高职高专“十二五”电子信息类专业规划教材
（微电子技术专业）

微电子专业英语

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赠电子课件

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前言

PREFACE

当今世界处于国际化、信息化时代，科技的不断发展和国际化趋势对科技人才英语的要求越来越高。开设专业英语的目的是为了强化和巩固基础英语并进行实践应用，从而掌握科技英语技能，方便国际交流，了解国内外最前沿的专业动态。

本课程的教学对象是微电子专业的高职高专学生。入学时，由于经过中学6年的英语学习，学生应已经掌握了基本的英语语法知识和一定数量的单词，并在听、说、读、写等方面受过初步的训练。在本课程之前，由于已上过“半导体器件物理基础”、“微电子概论”、“微电子工艺”、“集成电路设计”等相关课程，学生应该已经具备一定的专业知识并能较好地进行微电子专业英语的学习。本书共分为六章。第一章为History，第二章为Chip，第三章为Technology，第四章为Encapsulation & Testing，第五章为Equipment，第六章为Business Writing。建议本课程的授课时数为32～64学时。

本书由常州信息职业技术学院的张红老师担任主编，负责第二章和第六章内容的编写及本书所有章节的安排和统稿；无锡商业职业技术学院的吴建军老师担任副主编，负责第四章内容的编写；此外，淮安信息职业技术学院的张楼英老师也担任副主编，与淮安信息职业技术学院的赵安邦老师负责第三章内容的编写；大连职业技术学院的王秋菊老师负责第一章内容的编写；南京信息职业技术学院的赵丽芳老师负责第五章第4单元内容的编写；重庆信息职业技术学院的刘新老师负责第五章第1～3单元内容的编写。本书由中电集团第24研究所的刘涛工程师任主审。大连职业技术学院的孟祥忠老师和北京邮电大学的张官兴同学为本书搜集了很多的资料，给予了很多帮助。在此，对于所有帮助过我们的老师和同学表示最诚挚的感谢！

由于受到时间和水平的限制，本书难免存在许多不足之处，敬请尊敬的专家、老师、同学和读者们批评指正。

编者

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Chapter I History

Unit 1

A. Text

The First Transistor in Fairchild

General Description

The first seven bench diffusion furnaces used in the corner of Fairchild's Palo Alto facility were very similar to furnaces used by Shockley Semiconductor. Cecil A. Lasch Jr., a technician who worked at Fairchild, did most of the work on the diffusion furnace hardware.

Fairchild's diffusion furnace had a quartz tube with an inner diameter of 2″ and a quartz liner between the processing tube and heating element. A very simple "variac" adjustable variable transformer was used to control the temperature of the single zone. The tube was equipped with a network of quartz pipes, quartz valves, and flowmeters. All systems resembled research laboratory equipment rather than industrial manufacturing equipment.

The wafers were pushed into and pulled out of the tubes manually. Cooling of wafers usually took place in a cool zone within the diffusion tube, which allowed the wafers to cool to a temperature suitable for handling[1]. The programmed heating and cooling was not used because of the difficulty in maintaining good temperature profiles.

The used gases were just emitted into the atmosphere by vents placed just above diffusion tube exhausts. There was no "clean room etiquette", so the chain smoker Robert Noyce frequently smoked in the Fairchild manufacturing facility.

Jay Last, who had a background in optics from the time of his studies at MIT, paired with Robert Noyce and designed contact masking equipment which aligned masks to the wafer flat.

The structure and dimension of the Fairchild mesa transistor were identical to the Bell Laboratories transistor 2N560. Shockley Laboratory was provided with all details of new Bell Labs' devices and "The California Group" had full access to this information.

The geometry of the 2N560 and the Fairchild transistor was huge. The diameter of the mesa ring was approximately 750 μm. Alignment error was not better than 100 ~ 150μm.

Three masks were necessary to complete the transistors:

1) Emitter region
2) Base and emitter contacts
3) Metal

The wafers were placed with their front side (resist) on the emulsion side of the masking plate, and were exposed for 60 sec by mercury lamp. The exposed wafers were developed and backed.

There was a competition for six weeks between Gordon Moore and Jean Hoerni. Both transistor projects were successful, but the NPN transistor was easier to manufacture, mainly because of the contact to the base. To form an Aluminum ohmic contact to the moderately doped Antimony base of a PNP transistor is much more difficult than in the case of Boron' doped base of a NPN transistor[2]. The yield of the NPN transistors was higher and G. Moore, as the head of group, had the power to choose the NPN transistor as the first Fairchild transistor. Jean A. Hoerni was clearly unhappy because his PNP transistor did not prevail. Significant differences between Moore's and Hoerni's personalities only increased tension between Hoerni and his boss.

