

Semiconductor Family Tree

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By DON C. HOEFLER

SAN FRANCISCO. — As Fairchild Semiconductor has again bit the bullet, through loss of the sixth and seventh of its original eight founders, seasoned observers throughout the industry once again have had reason to wonder if the teenage semiconductor business, spawned by Bell Telephone Laboratories in 1952, ever will exhibit signs of stable maturity.

With the departure of Drs. Robert Noyce as group vice-president, and Gordon Moore as R&D director, the remaining Fairchild founder is Julius Blank, special assistant to general manager Thomas H. Bay.

Four of the original eight left in 1961 to form Amelco Semiconductor. Dr. Victor Grinich left Fairchild Instrumentation this spring to return to the academic community. Now Drs. Noyce and Moore have raised the defection percentage to 87.5.

Fairchild Spinout Significant.

Fairchild was by all odds the most significant spinout in the 16-year history of the industry, having come from Shockley Transistor

which in turn spun out of Bell Telephone Laboratories. Fairchild itself has spawned many firms, in instruments and production equipment as well as semiconductors, the major spinouts being Rheem Semiconductor (now Raytheon), Amelco Semiconductor (division of Teledyne, Inc.), Signetics Corp. (subsidiary of Corning Glass Works), General Microelectronics (now Philco-Ford), and Molectro Corp. (now absorbed into National Semiconductor Corp.).

Begat Others.

Those spinouts in turn gave birth to other new ventures, including Union Carbide Electronics; Intersil, Inc.; American Micro-Systems and Electronic Arrays, Inc., all formed by ex-Fairchild people. Now Isy Haas and Robert Norman, also former Fairchilders, are forming companies.

