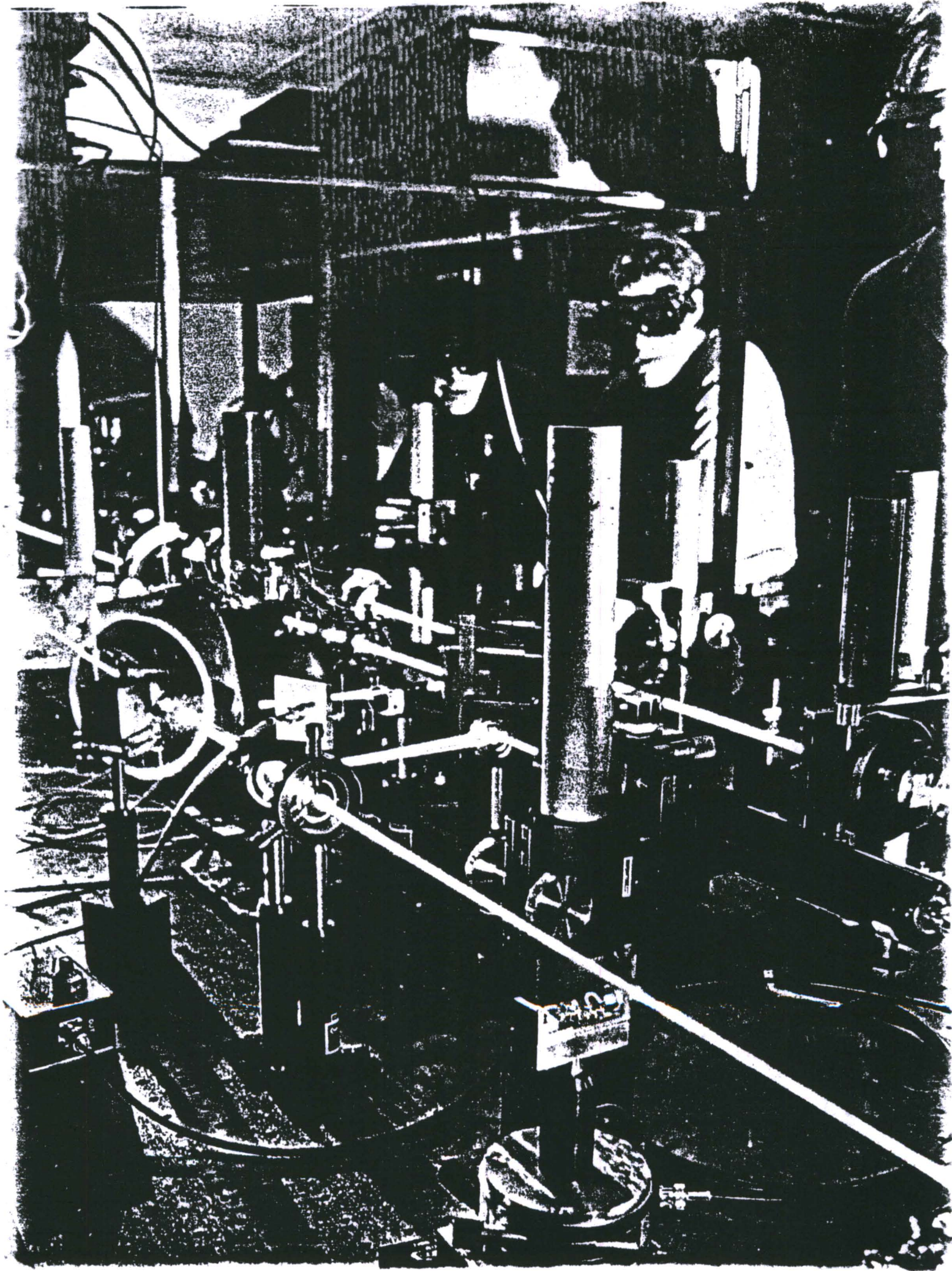
BEYOND THE BOMB

TURMOIL IN THE

By William

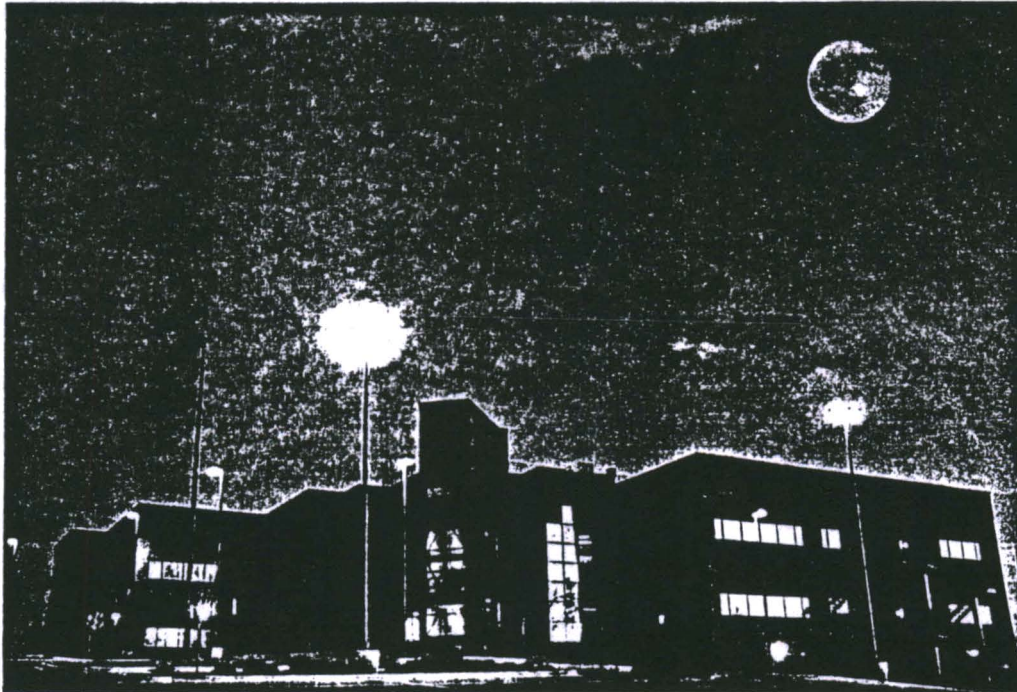


0354973 40



THE BOMB

MOIL IN THE LABS



PETER MENZEL

By William J. Broad

THE BOOM TIMES of the Reagan era have ended for the elite scientists who practice the secret art of designing and testing new kinds of nuclear arms. At America's rival centers for nuclear research — the 7,800-person Los Alamos National Laboratory, high in the mountains of New Mexico, and the 8,000-

William J. Broad is a science reporter for The New York Times.

person Lawrence Livermore National Laboratory, set amid the grassy hills of northern California — the atmosphere is of ferment and soul-searching. By their own admission, the high priests of the atomic brotherhood have reached a turning point, some would call it an identity crisis, as they try to fathom their future.

No longer are research budgets rising and orders for new and improved nuclear warheads seemingly endless. Instead, there are layoffs, budget cuts, bad press about internal scientific disputes, and a spate of house-for-sale

signs. The East-West competition to build new weapons has given way to serious talk of cutting the world's arsenals in half. Already an agreement has been reached to eliminate a whole class of nuclear arms, including, for America, the Pershing II and the ground-launched cruise missile. Most troubling of all to the atomic scientists, momentum is building in Congress to limit the explosive testing of nuclear arms. ✓

Even before the appearance of these potential curtailments, the nuclear labs had moved to broaden their agenda to include work on

Internal dissent and an uncertain nuclear future create confusion at Los Alamos and Livermore.



Demolishing a silo for outmoded Titan missiles, Arkansas, 1987. As East and West talk increasingly of disarmament and American budget constraints increase, the strength of the next weapons-building cycle is in doubt.

Star Wars antimissile weapons. Now they are racing to further diversify by developing nonnuclear arms, helping industry perfect high-technology goods and embarking on big new research projects.

As if the weapons labs in this time of flux were not already troubled enough, both Los Alamos and Livermore have been rocked by allegations from some of their own top scientists. They have assailed the status of secret arms projects and challenged the objectivity of sensitive national programs, triggering investigations by Congress and Federal reforms. Their assault spans the spectrum of nuclear topics, including critical issues in areas of arms design, stockpile reliability, the seismic monitoring of nuclear blasts, and the search

for technical alternatives to the explosive testing of nuclear weapons. Their underlying charge is the most serious a scientist can make: that the truth has been betrayed, often for reasons of politics or ideology.

Telleritis
LOS ALAMOS AND Livermore are the brains behind a vast industry run by the Department of Energy. The weapons complex, which includes research and production facilities, employs 90,000 people and spends about \$8 billion a year.