The first 100 Fairchild transistors were mailed to IBM in July 1958. A tentative specification for the 2N696 was issued in August 1958 and an advertising campaign started in September 1958. The Fairchild silicon mesa transistors significantly improved several transistor parameters and there was no competitor who could offer similar products.

In 1959, there were 26 companies manufacturing transistors and sales of transistors reached approximately $0.8 Billion.

In November 1959, there was no product on the market that could compete with portfolio of eight Fairchild transistors. Despite that the yield of mesa transistors was very low, Fairchild's sales reached $65,000 in July and August 1958 because of the transistors' high selling price.

New Words and Expressions

diffusion	*n.* 扩散，传播
diffusion furnaces	扩散炉
facility	*n.* 设施设备；容易，熟练
quartz	*n.* 石英
tube	*n.* 管子，管，真空管
diameter	*n.* 直径
transformer	*n.* 变压器
pipe	*n.* 管子，笛子，烟斗，管乐器
valve	*n.* 阀门，阀，瓣膜，瓣，闸阀
flowmeter	*n.* 流量计
resemble	*v.* 像，很像，比拟
wafers	*n.* 晶圆
profile	*n.* 规范，概要
vent	*n.* 通风口，开衩，通风孔，出口，排放
exhaust	*n.* 排气，排气装置
etiquette	*n.* 礼节，礼仪，道德规范
chain smoker	老烟枪
optics	*n.* 光学
MIT (Massachusettes Institute of Technology)	（美国）麻省理工学院
align	*vt.* 排列，对准
mesa transistor	台面型晶体管
geometry	*n.* 几何，几何学，几何学书；图形
emitter	*n.* 发出者，发射体
base	*n.* 基区
emulsion	*n.* 感光剂，乳状液
masking plate	掩膜板
expose	*v.* 使……曝光，使……处于，暴露，曝光
mercury lamp	汞灯
aluminum	*n.* 铝
ohmic	*adj.* 欧姆的
ohmic contact	欧姆接触
moderately	*adv.* 相当地，不过分地

dope	*v.* 掺杂
antimony	*n.* 锑
boron	*n.* 硼
yield	*n.* 成品率
prevail	*v.* 流行，优先，成功，获胜

tentative	*adj.* 试验的，暂时的，犹豫的
advertising campaign	广告宣传
silicon	*n.* 硅
portfolio	*n.* 业务量
despite	*prep.* 尽管

Supplementary Words

diffusion capacitance	扩散电容
quartz crystal	石英晶体
tube diode	真空二极管
Program Overview and File	程序概要和文件
exhaust valve	排气阀
exhaust algorithm	穷举算法
chain break	链中断
optics design	光学设计
mesa diffusion	台面扩散
Geometry Theorem Prover	几何学定理证明

emitter follower	射极跟随器
Base Band	基带
mercury tank	水银槽
ohmic resistance	欧姆电阻
doped oxide diffusion	掺杂氧扩散
yield criteria	合格率标准
tentative table of equipment	试行设备表
silicon MESFET process	硅金属半导体场效应晶体管工艺

Notes

1. Cooling of wafers usually took place in a cool zone within the diffusion tube, which allowed the wafers to cool to a temperature suitable for handling.

译文：晶圆冷却通常在扩散管内的冷却区进行，以使晶圆冷却到适合处理的温度。

2. To form an Aluminum ohmic contact to the moderately doped Antimony base of a PNP transistor is much more difficult than in the case of Boron' doped base of a NPN transistor.

译文：在 PNP 晶体管中形成铝欧姆接触的中度掺杂锑基极比相同情况下在 NPN 晶体管中形成硼掺杂基极要困难得多。

Exercises

Mark the following statements with T (true) or F (False) according to the passage.

1. All systems resembled research laboratory equipment rather than industrial manufacturing equipment.

2. The wafers were pushed into and pulled out of the tubes automatically.

3. The structure and dimension of the Fairchild mesa transistor were the same as the Bell Laboratories transistor 2N560.

4. Alignment error of the mesa ring was less than 100 ~ 150μm.

5. The PNP transistor was easier to manufacture than the NPN transistor.

B. Reading

The Planar Transistor

In the history of transistors and integrated circuits, there are only a few cases when well-planned and managed projects resulted in success. The transistor, diffusion technology, and the planar process were not the result of co-ordinated and supervised effort. The occurrence of such a constellation of facts and imperatives are now interpreted as results of exceptional Fairchild business management. This is not the case, for the planar transistor. Who then was responsible for such great achievements?