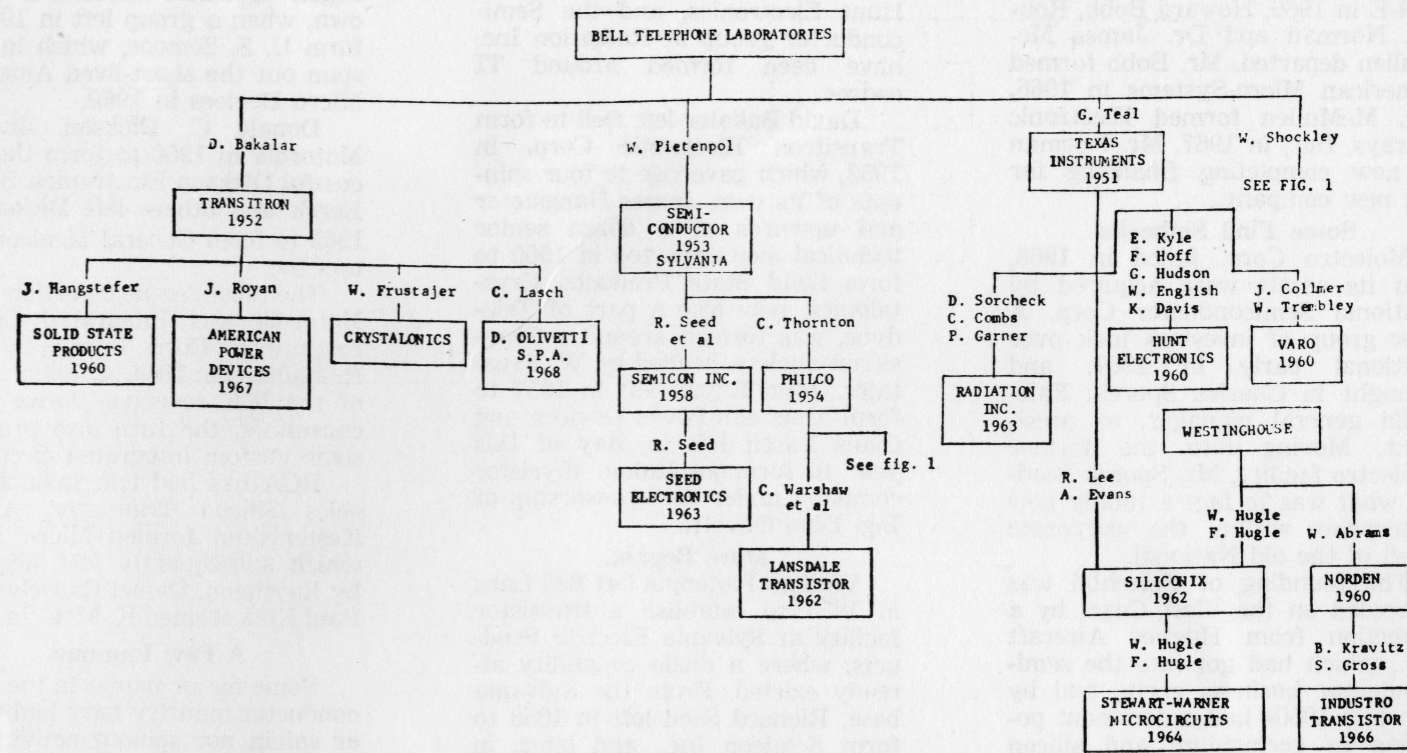
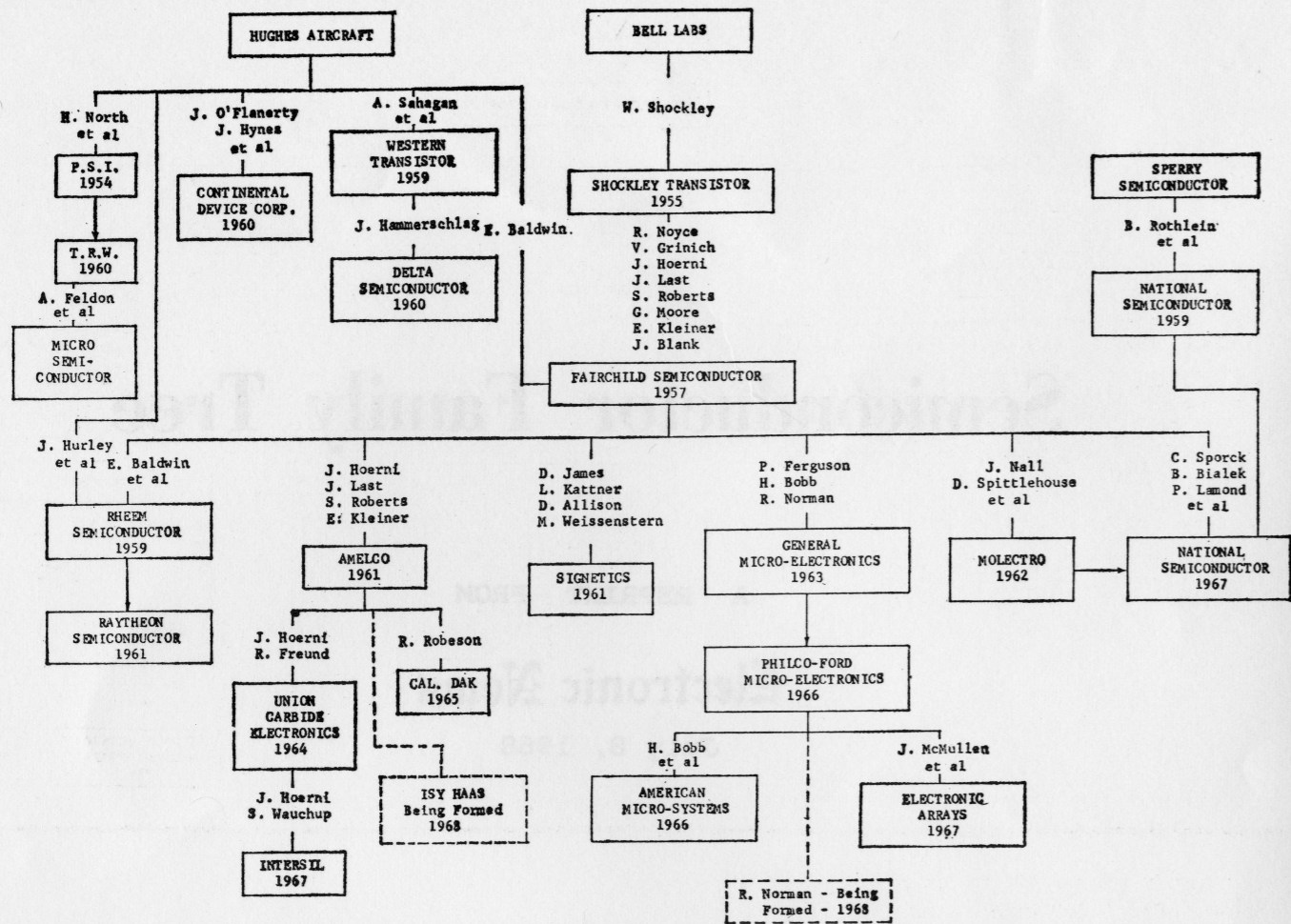
A little-known event of 1954 might have altered the course of semiconductor history, and made Boston's Bay Area—not San Francisco's Bay Area — one of the world's leading producers.