The research side of the enterprise, in addition to Livermore and Los Alamos, includes the 7,200-person Sandia National Laboratory in Albuquerque, 100 miles south of Los Alamos, which designs nonnuclear parts of war-

heads, and the 1,350-square-mile Nevada Test Site, with 8,000 employees, where prototype weapons are detonated anywhere from 500 to 2,500 feet beneath the desert. According to the Natural Resources Defense Council, a private environmental group that publishes the "Nuclear Weapons Databook," America's atomic scientists over the past four decades have created more than 100 different types of nuclear warheads.

Perched on a mile-high plateau amid tall pines and deep canyons, Los Alamos ("the poplars"), America's oldest nuclear lab, the birthplace of the bomb during the Manhattan Project, is physically isolated. No great universities and few high-technology companies are located nearby. The mesa, formed by the outpouring of a huge prehis-

models... "Science"

its most sensitive research on nuclear weaponry.

As he sips a Corona beer on the deck of his home overlooking an arm of the San Joaquin river in central California, Woodruff looks anything but a warrior. Clad in a bathing suit, deeply tanned, heavy around the middle, the 47-year-old physicist could pass for a construction worker. But that impression is belied by his quiet intensity, his careful choice of words, and his repeated reference to a folder thick with letters and Government documents telling the tale of his continuing war with the nuclear bureaucracy.

"I grew up in the aftermath of World War II and the Holocaust," he said, his face drawn. "I always asked myself, 'How is it possible six million people went to their death?'" Why did German citizens fail to take the steps necessary to end Hitler's extermination of the Jews? "The answer, I think, is that most people are not risk takers. Many have enough solid values and integrity so they will not lie. But they will not go out on a limb to fight the system."



MAX AGUILERA-HELLWEG

Above: Ray Kidder, a 32-year Livermore veteran, flatly contradicted the labs' argument that explosive weapons-testing is needed. "The lab is basically an honest place. But it's filled with human beings who are expected to sell programs."

For Woodruff, a two-decade Livermore veteran, the war began in December 1983 when he confronted the aged but still immensely powerful patriarch of the nation's nuclear enterprise — Edward Teller, who was associate director emeritus of the lab. Teller had played a central role in the birth not only of the hydrogen bomb but also of President Reagan's Star Wars antimissile program.

evidence that the X-ray laser had indeed flashed to life. A few days later, Teller sent a glowing account of Livermore's work on the laser to George A. Keyworth 2d, then President Reagan's science adviser. In it, he touted the desert success, saying the X-ray laser was "now entering the engineering phase," a term implying that basic research was complete.

Left: Roy Woodruff of Livermore, the most senior of the nuclear rebels, confronted Edward Teller about the accuracy of Teller's advice to Washington on Star Wars. "I think the laboratory is losing its way. . . . I think it's become politicized during the Reagan Administration."

The issue that divided the two physicists was the O Group's X-ray laser, also known as Excalibur. The futuristic device was meant to channel the blast of an exploding nuclear weapon into beams of concentrated X-rays to destroy enemy missiles. The force behind the idea was Lowell L. Wood Jr., a bearded, abrasive, hard-driving protégé of Teller's who led the O Group. Teller took the X-ray breakthrough to the White House, where it helped inspire the Star Wars program.

But Woodruff was intimately familiar with the serious problems that had beset the X-ray laser program since its start in 1980, the greatest of which was developing sensors to record quickly and accurately what happened between the time of the firing of the laser and the destruction of the sensors by the expanding fireball a split second later.

Woodruff, who headed the nuclear design program at Livermore and thus oversaw Excalibur's development, first confronted Teller following an underground test that took place on Dec. 16, 1983. That test, Federal scientists say, provided the first clear

Woodruff, after reading Teller's letter, stormed into his colleague's office two floors below, objecting in strong terms and saying the letter was wildly premature. Teller refused to send a follow-up clarification, and a proposed corrective letter that Woodruff drafted was blocked by the lab's director, Roger Batzel. "At that point it was not a fall-on-your-sword

(Continued on Page 72)



ED KASHI

CIA-connections

The Shape of Things to Come.

Things are changing. Fast. But we can think of three things that won't change. Not surprising, since good things come in threes.

First off, falling in love will look much the same in years to come. People seem to like it just fine the way it is. And, well, if it isn't broken, don't fix it.

Next is the Fontana di Trevi in Rome. Couples have been falling in love by its cascading waters for hundreds of years. Another good one. We'll keep it.

Third would have to be Sambuca di Trevi. Italians know a little something about design. And our bottle, we humbly submit, would do any of the great masters proud.

Share some Sambuca di Trevi with a special someone by the waters of the Fontana di Trevi.

Of course, there are more accessible romantic fountains. We know a great little spot in Central Park...



© 1984. Imported from Italy by Chairman Importing Co., New York, N.Y. 84 prod.

TURMOIL

Continued from Page 25

kind of issue," Woodruff recalled. It was, however, a portent of things to come.

In early 1984, a few months after Teller's letter, Livermore physicists hit upon a refinement of Excalibur, known as Super Excalibur, that in theory was more capable of destroying enemy missiles. It was to be markedly brighter and thus more powerful than its predecessor, and would fire thousands of individual beams to knock out thousands of enemy missiles. Unlike Excalibur, however, Super Excalibur hadn't even the minimal experimental basis provided by explosive tests beneath the desert.

Teller — worried by the announcement late that year that new East-West arms talks were to be held, including ones to limit space weapons — wrote key Administration officials to tell them of Super Excalibur and urge them not to endorse agreements that might block its development. On Dec. 28, Teller wrote Paul H. Nitze, the State Department's senior arms-control adviser, that a single Super Excalibur laser "the size of an executive desk" could "potentially shoot down the entire Soviet land-based missile force." He added that it might fire "as many as 100,000 independently aimable beams," each one "lethal even to a distant hardened object in flight."

On the same day, Teller wrote Robert C. McFarlane, then the President's national security adviser, saying Super Excalibur might be achieved "in as little time as three years." Boldly, Teller acknowledged that his motive was "to try to prevent the inadvertent appearance in any possible forthcoming agreement with the Soviets of limitations that might impede our work."

Woodruff was outraged. In a proposed letter of his own to Nitze, Woodruff called Super Excalibur "not impossible, but very unlikely." But as before, attempts to deliver his written clarification were

marked. "Congressman Stark summed it up perfectly. Woodruff was right. Teller was famous."

Star California Democrat, represents the Livermore area.

The following year saw a gap grow between X-ray and expectation. In March 1985, the first underground test of Super Excalibur, code-named Cottage, was soiled with problems that sparked a Congressional probe. Yet in September after visiting President Reagan at the White House, Teller secured an extra \$5 million to accelerate X-ray laser research.

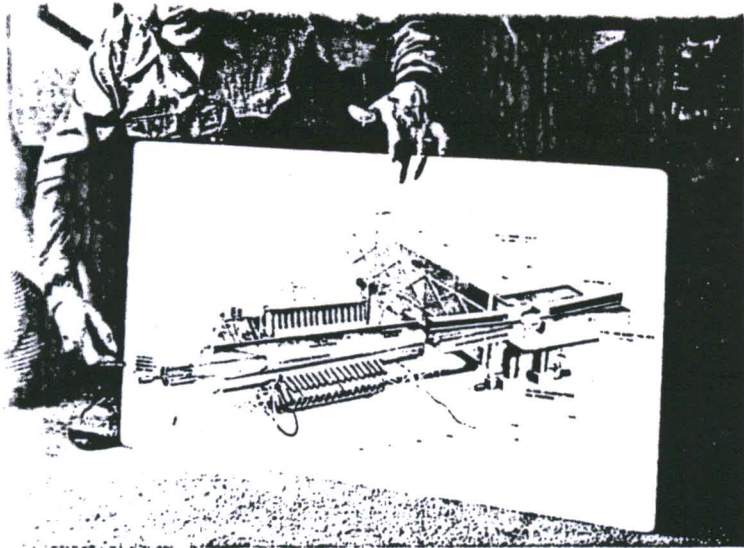
In October, Woodruff signed his post as associate director for defense systems at Livermore, citing, in a letter to Batzel, nearly 10 years of "potentially misleading" X-ray laser appraisal being delivered to "the leaders and policy makers of the Administration."

Woodruff took a lowly post at the lab. After a year, he applied for a more responsible post but was denied it and a pay increase as well. On the door of his windowless Livermore office, sympathetic colleagues hung a sign that said "Gorky West," after the closed Soviet city to which the nuclear physicist Andrei D. Sakharov was exiled.