The planar transistor was the product of a well-educated man with mixed social skills, who could be very charming, but also garrulous, and not always friendly. Hoerni was the only one from the "Traitorous Eight" who stood on the level of William B. Shockley. And in the same way as Shockley, Hoerni got no recognition for his planar process.

The planar transistor was the result of personal individuality and personal individuality only. The planar transistor was the product of a scientist who was characterized as a moody and not a very polite and friendly person. Does this make the significance of the planar device less significant?

Hoerni knew that the support, which he suddenly got from Noyce and Moore, was mainly due to pressure from Autonetics. Hoerni had no major word in decisions where the young Fairchild Semiconductor was heading.

Although his title was the head of the Physics Department, he was the only employee in the department. There was not even a technician. It took another year before Fairchild Semiconductor first introduced the diffused planar transistor during the Institute of Radio Engineers show in New York in March 1960. In August 1960, the planar version of the 2N696 was ready for sampling. In October 1960, Robert Noyce announced that "now Fairchild intends to convert all of its transistors to the new construction as quickly as possible."

There was no transistor on the market which could compete with Hoerni's device. Hoerni's transistor made all other transistor technologies obsolete. The 1,000 hour test confirmed that the planar transistor has less than one nA of leakage at VC = 60V compared to typically 10nA at VC = 30V for mesa transistor. During his work on planar transistors, Hoerni envisioned two additional devices.

In his monthly report to Gordon Moore dated July 1, 1960, Hoerni described transistor logic using N-MOS transistors. Hoerni did his work at the same time when Dawon Kahng of Bell Labs filled his patent application # 13,688 and # 32,801 in March and May 1960 for MOS transistors. The second Hoerni idea was a planar diode manufactured a similar way as the transistor. In mid-1960 Fairchild management had no idea what n MOS device is, and did not pay any attention to Hoerni's device. Hoerni, pre-occupied with problems of planar technology, had no time to go back and continue work on his unipolar transistor. As the result of Hoerni's effort, Fairchild Semiconductor opened a "diode facility" in San Rafael, and at that time the more practical diode got into production.

Exercises

Translate the following phrases into English.

1. Diffusion Technology
2. integrated circuits
3. the Planar Process
4. unipolar transistor
5. the diffused planar transistor

C. Extracurricular Knowledge

The Development of Fairchild

By the end of 1960, Fairchild Semiconductor employed 1550 employees. Thanks to Ed Baldwin, Fairchild had a state-of-the-art new facility completed in August 1959 and expanded in 1960, with total area of 108,000 sq. ft. at 545 Whisman Road in Mountain View. The facility in San Rafael had about 55,000 sq. ft. and the facility in Palo Alto had 56,000 sq. ft. The major problem was to find a qualified labor force. At that time Fairchild Semiconductor was hiring almost indiscriminately.

The company was growing significantly, and as always, the growth brings problems. Transfer from the development facility in Palo Alto to manufacturing facilities was slow and difficult, and management needed to solve many problems which may be tougher than technical ones. For example, in December 1960, Eugene Kleiner asked Gordon Moore to solve a problem when the staff in Palo Alto was accusing people from Mountain View of taking Palo Alto's supplies of paper and pencils.

When Charles E. Sporck arrived as a new Production Manager in October 1959, he noticed that Fairchild had "no structured manufacturing organization". The Fairchild Research and Development was in the same situation. At the end of 1959, Gordon Moore ran the Chemistry Section with Bernard Rabinovitch (surface characterization), Worden Waring (packaging), Paul Ignacz (electrochemical) and Bernard Yurash (analytical services). In the Physics Section were C. T. Sah, D. A. Tremere (tunnel diode), B. D. James and Fred Schulenberger (Aluminum Alloying), Otto Leistiko, A. P. Halle (vacuum deposition of SiO (not SiO_2!)), TomBurke and Phillip S. Flint (mesa transistor), O. V. Hatcher (low capacitance diode), C. A. Lasch, E. W. O'Keefe (diffusion and furnace operation), Sheldon Roberts and L. Lynn (material research). The members of the transistor Development Sections were M. Weissenstern, S. Levine, Garry Parker, R. Brown, P. James, R. Craig, Dave Allison and B. Bently. Victor H. Grinich was running the Engineering Department and the Device and Reliability Evaluation Department. After Ed Baldwin's defection, Bob Noyce became the General Manager and Vice-President. Julius Blank was running Fairchild Facility, and Eugene Kleiner was running business operations in the Mountain View Facility. Jay Last and Jean Hoerni were in the company's shadow. Jay was working on the parametric diode and integrated circuits and Jean was preoccupied with production of planar devices in Mountain View.