Well-remembered is the triumphal return of Dr. William Shockley, co-inventor of the transistor, to his native Palo Alto in 1955. There with the backing of Beckman Instruments, Inc., he founded Shockley Transistor, which gave rise to Fairchild Semiconductor and the vast Bay Area semiconductor community.

Courted Raytheon.

Not so well known is that the year before he was negotiating a similar deal with Raytheon Co. He did join Raytheon as a consultant, but wanted a long-term deal which would guarantee him \$1 million over a three-year period. Raytheon was unwilling to make the commitment, and the relationship was terminated after only one month.

When Dr. Shockley left Bell Telephone Laboratories in 1955 to form Shockley Transistor Corp., he recruited from various companies and universities a uniquely talented group of engineers and scientists. But many of this group soon differed with Dr. Shockley's



decision to concentrate on four-layer diodes. There were some sharp personality clashes, and the stage was set for the defection of eight of his senior people in September, 1957.

Obtained Backing.

Through Hayden, Stone Inc., backing was obtained from Fairchild Camera & Instrument Corp. to set up the subsidiary Fairchild Semiconductor Corp. The founding group comprised Drs. Noyce, Moore, Grinich and Mr. Blank; also Drs. Jean Hoerni, Jay Last, Sheldon Roberts, and Mr. Eugene Kleiner. To them was added as an equal shareholder, Dr. E. M. Baldwin, who came in from Hughes Semiconductor to provide "seasoned management."

The new company was successful in the marketplace beyond anyone's dreams, but Dr. Baldwin was no more compatible with the founding group than Dr. Shockley had been, and in March, 1959, Fairchild suffered its first spinout.

Then Dr. Baldwin left to form Rheem Semiconductor Corp., a subsidiary of Rheem Manufacturing Co., taking some 10 senior operating Fairchild people with him.

Rheem never achieved Fairchild's eminence, however, and by 1961 had succumbed to a takeover offer by Raytheon Co.

Noyce Took Over.

On Dr. Baldwin's departure, Dr. Noyce, then 32 years old and with no management experience, was put in charge of the Fairchild operation. The firm continued to grow at an explosive rate, and attracted a number of singularly capable and ambitious people. But even then, symptoms of later personnel problems began to appear.

Although FC&I stock was increasing in value daily, no options were available (although some small ones were granted after 1961, by which time the price had evidently stabilized, and was then considered by many to be too high). Fringe benefits were those negotiated by a bargaining unit at FC&I headquarters in Syosset, N. Y., and had little relevancy in California. Although there were several efforts to establish an incentive program through a profit-sharing or bonus plan, Syosset would not hear of it.

Rumblings Prevalent.

Finally, inexperienced management coupled with a cumbersome organization caused many capable people to feel cut off from the decision-making process. Even among the founding group, some of the same frustrations they had felt at Shockley were again evident.

Relations between Syosset and Mountain View were tenuous at best. John Carter, then FC&I president, was anxious to expand the parent company, but the corporation was in a critical cash position, which put great strains on the highly profitable Semiconductor division.

Entrepreneurs Proliferate.

The cauldron boiled over in February, 1961, when four Fairchild founders left to form Amelco, and spinouts began coming thick and fast. By now the huge financial rewards to be reaped by successful founders were well known, and a large number of potential spinouts within Fairchild were laying clandestine plans.

Amelco-Teledyne was formed by Drs. Hoerni, Last, Roberts and Mr. Kleiner. In August of the same

year, another group left to form Signetics Corp. A few months later, Molectro Corp. was formed. Two years later, in 1963, still another group left to form General Micro-Electronics.

Personal Influence a Factor.