Last year, a hearing board made up of Livermore scientists convened at Woodruff's request found Livermore had taken unusual reprisals against him, making him an "unperson." In December the laboratory announced that Woodruff had been promoted to head the department of treaty verification, not the equivalent of his former job, but a senior post. A few months later, perhaps coincidentally, Batzel retired.

Teller makes no apology about the affair. "Let me plead guilty to the great crime of optimism," he said this year, after the release of a Congressional report on the episode. The report found that his enthusiasm about Excalibur was generally in line with that of scientists





PETER MENZEL

Cheroni, at home in Los Alamos with plans for laser-fusion research.

ray
ntire
ssile

E.
rnia
the
dely
con-
ams
sted
been
ria"
ays.
sode
omic
ora-
said
ome,
fe's.
nical
in
be
the

ell-
eds
her,
stem
s en-
— a
d to
the
he

all
RE-
the
pons
ques-
ng nu-
ound
ne air
vboy,
ns, a
nd a
his
d he
s the
ears,

the labs and the Energy Department vigorously fought a nuclear test ban, orchestrating campaigns to sway Congress, which has repeatedly voted to limit nuclear tests to all but the smallest. (It has also repeatedly backed down again, under White House pressure.)

At first, arms advocates argued that a ban could not be policed; but seismologists showed that their devices could detect extremely faint rumbles. The next assertion was that explosive testing was essential to insure weapon reliability.

In 1985, the Soviet Union declared a unilateral moratorium on the testing of nuclear weapons and urged the United States to join it, saying such a move would halt the development of new weapons but leave old ones unharmed. The Reagan Administration rejected the Soviet bid, publicizing once-secret data that showed the nation's nuclear arsenal had been plagued by serious problems, including a number of dud tests that were discovered and corrected by nuclear testing. "Over one-third of all nuclear-weapons designs introduced into our stockpile since 1958 have encountered reliability problems, and 75 percent of these were discovered and subsequently corrected thanks to actual explosive testing," declared Caspar W. Weinberger, then the Secretary of Defense.

That argument was dramatically challenged by a 33-page study, parts of which have now been declassified,

that Dr. Kidder prepared last year at the request of Congress. A 32-year Livermore veteran who is a nuclear-weapons-physics expert, Kidder had been responsible for the analysis of atmospheric nuclear blasts in the South Pacific. He is the author of more than 100 secret and top-secret reports as well as scores of unclassified scientific papers. Kidder has a reputation for analytic rigor that has won him the respect of friends and foes alike.

Kidder's report assessed claims that 14 of the nation's 41 weapon designs were beset with problems. He found that these claims had "little if any relevance to the question of maintaining the reliability of the stockpile." Nine of the cited problems, he found, were with weapons that had been rushed into the stockpile during an East-West testing moratorium in the late 1950's and early 1960's. These weapons, he wrote, were "very poorly tested by today's standards." Five other problems occurred in designs dating from the early days of the Reagan Administration, which would never have happened "had they been subjected to the more rigorous standards of nuclear weapon testing that have become routine." He concluded that the issue of reliability is a chimera. "The bombs work," he later said. "You don't need to test them."

Kidder's claim alarms the labs because, among other things, it could bolster arguments saying it is safe to bring the weapon-design



Natural Lunarine Mink

De'Cor

FURS INC.

MORGENSTIEN-HAMMER

KAHN & PINTO

130 WEST 30th STREET, NEW YORK CITY

(212) 563-4877

stockpile can last 60 more years without testing

So what? in 30 years that is great; so

MASTERLOOK: A positive approach for lounging, sitting, and sleeping...truly a masterpiece. Casa Bella's Masterlook by architect Antonio Fiorentino.



CASA BELLA.
INTERNATIONAL
215 E 58 ST NEW YORK 212-688-2020



**Luxurious comforters, pillows
bed linens and beds.**

Our autumn linen sale
is now in progress.

STAIRS?... Who Cares!



Inclinette



"Elevette"

Enjoy using your home advantageously and preserve your health! Install automatic INCLINETTE or "ELEVETTE"! 50 years experience, complete safety-code compliance and engineering service, thousands of satisfied users. Home elevator specialists—colors to match any decor. Tax deductible when recommended by a doctor.

Write for FREE color brochure!

Survey and Estimates without Obligation.

Inclin-ator

521 Fifth Avenue
New York, N.Y. 10115
212-563-0123

378 Liberty St.
Little Ferry, NJ 07643
201-641-8181



Academic rebel: Colorado geophysicist

business to a virtual halt. Administration officials object to the report, calling Kidder inexperienced in such affairs. Livermore published its own 59-page report. But such objections lost some of their punch when Congressman Edward J. Markey, Democrat of Massachusetts, this year made public internal Los Alamos memos written by James H. McNally, until recently a special assistant to the head of weapons technology, warning that the reliability arguments were on "thin ground."

To Kidder, the episode was a vindication of his work and a glimpse behind the bureaucratic veil. "The lab is basically an honest place," he said, as he sat in the wooded backyard of his home. "But it's filled with human beings who are expected to sell programs. I try to give a factual status of programs without the benefit of salesmanship."

CHARLES B. ARCHambeau is the picture of a university don, rail thin, seldom without pipe in hand, often wearing baggy pants, coat and tie, even when traipsing across the Asian outback or the hills near his home in Boulder, Colo. The

track
quake
oil an

Such
to ha
clear
tial.
fense
up to
beau's
Unive
the C
Techn
search
quires
clear
and g
nucle
under
condu
the
Kazak

Arch
the ar
he bro
the R
— the
cheati
bans
larger
his pr
and ex
wise,
before
Govern
Alto
import
weapo
Liver

than those of the same size at the American nuclear test site in Nevada.

The scientific issue flared to political prominence with the arrival of the Reagan Administration, which charged repeatedly that the Soviet Union was violating the 150-kiloton testing limit. In the early 1980's, Archambeau vainly fought for a major revision of the estimation methods. Upset with his increasingly public advocacy, the Defense Department cut his research funding by nearly half and it was rumored that Defense was going to drop him altogether. It wasn't until 1985 that Archambeau prevailed, at a key meeting, sponsored by the Central Intelligence Agency. The panel called for a significant revision in standards of estimation. Pentagon bureaucrats quashed the panel report and called together

new groups. But they too told the Pentagon it was misinterpreting the data.

On Jan. 21, 1986, William J. Casey, then Director of the C.I.A., approved the change, over strong objections from some senior Defense Department officials. The shift, though not as large as Archambeau had advocated, when applied retroactively, greatly reduced the chance that the Soviets had violated the 150-kiloton limit. Indeed, in January 1987 representatives of both Livermore and Los Alamos testified before Congress that the pattern of Soviet testing was generally consistent with treaty compliance.

"I began to despair at various times that the bureaucrats were never going to lose, because they had a tremendous amount of money, a lot of clout, and hid everything," Archambeau said, puffing his pipe. "But we hammered hard enough. It's amazing how fragile they really were in many areas."

Archambeau even won financially, in a roundabout

way. This past July, the MacArthur Foundation of Chicago presented him with one of its "genius" awards, insuring him a hefty supplemental salary for five years.

To Archambeau, the early part of the decade-long struggle shows the ease with which science can be subverted by politics. The final chapter, he said, illustrates the power of committed individuals. "Sometimes you can change the course of the river," he remarked, puffing his pipe.

THE QUIETUDE OF Los Alamos was recently broken by one of its first rebels. P. Leonardo Mascheroni, a physicist, was laid off early this year amid a dispute over a key project known as laser fusion, which seeks to harness the energy that powers the sun, stars, and hydrogen bombs, and which might be used for constructive purposes on earth. He charges that the current approach is doomed to failure, and that the atomic establishment is too set in its ways to admit it.

Mascheroni seemed at least likely of the rebelling comfortably middle class happily ensconced with wife and children in a mountain home on a canyon rim a few miles from the weapons lab. The 53-year-old physicist, born in Argentina of Italian and Hispanic parents, trained at Berkeley, and employed at Los Alamos for nine years, solving atom-bomb riddles.

For a man with no income and great uncertainty about his future, Mascheroni seemed extraordinarily relaxed as he chatted. The physicist, who runs a small business who run afoul of the scientific establishment in this company town have few employment alternatives in the region, increasing the leverage over employees and some accounts making the move overly conservative.

"There's a lot of fear here," Mascheroni said, his smile momentarily fading. "Management may have good intentions, but too many of its decisions are based on politics, not technical merit. We're too is

(Continued on Page 88)

Luxury Homes and Estates



TREES,

illed formal living room, powder room, and wood-burning fireplace with fireplace studio area encl. 4 acres \$1,100,000.