Unit 2

A. Text

The History of Logic Circuit

General Description

Fairchild's epitaxial Micrologic product line was introduced in August 1963 at the Western Electronic Show and Convention (WESCON); Fairchild added new elements (4-input gate, half shift register without inverter) to their line which completely replaced the original Micrologic line.

The product manager for Micrologic, Mel H. Phelps announced at WESCON "an order of magnitude increase in deliveries of the new Micrologic." The reduced time of isolation diffusion, from 22 hours to 6 hours, resulted in higher yield due to reduced wafer warpage and breakage[1].

Bob Noyce announced that by January 1964 the Mountain View facility would be converted to production of integrated circuits mainly, move transistor work to the Portland, ME., plant. The problem was that the Fairchild parts became obsolete. In 1972, Bob Noyce said "we pushed RTL much longer than we should have." The introduction of DTL by Signetics had an enormous impact on the industry, because designers were quickly accustomed to work with the concept behind DTL.

The original four founders of Signetics had no circuit expertise. They hired Orville Baker as the manager of circuit development, and he unilaterally decided to go into DTL. Signetics came to the 1962 IRE show in New York with exactly one circuit, a NAND gate which sold for $125.00. Signetics never started in the discrete component business but quickly began a serious challenge to Fairchild in digital products.

When there is no competition, almost anyone can run a company. From the start the Fairchild management had an advantage to be ahead of the crowd in a market at least by a year and a half.

When Signetics began winning the digital customers, and Fairchild digital revenue started to decline, Bob Widlar's analog products maintained Fairchild revenue. Fairchild reported total sales $109.7 million in 1965; just over $40 million was generated by higher priced linear parts. The problem of mismanagement of Fairchild was for another year or two hidden by Widlar's success[2].

The required reliability testing involved putting each unit through 1,000 hours of electric life test at high temperature, vibration test, etc. An explosive demand for integrated circuits which was triggered by a large quantity of Minuteman contracts caught the industry with demand in excess of capacity.

Exact numbers were classified, but very reasonable estimates called for tens of thousand of parts every month. Everybody tried to climb on the bandwagon at once. The cost of manufacturing, cycle time, and overall manufacturing efficiency suddenly became a big issue.

The circuits were used in the inertial guidance, computer, flight control and ground support for Minuteman II. In addition to the current four suppliers (Texas Instruments - 18circuits, Westinghouse-18 circuits, RCA one circuit, General Electric one circuit), four other companies were considering to apply for Autonetics qualification. Texas Instruments was the chief supplier at $9,875,649, Westinghouse Electronics Corporation $3,787,900; RCA $1,300,920; and the General Electric Co., $153,042. The four other companies were Pacific Semiconductors, Fairchild Semiconductor, Signetics and Melpar.

New Words & Expressions

epitaxial	*adj.*	（晶体）取向附生的，外延的
micrologic	*adj.*	显微科学的
WESCON (Western Electronic Show and Convention)		西部电子展览和会议［美］
shift register		移位寄存器
inverter	*n.*	反相器
order of magnitude		数量级
isolation	*n.*	绝缘，隔离，分离
isolation diffusion		隔离扩散
result in	*v.*	结果是，造成
warpage	*n.*	热变形，扭曲
IC (integrated circuits)		集成电路
obsolete	*adj.*	废弃的，过时，废退的，过时的
RTL (resistor transistor logic)		电阻晶体管逻辑（电路）
DTL (diode transistor logic)		二极管晶体管逻辑（电路）
unilaterally	*adv.*	单方地
IRE (Institute of Radio Engineers)		无线电工程师学会（［美］，已改名为 IEEE）
NAND gate		与非门
discrete	*adj.*	分立的，不连续的
discrete component		分立元件
the crowd	*n.*	大众
revenue	*n.*	收入，收入来源，岁入
hide	*v.*	躲藏，隐瞒，遮掩，痛打，隐匿
reliability	*n.*	可靠性
vibration	*n.*	振动，颤动
vibration test		振动测试
explosive	*adj.*	爆炸的，爆炸性，暴躁的
trigger	*vt.*	触发，发射，引起
capacity	*n.*	容量，生产量，能力，地位
estimate	*n.*	估计，看法
climb on the bandwagon		赶时髦；追随潮流
cycle time		周期
overall	*adj.*	从头到尾的，总，总的
inertial guidance		惯性制导
flight control		飞行控制
ground	*n.*	地，土，场地，场院，底子，地方
Texas Instruments		德克萨斯（德州）仪器
Westinghouse		美国西屋公司
RCA		美国无线电公司
General Electric		通用电气公司
Autonetics		自动控制学
qualification		资格，限制，执照