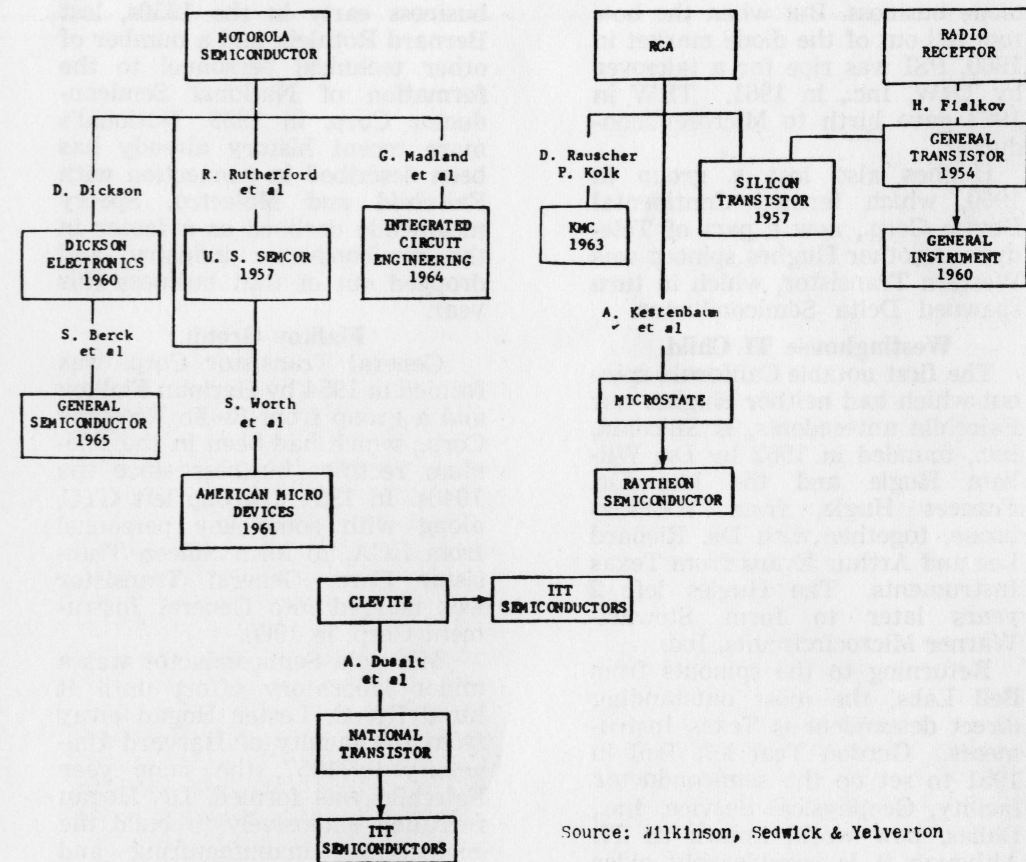
The motivation in each of these moves was the same. Besides the incentive of ownership and the expected financial rewards, each of the groups was motivated by a desire to exert greater personal influence in the management and destiny of his company.

The defectors were well advised. Each of the founders of Fairchild Semiconductor received FC&I stock valued at \$600,000 in September, 1959, 2 years after incorporation of the subsidiary. The founders of GM-E, never highly successful, each had pretax capital appreciation of more than \$300,000 when that company was acquired by Philco-Ford in 1966.

New Generations Spawn.

Hardly had the first-generation spinouts from Fairchild begun to abate, than second- and third-generation spins twisted to the surface.

Dr. Hoerni and Robert Freund left Amelco in 1964 to set up a semiconductor facility for Union Carbide Electronics. Dr. Hoerni left UCE last year to form Inter-



Source: Wilkinson, Sedwick & Yelverton

sil, Inc. Isy Haas, R/D director, left Amelco this year to seek financing for a new firm.

When Philco - Ford acquired GM-E in 1966, Howard Bobb, Robert Norman and Dr. James McMullen departed. Mr. Bobb formed American Micro-Systems in 1966, Dr. McMullen formed Electronic Arrays, Inc., in 1967. Mr. Norman is now completing financing for his new company.

Some Find Setbacks.

Molectro Corp. failed in 1966, and its assets were acquired by National Semiconductor Corp. A new group of investors took over National early in 1967, and brought in Charles Sporeck, Fairchild general manager, as president. Moving into the former Molectro facility, Mr. Sporeck headed what was in fact a totally new enterprise within the corporate shell of the old National.

The founding of Fairchild was preceded on the West Coast by a defection from Hughes Aircraft Co., which had got into the semiconductor business early, and by the late 1950s had a dominant position in germanium and silicon diodes.

Diodes Bottom Out.

In 1954, Harper North and some associates left Hughes to form Pacific Semiconductor, Inc., which became modestly successful in the diode business. But when the bottom fell out of the diode market in 1960, PSI was ripe for a takeover by TRW, Inc., in 1961. TRW in 1963 gave birth to Microsemiconductor.

Hughes also lost a group in 1960, which formed Continental Device Corp., now a part of Tele-dyne. Another Hughes spinout was Western Transistor, which in turn spawned Delta Semiconductor.

Westinghouse TI Child.