BUCKS COUNTY TWIN SILO FARM
102 Acres

Striking Pre-Revolutionary farm estate has enchanting setting created by lovely English gardens and long distance views of 7 fenced pastures, 2 acre pond and woods. Fieldstone manor home, restored with extraordinary craftsmanship, is a wonderful blend of cherished Bucks County charm seen in LR w/walk-in fireplace, Dr w/open beams and European elegance seen in kitchen with Delft tiles, verde antique marble in master bathroom and fireplaces. Gallery room w/exposed stone walls has French doors onto terrace and pool and leads to music room with cathedral ceiling w/walk-in fireplace. Four lovely bedroom suites. Fieldstone barn, carriage house w/managers apt. and guest apt. swimming pool, tennis court. \$1,100,000.

CLEAR LAKE SUNAPEE WATER



The spring-fed waters of Lake Sunapee are a step away from the beach at Browns Hill Farm; relax on the porch of the turn-of-the-century boat house; or venture out for a sunset boat ride. This purity is enjoyed by a few select property owners. Each property provides spectacular lake and mountain views and is surrounded by 90 acres of conservation land. Town sewer, paved roads, tennis courts.

AMMONTI

YESTERDAY

Make this gorgeous hillside home a dead end town with rolling grounds & garden. 4 BR's; 2 1/2 baths; large outbuilding. Private location with open fields around \$485,000.

COUNTRY, INC. P.O. Box 1137 (802) 257-4646

VILLAGE PRE-WAR CONDO



wood burning fireplace or take in unobstructed views of the World Liberty from this huge, glorious 3 bedroom, 2 bath pre-war condo in a full basement. Correctly priced at \$525,000.

(Res.) 924-7729
212-925-3333

ANT CARTON, INC.

BENWICK & WINTERLING REALTY



PEREGO
LA CLAREN
GRACO

TROLLERS
CAR SEATS
BERS

KID'S HOUSE

Free Catalog
83-0134
MasterCard

ogy Place, #108
Each, FL 33407

Milan



ccomodate
3-13 N-XW.
CENTRE
10022

GLOBES



crafted solid wood
grass meridians
to home or office
available.

10-322-7708
FOR CATALOG
Library, Inc.

by's
V
nes
on

cost over \$1
The question of how to
proceed at this point is ex-
tremely difficult."

Despite the push for diver-
sification, the labs still con-
sider their main mission to be
the design, computer simula-
tion, prototype construction
and explosive testing of new
kinds of nuclear arms. It is a
mission, they say, that will
not go away. Yes it will

Although bomb designers
concede that the world's nu-
clear arsenals will shrink in
the years ahead, and that
domestic atomic scientists
probably tinker with
new designs, they say the
development of individual
weapons will increase be-
cause there will be less pro-
tection afforded by sheer
numbers. Moreover, new
kinds of weapons will be
developed along with changes
in the development of Soviet
and Chinese weapons.

American
weapons merchants
and Russian
weapons merchants
are both expected to
develop new weapons
for the Soviet
Union and China.
The Soviet Union
is expected to develop
new nuclear
weapons, and
China is expected
to develop new
nuclear weapons.

THE
QUESTION IS
HOW TO
PROCEED
AT THIS
POINT IS
EXTREMELY
DIFFICULT.

THE
QUESTION IS
HOW TO
PROCEED
AT THIS
POINT IS
EXTREMELY
DIFFICULT.

what an enemy might be
developing. Moreover, the
work has been done in great
secrecy and with an unusual
degree of freedom from regula-
tion — features that can
free creative minds to make
dazzling breakthroughs but
can also promote all kinds of
bureaucratic ills.

Today, the labs have be-
come the focus of a national
debate over whether they are
routinely violating the truth
on key issues of national se-
curity and, if so, what should
be done about it. U.S. News &
World Report, in an article
this year entitled "Long
Knives in the Laboratory,"
noted that one group of Liver-
more scientists, anxious over
the X-ray laser battle, took
the unusual step of gathering
signatures on a statement as-
serting the lab had "no short-
age of technical credibility
and scientific integrity."


The California Legislature,
which helps oversee the Uni-
versity of California, which
in turn manages Los Alamos
and Livermore for the Fed-
eral Department of Energy,
recently called for the crea-
tion of a team of weapons lab
"overseers" who would have
access to all secret data and
would provide objective in-
formation to members of
Congress and the State
Legislature. — The action,
sponsored by Assemblyman

handful of rebels among thou-
sands of contented lab scien-
tists does not add up to a
crisis. Atom disputes are not
all that uncommon, they say.
What is unusual is the public
airing of disagreements —
something Federal officials
would like to stop. When
Lieut. Gen. James A. Abra-
hamson resigned his post as
Pentagon director of the Star
Wars program recently, for
example, he said only that a
new Administration would
"undoubtedly have different
ideas about S.D.I." and would
best be served by appointing
its own leadership. If he had
objections to the direction
the program was taking, he
wasn't saying so publicly.

But questions about the
health of the nuclear labs are
unlikely to go away. Whether
the rebels' charges are true
or not, it is clear that the
labs are increasingly seen as
partisan rather than objective.
Moreover, the rebellion has
reinforced the image of the
labs as rigid organizations
steeped in secrecy, hesitant
to pursue the truth if it leads
in inconvenient directions
and quick to please political
masters. Unless that percep-
tion changes, the remarkable
autonomy the atom scientists
have enjoyed since the dawn
of the nuclear era is likely to
end. ■

qualities while as-
men and women
varsity and intram-
grams, horseman-
curricular activi-
gram Jr. ROTC. SA
techniques. Com-
Band scholarship
Summer Session
Day students wel-
Hadley, Jr., U.S.A.
5 Miles fr
Write: Director
28 Academy Ave.
NY 12520 Tel: 5

Magnificent thous-
bining scholarship,
vice, business, as w
with desirable tradi-
needed. Near Dart-
horses and indoor
bination academic
tions accepted.
T. Ingham, Verstr



Grades 8 thru 12
riculum — Small C
Abundant Academ-
daily — OUTSTA
Facilities on scen-
Students Admitted
St
Write James
85 Cott

Place
Your
By
Phon
Call
(212)
354-3
OR
1-80
ADTI
8A.M.-7
Monday-
9A.M.-5:3
Saturd
Sund
THE N

*Livermore is close to UofC
Professors have small chance
to succeed*

Solutions to Last Week's Puzzles

STAR	SWAP	SPA	TABARD
LACE	OHARE	CAR	RIATAS
AMOST	DEV	COWARD	FRUITS
TERTIARY	PENCE	IMBUE	
APSE	ALAD	NASAL	
CASTS	ADELA	CHIEFLY	
ARME	HUMID	LENTIL	LIE
LEA	ALAE	BEEN	LENA
ENL	UNCHUNKIST	GNOMES	
BALANCES	EASES	OPART	
METER	TURIN	SIREN	
MAHDI	PAREN	RETARDED	
UNBELT	SHINGMATCH	SRA	
RIAS	ALTO	ADAH	COT
ELLS	UKASES	HOOEY	CEDE
ESSENES	ACORN	TOMES	
BLOYS	TORI	CRAM	
LABOR	TRIMS	TRAIPTSED	
PERIOD	ABABIN	REELANDR	
ASENSE	KIT	NEAPS	RAGE
MEAGER	ESE	GAPE	EPEE

ANNE (RIVERS) SIDONS: PEACHTREE
ROAD — Dalliance and flirtation descended on
them at puberty, these unprepossessing small
girls we had known all our lives; popularity and
coquet became their raisons d'être, and many
of them never yielded up that priority all their
lives.

Exhibit "W"

W

vice in California (hereinafter referred to as the Standards, which shall be effective and binding from and after the date of the order of the Board of Governors of the State Bar of California, effective April 1, 1979.)*

- (7) Whether the fee is fixed or contingent.
- (8) The time and labor required.
- (9) The informed consent of the client to the fee agreement.

ment to accomplish any of the following objectives, nor shall the member do so if he knows or should know that the person solicited for or offering the employment wishes to accomplish any of the following objectives:

- (A) Bring a legal action, conduct a defense, or assert a position in litigation, or otherwise take steps, solely for the purpose of harassing or maliciously injuring any person or to prosecute or defend a case solely out of spite.
- (B) Present a claim or defense in litigation that is not warranted under existing law, unless it can be supported by good faith argument for an extension, modification or reversal of existing law.
- (C) Take or prosecute an appeal solely for delay, or for any other reason not in good faith. (Amended by order of Supreme Court, effective April 1, 1979.)

RULE 2-108. FINANCIAL ARRANGEMENTS AMONG MEMBERS.