The first notable California spinout which had neither Hughes nor Fairchild antecedents, is Siliconix, Inc., founded in 1962 by Dr. William Hogle and the late Dr. Frances Hogle, from Westinghouse, together with Dr. Richard Lee and Arthur Evans from Texas Instruments. The Hugles left 2 years later to form Stewart-Warner Microcircuits, Inc.

Returning to the spinouts from Bell Labs, the most outstanding direct descendent is Texas Instruments. Gordon Teal left Bell in 1951 to set up the semiconductor facility, Geophysical Service, Inc., Dallas, now world known as TI. Although it is considerably older and somewhat larger than Fairchild, TI has had only four significant spinouts.

TI Emigrés Scatter.

Although many TI people have left to join other companies, only Siliconix, a group at Varo, Hunt Electronics, and the Semiconductor group at Radiation Inc. have been formed around TI cadres.

David Bakalar left Bell to form Transitron Electronic Corp. in 1952, which gave rise to four spinouts of its own. James Hangstefer and upwards of a dozen senior technical men departed in 1960 to form Solid State Products. Crystalonics, now also a part of Tele-dyne, was formed around a Transitron nucleus headed by W. Frustajer. John Royan left in 1957 to form American Power Devices, and Claus Lasch left in May of this year to form an Italian thyristor company under the sponsorship of Ing. Dino Olivetti.

More Begats.

William Pietenpol left Bell Labs in 1953 to establish a transistor facility at Sylvania Electric Products, where a diode capability already existed. From the Sylvania base, Richard Seed left in 1958 to form Semicon Inc., and later, in 1963, Seed Electronics. Earlier, in 1954, Clair Thornton had left Sylvania to provide the technology required to put Philco Corp. into the business.

Sperry Semiconductor, in the business early in the 1950s, lost Bernard Rothlein and a number of other technical personnel to the formation of National Semiconductor Corp. in 1959. National's more recent history already has been described in connection with Fairchild and Molectro. Sperry meanwhile declined as a factor in the semiconductor industry, and dropped out of that business this year.

Fialkov Group.

General Transistor Corp. was formed in 1954 by Herman Fialkov and a group from Radio Receptor Corp., which had been in the selenium rectifier business since the 1940s. In 1957 a group left GTC, along with some key personnel from RCA, to form Silicon Transistor Corp. General Transistor was merged into General Instrument Corp. in 1960.

Motorola Semiconductor was a minor laboratory effort until it hired Dr. C. Lester Hogan away from the faculty of Harvard University in 1957, the same year Fairchild was formed. Dr. Hogan recruited extensively to build the engineering, manufacturing and marketing staff required to make Motorola a factor in the business. Many key people came in from

General Electric, with others from Bell Labs, IBM, CBS and TI.

Almost immediately, Motorola began to suffer defections of its own, when a group left in 1957 to form U. S. Semcor, which in turn spun out the short-lived American Micro Devices in 1960.

Donald C. Dickson, Jr. left Motorola in 1960 to form the successful Dickson Electronics. Steven Berck and others left Dickson in 1965 to form General Semiconductors Inc.

The most recent defection from Motorola was Integrated Circuit Engineering Corp., formed by Glen R. Madland in 1964. Although most of the ICE revenues derive from consulting, the firm also provides some custom integrated circuits.

RCA has had two spinouts besides Silicon Transistor. Arnold Kestenbaum formed Micro State, which subsequently was acquired by Raytheon. Daniel Rauscher and Paul Kolk formed K. M. C. in 1963.

A Few Immune.

Some major names in the semiconductor industry have had neither spinin nor spinout activities of any significance. These include General Electric, IBM, North American Rockwell (Autonetics division), Delco, H-P Associates, Sprague and Bendix.

It must be noted, however, that David Hilbiber left Hewlett-Packard and is now forming a company, and both GE and HPA now have groups within their ranks who are seeking capital.

So the start-up fever rages on. Although it is industry folklore that each new company is supposed to be in too late to snatch a viable market share, there is no evidence that the cutoff date has arrived.

Beginners Lucky.

Despite naive managements and undercapitalization of many firms entering the business in the last decade, the failure rate is amazingly low.

Although not all companies have been standouts like Fairchild or Signetics, the success ratio is quite enough to continue attracting venture capital.

At any given point in time, day and night throughout the last 15 years, and continuing up to this very instant, somebody somewhere has been plotting the formation of yet another contender in the semiconductor sweepstakes. Capital is available and the rewards are real for the successful entrepreneur.