A member of the State Bar shall not divide a fee for legal services with another person licensed to practice law who is not a partner or associate in the member's law firm or law office, unless:

- (1) The client consents in writing to employment of the other person licensed to practice law after a full disclosure has been made in writing that a division of fees will be made and the terms of such division; and
- (2) The total fee charged by all persons licensed to practice law is not increased solely by reason of the provision for division of fees and does not exceed reasonable compensation for all services they render to the client.

RULE 2-111. WITHDRAWAL FROM EMPLOYMENT.

- (A) In general.
 - (1) If permission for withdrawal from employment is required by the rules of a tribunal, a member of the State Bar shall not withdraw from employment in a proceeding before that tribunal without its permission.
 - (2) In any event, a member of the State Bar shall not withdraw from employment until he has taken reasonable steps to avoid foreseeable prejudice to the rights of his client, including giving due notice to his client, allowing time for employment of other counsel, delivering to the client all papers and property to which the client is entitled, and complying with applicable laws and rules.
 - (3) A member of the State Bar who withdraws from employment shall refund promptly any part of a fee paid in advance that has not been earned. However, this rule shall not be applicable to a true retainer fee which is paid solely for the purpose of insuring the availability of the attorney for the matter.
 - (4) If upon or after undertaking employment, a member of the State Bar knows or should know that the member ought to be called as a witness on behalf of the member's client in litigation concerning the subject matter of such employment, the member may continue employment only with the written consent of the client given after the client has been fully advised regarding the possible implications of such dual role as to the outcome of the client's cause and has had a reasonable opportunity to seek the advice of independent counsel on the matter. In civil proceedings, the written consent of the client shall be filed with the court not later than the commencement of trial. In criminal proceedings, the written consent need not be filed with the court but the member has the duty, before testifying, of satisfying the court that such consent has been obtained from the client if representing the defendant. The member may continue employment and the client's consent need not be obtained in the following circumstances:
 - (a) If the member's testimony will relate solely to an uncontested matter; or

Court, effective April 1, 1979. SECTION 27.108. FINANCIAL ARRANGEMENTS AMONG MEMBERS THROUGH THE STATE BAR.

Court, effective February 1, 1979.

Court, effective April 1, 1979. SECTION 27.109. AGREEMENTS RESTRICTING THE PRACTICE OF A MEMBER OF THE STATE BAR.

the State Bar shall not enter into an agreement or collect an illegal fee when it is so exorbitant as to be beyond the reasonable expectations of the community. Reasonableness of circumstances existing at the time the fee will be affected shall be considered, and the reasonableness of a fee shall be determined on the basis of the difficulty of the service to be performed.

RULE 2-109. AGREEMENTS RESTRICTING THE PRACTICE OF A MEMBER OF THE STATE BAR.

- (A) A member of the State Bar shall not be a party to or participate in an agreement, whether in connection with the settlement of a lawsuit or otherwise, if the agreement restricts the right of a member of the State Bar to practice law.
- (B) Nothing in subdivision (A) of this rule shall be construed as prohibiting such a restrictive agreement which:
 - (1) is a part of an employment or partnership agreement between members of the State Bar provided said restrictive agreement does not survive the term of said partnership or employment; or
 - (2) requires payments to a member of the State Bar upon his permanent retirement from the practice of law.

RULE 2-110. ACCEPTANCE OF EMPLOYMENT.

A member of the State Bar shall not seek or accept employment to accomplish any of the following objectives, nor shall the member do so if he knows or should know that the person solicited for or offering the employment wishes to accomplish any of the following objectives:

the difficulty of the service to be performed.

if apparent to the client the particular employment by the lawyer.

involved and the results obtained in the performance of the services.

length of the professional service to be performed.

reputation, and ability to perform the services.

minimum Standards for a member of the State Bar shall not seek or accept employment to accomplish any of the following objectives, nor shall the member do so if he knows or should know that the person solicited for or offering the employment wishes to accomplish any of the following objectives:

RULES OF PROFESSIONAL CONDUCT

Exhibit U

ber of the St
et that is ill
er these Ri
e State Bar A

(3) A member of the State Bar or the member's firm may include employees not members of the State Bar in a retirement plan, even though the plan is based in whole or in part on a profit-sharing arrangement.

nders it unre
of the State

(H) A member of the State Bar shall not compensate or give or promise anything of value to any person or entity for the purpose of recommending or securing employment for the member or the member's firm by a client, or as a Steward for having made a recommendation resulting in employment of the member or the member's firm by a client. A member's offering of or giving a gift or gratuity under the State Bar resulting in the employment of the member or the member's firms, shall not of itself violate this rule, provided that the gift or gratuity was not offered in consideration of any promise, agreement or understanding that such a gift or gratuity would be forthcoming or that referrals would be made or encouraged in the future. (Amended by order of Supreme Court, effective October 1, 1979.)

(I) A member of the State Bar shall not compensate or give or promise anything of value to any representative of the client likely to be used in the press, radio, television or other communication medium in anticipation of or in return for publicity of the member, the member's firm, or any other attorney as such in a news condition, but the incidental provision of food or beverages out the employment shall not of itself violate this subdivision. (Amended by order of Supreme Court, effective April 1, 1979.)

3-103. FORMING A PARTNERSHIP WITH A LAWYER.

A member of the State Bar shall not form a partnership with a person not licensed to practice law if any of the activities of the partnership consist of the practice of law.

4-101. ACCEPTING EMPLOYMENT ADVERSE TO A CLIENT.

A member of the State Bar shall not accept employment from a client or former client, without the informed and written consent of the client or former client, relating to a matter in which he has obtained confidential information by reason of or in the course of his employment by the client or former client.

5-101. AVOIDING ADVERSE INTERESTS.

A member of the State Bar shall not enter into a business transaction with a client or knowingly acquire an ownership, beneficial, security or other pecuniary interest adverse to a client, unless (1) the transaction and terms in which the member of the State Bar acquires the interest are fair and reasonable to the client and are fully disclosed and transmitted in writing to the client in a manner and terms which should have reasonably been understood by the client, (2) the client is given a reasonable opportunity to seek the advice of independent counsel of his own choice before the client's choice of the transaction, and (3) the client consents in writing thereto.

5-102. AVOIDING THE REPRESENTATION OF ADVERSE INTERESTS.

(A) A member of the State Bar shall not accept professional employment without first disclosing his relationship, if any, with the adverse party, and his interest, if

any, in the subject matter of the employment. A member of the State Bar who accepts employment under this rule shall first obtain the client's written consent to such employment.

(B) A member of the State Bar shall not represent conflicting interests, except with the written consent of all parties concerned.

RULE 5-103. PURCHASING PROPERTY AT A PROBATE, FORECLOSURE OR JUDICIAL SALE.

A member of the State Bar shall not directly or indirectly purchase property at a probate, foreclosure or judicial sale in an action or proceeding in which such member or any partner or associate of such member appears as attorney for a party or is acting as executor, trustee, administrator, guardian or conservator.

As used in this rule, the term "associate" means an employee or fellow employee who is a member of the State Bar.

RULE 5-104. PAYMENT OF PERSONAL OR BUSINESS EXPENSES INCURRED BY OR FOR A CLIENT.

(A) A member of the State Bar shall not directly or indirectly pay or agree to pay, guarantee, or represent or sanction the representation that he will pay personal or business expenses incurred by or for a client, prospective or existing and shall not prior to his employment enter into any discussion or other communication with a prospective client regarding any such payments or agreements to pay; provided this rule shall not prohibit a member:

- (1) with the consent of the client, from paying or agreeing to pay to third persons such expenses from funds collected or to be collected for the client; or
- (2) after he has been employed, from lending money to his client upon the client's promise in writing to repay such loan; or
- (3) from advancing the costs of prosecuting or defending a claim or action or otherwise protecting or promoting the client's interests. Such costs within the meaning of this subparagraph (3) shall be limited to all reasonable expenses of litigation or reasonable expenses in preparation for litigation or in providing any legal services to the client.

(B) Nothing in Rule 5-104 shall be deemed to abrogate any of the provisions set forth in Rules 5-101 through 5-103.

(C) Nothing in this Rule 5-104 shall prohibit a member of the State Bar from reading or showing this Rule to a prospective client and describing the nature and extent of the conduct prohibited by this rule.

RULE 5-105. COMMUNICATION OF WRITTEN SETTLEMENT OFFER.

A member of the State Bar shall promptly communicate to the member's client all amounts, terms and conditions of any written offer of settlement made by or on behalf of an opposing party. As used in this rule, "client" includes a person employing the member of the State Bar who possesses the authority to accept an offer of settlement, or, in a class action, who is a representative of the class. (Added by order of Supreme Court, effective March 15, 1979.)

PROFESSIONAL CONDUCT

Exhibit
2

8835 Balboa Avenue
San Diego, CA 92123

April 11, 1983

Dr. Raymond C. O'Rourke
7949 Lowry Terrace
La Jolla, California 92037

Dear Ray:

I was very disappointed that you did not show up last Friday at our pre-arranged meeting, and that you did not call me thereafter as you said you would during our subsequent telephone conversation. I was simply responding to a telegram from you "demanding" that we deal with the 13,500 shares of Maxwell stock which is owned by the two of us as part of the Rorack assets.

I will reiterate my willingness to cooperate with you at any time to evenly divide these Maxwell shares, so that we can independently do whatever we wish with our respective shares.

Dave Evans has the papers which must be signed in his office, and he can also arrange to have our signatures guaranteed, which is a legal requirement, according to my understanding of the necessary procedures.

Whenever you want to proceed, you can call me (or Mrs. Jaro) to arrange a time to get together with Dave, or we can meet with Dave separately to sign the documents--whichever you desire.

I would also remark that dealing with the 13,500 shares, a matter which your telegram to me indicated was an urgent matter from your point of view, does not terminate the legal existence of Rorack or imply any distribution of the other remaining assets.

This morning, just as I was about to mail you this letter, I received another telegram from you which I can only interpret as meaning that you and Albert have less than ideal communication. Last Thursday your son talked to Mrs. Jaro in my absence relative to meeting with you in order to act with you to evenly distribute the

Dr. Raymond C. O'Rourke
April 11, 1983
Page 2

2

Maxwell stock to you and to me. It was he (not me) who said that we could meet at 9:00 a.m. Friday, April 8. Mrs. Jaro asked him if she could confirm this meeting with me. He said yes. I am attaching a copy of my telegram to you with this letter since I am not certain what you see and don't see. In view of the above, and referring to your telegram to me today, your implication in that telegram that the misunderstanding Friday morning was mine is not related to reality. To summarize in a few words:

April 7, 1983, 3:55 p.m. - Telegram received by Kolb signed by Raymond C. O'Rourke. Demands that Kolb contact Ray O'Rourke in regard to Rorack position of 13,500 Maxwell shares. Also renews "threat" to file suit if necessary.

April 7, 1983, 4:49 p.m. - Telegram sent by Kolb to Ray O'Rourke indicating readiness to have Rorack shares evenly distributed and suggesting a meeting at Bateman, Eichler's office at O'Rourke's convenience.

April 7, 1983, 5:00 p.m. - Mrs. Jaro called the O'Rourke residence to confirm that Dr. O'Rourke received the telegram. Mrs. O'Rourke answered the phone and said, "Yes, Myrna, we have the telegram."

April 7, 1983, 5:15 p.m. - Al O'Rourke called Mrs. Jaro. Al O'Rourke said, "Alan wants to meet with my Dad?" Mrs. Jaro answered, "Yes, at his convenience." Al O'Rourke then said that Dr. O'Rourke could meet with Dr. Kolb in Dave Evans' office at 9:00 a.m. on Friday, April 8. To make sure there would be no confusion or misunderstanding, Mrs. Jaro then asked, "Can I confirm that time to Dr. Kolb?" Al O'Rourke answered, "Yes."

Finally, I would respectfully request that you read and thoughtfully review any and all letters or telegrams which your son sends to me or anyone else on your behalf, or under your signature. I ask you this because

2

Dr. Raymond C. O'Rourke
April 11, 1983
Page 3

you repeatedly told me that Albert acts for you without your close supervision and that his inflammatory language isn't what you really mean, but "that is the way lawyers talk." As an example, on Friday you said you had no knowledge of a telegram sent to me under your name. Accordingly, I read to you the telegram which you sent to me--a set of circumstances which I find to be strange, indeed.

Nevertheless, as I have stated above, I am prepared to cooperate with you at any time regarding the even distribution to each of us of the Maxwell stock held by Rorack.

Very truly yours,



Alan C. Kolb

ACK:mj

Enclosure

Plaintiff's Exhibit (a)

AGREEMENT OF LIMITED PARTNERSHIP

THIS AGREEMENT OF LIMITED PARTNERSHIP, made as of the 1st day of January, 1968, by and among COMPUTRAD, INC., a Delaware corporation (hereinafter sometimes referred to as the General Partner), and WILBUR D. MAY, FRANK W. CLARK, JR., VERNON H. BLACKMAN, JAMES Y. CAMP, JACK KRAMER, WALTER R. HILKER, JR., OMAR J. FAREED, N. MATTHEW GROSSMAN, STANLEY L. BAUER, MARK TOWNSEND, STANLEY J. GOODMAN, EDWIN C. Mc DONALD, JOHN F. O'HARA, WARD N. ALBERT, and PARKER, MILLIKEN, KOHLMEIER, CLARK & O'HARA, a partnership (hereinafter sometimes referred to as Limited Partners). Wherever reference is made herein to "partners," it shall mean the General Partner and the Limited Partners, unless otherwise specified herein.

Intending to be legally bound hereby, the parties agree to operate a limited partnership business under the laws of the State of California, under the following terms and conditions:

ARTICLE I

Formation of Limited Partnership

1. The parties hereto form a limited partnership pursuant to the Uniform Limited Partnership Act of the State of California.
2. The parties shall forthwith execute a Certificate of Limited Partnership and cause the same to be filed in all places required pursuant to said Uniform Limited Partnership Act.

ARTICLE II

Name, Character, Place of Business, and Term of Partnership

1. The business of the partnership shall be conducted under the firm name of MONTGOMERY STREET ASSOCIATES.
2. The purpose of the partnership shall be to engage in the investment business in all its phases, and for all purposes incident thereto.
3. The principal place of business of the partnership shall be at 2020 Research Drive, Livermore, California 94550, but additional places of business may be located at those locations as may from time to time be agreed upon by all of the partners.
4. The partnership term shall commence on the 1st day of January, 1968, and shall terminate upon the 30th day of June, 1969.

ARTICLE III

Capital Contributions, Accounts and Withdrawals

1. The General Partner shall contribute the sum of \$100.00 cash to the capital of the partnership.
2. Each of the Limited Partners shall make the following contributions in cash to the capital of the partnership:

<u>Name</u>	<u>Amount</u>
Wilbur D. May	\$ 4,000.00
Frank W. Clark, Jr.	4,000.00
Vernon H. Blackman	4,000.00

James Y. Camp	\$ 4,000.00
Jack Kramer	4,000.00
Walter R. Hilker, Jr.	1,000.00
Omar J. Fareed	1,000.00
N. Matthew Grossman	1,000.00
Stanley L. Bauer	1,000.00
Mark Townsend	1,000.00
Stanley J. Goodman	1,000.00
Edwin C. Mc Donald	1,000.00
John F. O'Hara	1,000.00
Ward N. Albert	1,000.00
Parker, Milliken, Kohlmeier, Clark & O'Hara	6,000.00
	<hr/>
	\$35,000.00
	<hr/> <hr/>

3. Each partner, General or Limited, may make additional contributions to the capital of the partnership in such amount as may from time to time be agreed upon by all of the partners.

4. No withdrawal may be made by any partner, General or Limited, from his capital account, unless all of the partners shall approve such withdrawal. No withdrawal shall be made by the personal representative of any partner, General or Limited, without the consent of all the partners in the event of the withdrawal, retirement, death or disability of any partner.

5. An individual capital account shall be maintained for each partner.

ARTICLE IV

Duties, Powers and Other Matters Relating to the Partners

1. The General Partner shall conduct the partnership business. Checks shall be drawn on the partnership bank account or bank accounts and shall be signed by the person or persons so designated by the General Partner.
2. The General Partner shall receive no salary.
3. The Limited Partners shall not take part in the management of the business or transact any business for the partnership, and they shall have no power to sign for or bind the partnership. No salary shall be paid to any Limited Partner.

ARTICLE V

Profits and Losses

1. The net profit or net loss of the partnership shall be determined in accordance with approved and accepted accounting practices. The fiscal year of the partnership shall commence with the first day of the aforesaid term and end on December 31st.
2. Subject to the provisions of Sections A and B of this Paragraph 2, the General Partner shall be credited with 25% of the profits of the partnership and shall be charged with 25% of the losses of the partnership. The Limited Partners shall be credited with 75% of the profits of the partnership and shall be charged with 75% of the losses of the partnership, which said profits and losses shall be divided among the said Limited Partners in the proportion that the capital contributions set forth opposite the name of each such Limited Partner in Article III of this Agreement shall bear to

the total capital contributions of all the Limited Partners set forth in said Article III. The partnership shall establish and maintain a capital account for the General Partner and each of the Limited Partners, and the net profits or the net losses shall be credited or charged, as the case may be, on a daily basis to such capital account. The net profits may not be distributed to the Partners prior to the termination of this partnership without the consent of the General Partner. The foregoing provisions of this Paragraph 2 are specifically subject to the following:

A. When the General Partner shall have no credit balance in its capital account and there shall be credit balances in the capital accounts of the Limited Partners, all losses up to the amount of said credit balances of said Limited Partners shall be debited to the capital accounts of the Limited Partners, to be divided among said Limited Partners in the proportion that the capital contribution set forth opposite the name of each such Limited Partner in Article III of this Agreement shall bear to the total capital contributions of all of the Limited Partners as set forth in said Article III of this Agreement.

B. When any losses shall be charged to the Limited Partners as set forth in Section A of this Paragraph 2, there shall thereafter be credited to the capital accounts of the Limited Partners that amount of profit which shall be necessary to offset such losses which shall theretofore have been debited to the capital accounts of the Limited Partners as set forth in said

Section A and not previously offset as set forth in this Section B. All credits to the capital accounts of the partners as set forth in this Section B shall be divided among said Limited Partners in the proportion that the capital contributions set forth opposite the name of each such Limited Partner in Article III of this Agreement shall bear to the total capital contributions of all of the Limited Partners as set forth in said Article III of this Agreement.

3. No Limited Partner shall be personally liable for any of the debts of the partnership or any of its losses beyond the amount originally contributed by him to the capital of the partnership, anything to the contrary herein inferable notwithstanding.

ARTICLE VI

Dissolution of Partnership

Upon the dissolution of the partnership the partnership shall be liquidated and its business wound up, its liabilities and obligations to creditors shall be paid, and its assets, or the proceeds of their sale, shall then be distributed to each of the partners, General and Limited, in proportion to his or its respective share of all of the capital accounts of the partnership.

ARTICLE VII

The General Partner

1. The General Partner shall manage the business and assets of the partnership, but may not, without the consent of the other Partners:

A. Assign, transfer, or pledge any of the claims of or debts due to the partnership except upon payment in full, or arbitrate or consent to the arbitration of any disputes or controversies of the partnership.

B. Make, execute, or deliver any assignment for the benefit of creditors or any bond, confession of judgment, chattel mortgage, deed, guarantee, indemnity bond, surety bond, or contract to sell or contract of sale of all or substantially all of the property of the partnership.

C. Lease or mortgage any partnership real estate or any interest therein or enter into any contract for such purpose.

D. Pledge or hypothecate or in any manner transfer his interest in the partnership, except to parties to this Agreement.

E. Become a surety, guarantor, or accommodation party to any obligation except for partnership business.

ARTICLE VIII

Miscellaneous

1. The partnership shall not be dissolved by the retirement, death or incapacity of a Limited Partner.

2. No Limited Partner may assign his interest in the partnership or pledge or otherwise encumber such interest, or substitute another person for himself as Limited Partner hereunder.

3. The General Partner shall not be liable, responsible or accountable in damages or otherwise to the Limited Partners for any action or failure to act by it in good faith in connection with the partnership and its operation, and no Limited Partner shall be entitled to recover from the General Partner the amount of any partnership losses which are charged to the account of such Limited Partner.

4. The partnership is formed under, and this Agreement shall be governed by and construed in accordance with the laws of the State of California.

5. The provisions hereof shall in all respects bind and inure to the benefit of the parties hereto and their respective heirs, executors, administrators and assigns.

6. This Agreement may be signed in several counterparts, all of which taken together shall constitute an original instrument.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hands and seals on the day and year first hereinabove written.

COMPUTRAD, INC.,
a Delaware corporation

SEAL

By William H. Mewster, President

General Partner

Wilbur D. May
Wilbur D. May, Jr., Attorney in Fact
Wilbur D. May

Frank W. Clark, Jr.
Frank W. Clark, Jr.

Vernon H. Blackman
Vernon H. Blackman

James Y. Camp
James Y. Camp

Jack Kramer
Jack Kramer

Walter R. Hilker, Jr.
Walter R. Hilker, Jr.

Omar J. Fareed
Omar J. Fareed

N. Matthew Grossman
N. Matthew Grossman

Stanley L. Bauer
Stanley L. Bauer

Mark Townsend
Mark Townsend

Stanley J. Goodman
Stanley J. Goodman

Edwin C. McDonald
Edwin C. McDonald

John F. O'Hara
John F. O'Hara

Ward N. Albert
Ward N. Albert

PARKER, MILLIKEN, KOHLMEIER,
CLARK & O'HARA, a partnership,

SEAL

By John B. Miller
Limited Partners

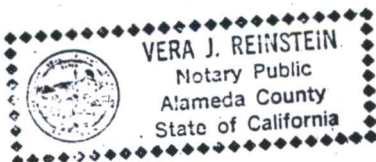
STATE OF California)
COUNTY OF Alameda) ss.

On March 22nd, 1968, before me, the undersigned, a Notary Public in and for said State, personally appeared William H. McMaster known to me to be the President of the corporation that executed the within Instrument, known to me to be the person who executed the within Instrument on behalf of the corporation therein named, and acknowledged to me that such corporation executed the within instrument pursuant to its By-Laws or a resolution of its Board of Directors.

WITNESS my hand and official seal.

Vera J. Reinstein
Notary Public in and for said State.
VERA J. REINSTEIN
My Commission Expires _____ My Commission Expires May 23, 1971

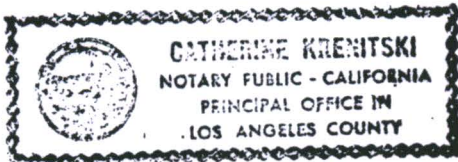
SEAL



STATE OF CALIFORNIA)
) SS:
COUNTY OF LOS ANGELES)

On February 16, 1968, before me, the undersigned, a Notary Public in and for said State, personally appeared FRANK W. CLARK, JR., VERNON H. BLACKMAN, JAMES Y. CAMP, JACK KRAMER, WALTER R. HILKER, JR., OMAR J. FAREED, N. MATTHEW GROSSMAN, STANLEY L. BAUER, MARK TOWNSEND, JOHN F. O'HARA and WARD N. ALBERT, known to me to be the persons whose names are subscribed to the within instrument and acknowledged that they executed the same.

WITNESS my hand and official seal.



SEAL

Catherine Krenitski
Notary Public in and for said State.

My Commission Expires JAN 24 1971

STATE OF *Missouri*
City
COUNTY OF *St. Louis*

On February 22, 1968, before me, the undersigned, a Notary Public in and for said State, personally appeared STANLEY J. GOODMAN, known to me to be the person whose name is subscribed to the within instrument and acknowledged that he executed the same.

WITNESS my hand and official seal.

Karen D. Deard
Notary Public in and for said State.

SEAL

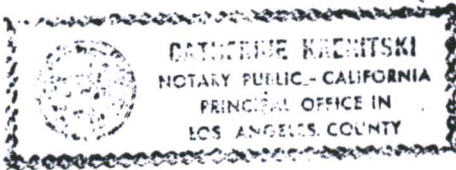
My Commission Expires July 14 1971

This act performed in the City of St. Louis which adjoins St. Louis County, for which I was commissioned.

STATE OF CALIFORNIA)
) SS:
COUNTY OF LOS ANGELES)

On February 16, 1968, before me, the undersigned, a Notary Public in and for said State, personally appeared JOHN B. MILLIKEN, known to me to be one of the partners of the partnership that executed the within instrument, and acknowledged to me that such partnership executed the same.

WITNESS my hand and official seal.



Catherine Krentski
Notary Public in and for said State.

S E A L

My Commission Expires Jan 24 1971

STATE OF CALIFORNIA)
) SS:
COUNTY OF LOS ANGELES)

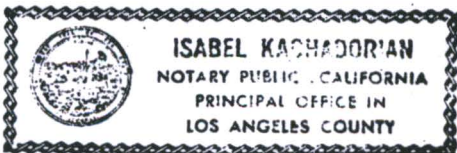
On February 27, 1968, before me, the undersigned, a Notary Public in and for said State, personally appeared EDWIN C. Mc DONALD, known to me to be the person whose name is subscribed to the within instrument and acknowledged that he executed the same.

WITNESS my hand and official seal.

Isabel Kachadorian
Notary Public in and for said State.

S E A L

My Commission Expires November 6, 1970



STATE OF CALIFORNIA)
) ss.
COUNTY OF LOS ANGELES)

On February 14, 1968, before me, the undersigned, a Notary Public in and for said State, personally appeared FRANK W. CLARK, JR., known to me to be the person whose name is subscribed to the within instrument, as the Attorney in fact of WILBUR D. MAY, and acknowledged to me that he subscribed the name of Wilbur D. May thereto as principal and his own name as Attorney in fact.

WITNESS my hand and official seal.

SEAL



Isabel Kachadorian
Notary Public in and for said State.

My Commission Expires November 6, 1970

Exhibit (b)

1/12/67

4300 University Rd
Lundgren
ad.

Dear Frank,

It has been many moons since we ^{last} broken bread and shared the joys - since it seems unpredictable when our paths cross I thought a previous report was in order. I will definitely be in NYC at a Physical Society Meeting for the week beginning 1/30/67. Will you be in NY then?

Trading in Soybeans has been held up because Bill came down with a serious case of pneumonia and is still in bed.

I have some smutz on the companies you asked me about:

Conductron

This outfit was organized (roughly 7 yrs ago) by several people who were connected with The University of Michigan, where I got my Ph.D. Roy O'Rourke was a classmate of Kip Siegle who is the President and dynamic behind this thing. I also talked to Dr. Peter Franken who just recently became Deputy Director of ARPA (Advanced Research Projects Agency), after taking leave of the Physics Dept. in Ann Arbor. Peter is a current friend of Kip, having entertained him at his home some two weeks ago. I also talked to Dr. Alex Glass who ran the laser program for IDA (Institute for Defense Analysis) here in D.C. Glass is now working at NRL in my Division. He has general knowledge of Conductron's reputation and technical capability. From these people I construct the following picture - which is certainly incomplete, but which may convey the flavor.

Siegle has lots of faults and lots of attributes, but the attributes win over the faults. He was formerly a full time Professor in the Electrical Eng. Dept. and was successful in that role. At one point he lectured in the Physics Dept. and was not accepted in the Dept (according to Franken). He does not have a PhD and he worries about this. At present he has a 1/10 time professorship and likes to be called professor (his secretary answers the phone "Prof. Siegle's Office" and this irritates the faculty. In other words Siegle needs (emotionally) an image)

During the first year Kip put \$3K into a plush office, a fact which annoyed some people in the early days. I am also told the first year's balance sheet showed 35K in the black, which is great except that some 200K showed up in

②

the asset column as "unrecoverable Research Assets". They counted a good chunk of their starting up and development costs as an asset.

They have stopped that sort of Mickey Mouse and now have a solid reputation for honesty.

When the outfit was born, Dale Grimes (from the University) pushed the use of Ferrites as a radar absorbing material. I don't know the original financial deal, but I think Paramount Pictures put up much of the cash. Grimes has since left to return to University life. There was no trouble - he enjoyed his stint with Conduction.

Wes Vivian was another key man early on. He also came out of the EE Dept. Franken collaborated with him in bouncing light off the moon (plus other games) and I think highly of his ability. He left to become a Congressman. Vivian was a V.P.

Lou Cutrone is another ex-professor who is now a V.P. He has a reputation for being a damn good engineer.

Another key fact is that "lots" of Michigan people are consulting. The University encourages this sort of thing. They would like Ann Arbor to be another Rt 128 (near MIT) or Palo Alto (near Stanford) and show the voters that research pays off for the state. There is no doubt that there is a lot of talent in Ann Arbor.

Conduction's interests are Electromagnetically oriented. They are involved in all kinds of optical systems, holography, data converters, i.e. digital to graphic converters, high speed data printers, wide band amplifiers. They seem to be aiming at optical data processing in general. This does not exhaust their range of interest. Kip Siegle will go anywhere that looks interesting and profitable. There is significant production - this is not just an R&D outfit.

Franken tells me that all the key people (and Junior people) that he has talked to "like the outfit and are enthusiastic about future possibilities." They think Kip is great (in spite of his personal "faults") and have a "profound respect for him" [The quotes are Franken's exact words] "When the chips are down Kip produces. He is a terrific salesman and a great innovator." Peter never heard of anyone leaving Conduccion because they were unhappy. Siegle leaves his tech people alone to solve their problems.

Siegle has sold 80% of his stock to McDonald Aircraft, who may now be the largest stock holder.

If you want more information I can get it through Ray and Peter. However, before I go much further I would have to tell them the motives.

This company looks like a winner.

SANDERS ASSOCIATES

This organization is growing very fast! The stock went from \$35 → ~\$55 this last year and is probably cheap (or at least a good buy) at the present price. They did around \$65 million last year and are projecting \$125 million this year. I understand that they did \$26 million in the first quarter and see no difficulty in exceeding the projection. Most, if not all, of their physical plant is being expanded to handle this growth. Rumor has it that they are planning for, and fully expect, to do \$250 million a year or two down the road. There are roughly 6000 employees.

Sanders has concentrated on electronic counter measures for the Navy, and military systems in general. Because of the use of SAM missiles in Vietnam this is big business They are interested in all kinds of radar, communications and have a real future in the military business They are in the club now and are getting their share of the action. Recently they set up a new Oceanographic Laboratory, which is a fast growing technical area.

From all I hear the technical staff is first class and enjoys a fine reputation.

On the negative side: they seem to do poorly in commercial ventures. Their venture into printed electronic circuitry is losing money ("Flexprint"). The management seems to have trouble mixing commercial and military business under one roof [EG&G has the same problem by the way]

The business was set up by technical people who ~~that~~ ignored established management principles. There are lots of separate operations and a helter skelter environment exists. They have become successful by taking BIG gambles, i.e. Sell systems before they are developed. However, the technical people seem good enough to come across with the goodies. They appear to really know military requirements

It is typical for one group to steal a technician or engineer from another group within the company. Certain top people are ready to quit all the time. [This is just the opposite of the Conduction environment]

Anyhow this seems to be a success story with or without sensible management practice. Sanders has the ambition to catch Raytheon in his lifetime, and at the rate these guys are going they may do it - \$100 million worth of electronics is a lot of electronics, especially when the business is doubling every year or two. I can't predict where they might saturate, especially since the requirements for military radars etc. are increasing rapidly.

My sources for this information were a Patent Attorney who has friends in the company and a personal friend in the microwave business who has seen the Sanders operation up close.

Textronix

They looked good 1 1/2 years ago when they had the fast oscilloscope market sewed up and had no real competition. Since then Hewlett Packard and Fairchild Camera are strong competitors (for some applications their scopes are better than Textronix) this opinion is shared by engineers working for me and Ray and a friend of Ray's who is in charge of planning

and acquisitions for Phelps-Dodge. Tektronix may be up to something else - I don't know. My impression is that they are fat and lazy (conservative) after years of being the only source for good oscilloscopes. I would guess that this company has passed its time for rapid growth.



Turning now to Maxwell. Carder is now projecting over 600K for Maxwell this Fiscal year. The system business is really booming. Another 120K capacitor bank for SANDIA now seems a sure thing. EGG will almost surely follow on with another 175K capacitor bank in June or July. We should do ~100K in Fitch's spiral generator (a sort of high voltage capacitor) this year. The capacitor sales are steady, but with the increased demand for systems using capacitors we expect that production will be increasing. They have not yet ironed out all the technical problems for high voltage capacitors. However, with follow on Gov't development contracts these problems should be solved on someone else's nickel. I am encouraged that Maxwell will be a leader in the pulsed energy game. There is already a good reputation in the technical community and we are attracting good people into the organization. A profitable operation at the million dollar level seems like a reasonable goal for this time next year.

Back to Soybeans

The computer program is completely debugged and can be used to trade as soon as Bill is out of bed. We are proceeding to set up the Corporation - to be called COMPUTRAD. Our plan is to build up to 10-\$5K games (total \$50,000) as soon as possible. We have \$25K in the bank ready to go and will start with \$10K to get a feeling for the thing. Hopefully we could go from \$25K to \$50K during late Feb. or March. During the next 6 mos we are going to analyze the trading patterns of other commodities and perhaps some swinging stocks. We want to analyze how much capital we might be needing in the next year or two. Our feeling is to use the soybeans as an exercise in getting our feet wet before we make final plans for absorbing large amounts of capital. If and when it appears that this is PIB (ASINO), then we can proceed with partnerships and all the rest. In the mean time you and Jim^{David} are invited to explore soybeans with us in order to get a feeling for the future possibilities. I can raise another 20K_{for soy beans} but will not do so until you decide whether or not you want to make a token investment on a 50-50 basis after expenses. Expenses should be covered from the profits of one or two of the ten games (each game is \$5K) We still like the idea of C partnerships if it is

established that substantial capital will be required to exploit these ideas. We believe that will be the case.

Ray and I could repay you the \$5K debt now but would appreciate more time while our lives stabilize - if that is not inconvenient for you. In any case, that loan is ^{now} covered by Ray's E6:6 stock - no matter what happens to our soybean venture.

That about winds up the thoughts I wanted to pass on.

If you can give me enough notice I could meet with you on your NY trips to tie up one thing or another. This month I am busy on the 16-18th - other than that my nights are clear.

Best regards

Alan