Supplementary Words

shift register latch	移位寄存器锁存电路
isolation barrier	隔离势垒
isolation region	隔离区
isolation masking	隔离掩蔽
isolation leakage	隔离漏流
discrete IC	分立集成电路
revenue bond	收益债券
revenue tax	财政关税，岁入税
hidden field	隐式字段
reliability statistics	可靠性统计
vibration noise	振动干扰
inertial mass	惯性质量

ground base	共基极接地
ground circuit	接地电路
qualification phase	限定相位
qualification test	合格性试验
qualification time	鉴定时间

Notes

1. The reduced time of isolation diffusion, from 22 hours to 6 hours, resulted in higher yield due to reduced wafer warpage and breakage.

译文：绝缘扩散的时间从 22 小时减少到 6 小时，由于减少了晶圆的热变形和破损，使得产量提高了。

2. The problem of mismanagement of Fairchild was for another year or two hidden by Widlar's success.

译文：在 Widlar 的成功掩盖下，仙童的管理不善的问题又持续了一两年。

Exercises

Mark the following statements with T (true) or F (False) according to the passage.

1. Isolation diffusion saved 16 hours and reduced wafer warpage and breakage.
2. None of the original four founders of Signetics had circuit expertise.
3. The introduction of DTL by Signetics had an enormous impact on the industry.
4. The required reliability testing involved putting each unit through 100 hours of electric life test at high temperature, vibration test, etc.
5. There are four companies to apply for Autonetics qualification.

B. Reading

The Challenge of Fairchild

A new serious competitor arrived on the scene just after Autonetics' deadline expired. In August 1963, Sylvania announced the world's fastest silicon switching transistor (2N2784) high beta in the microamperes range, gradual falloff beyond 10mA, low saturation voltage, typically 0.2V and switching speed of 12 nsec.

The abilities of management are tested when a company must compete. To manage a cost-effective manufacturing company with timely delivering of parts, it requires the utmost attention of management. When there is no competition or the customer is the government, almost any one could be the CEO of the company. Fairchild's Semiconductor management was now facing such a test.

The first indications of managerial problems at Fairchild organization surfaced in the beginning of 1965. However, the phenomenon and success of Widlar's parts delayed bigger visibility of company difficulties.

A major reorganization of Fairchild Semiconductor took place in April 1965. Fairchild Camera and Instruments Corporation re-grouped into two divisions: Fairchild Instrumentation and Fairchild Semiconductor. Fairchild Instrumentation produced oscilloscopes, test equipment and invented dual slope integrating digital voltmeters. Robert Noyce, vice-president and general manager of the Semiconductor division was named to a new post of group vice-president, with responsibility for both the Semiconductor and Instrumentation divisions. The new Instrumentation division was headquartered in Clifton with John S. Auld as general manager. Charles E. Sporck, former operations manager, succeeded R. N. Noyce as a general manager of the Semiconductor division.

What Fairchild needed was firm and steady leadership. In 1967, Bob Noyce was fighting lawsuits and wrestling with the Fairchild Camera and Instruments stock option committee over stock options. Noyce began to spend most of his time at Fairchild's headquarters on the East Coast.

Charlie Sporck was a well-organized manager with a clear vision how semiconductor manufacturing should be organized. He benefited highly from his tenure with Ford and General Electric where he learned mass production techniques. Although he was a mechanical engineer by training, he surrounded himself with engineers of great technical expertise and very soon Sporck's group was more competent than G. Moore's R&D organization. This situation created tension between the R&D and manufacturing groups. As Moore put it: "They were less willing to listen to the authorities in the R&D laboratory of how it had to be done and wanted to kill the process and start all over again so it was theirs instead of something that was transferred to them." The real situation was not so simple. As Don Kobrin, one of Sporck's aides recalls "when people in manufacturing would ask for help from the R&D organization, no one would show up."

Under Noyce's leadership, Fairchild Semiconductor was basically controlled by the Marketing Group. The Marketing Group had power over key decisions, such as which products to make, and when and where. Charlie Sporck attempted to overcome these problems between R&D and production by establishing several Product Managers with responsibilities to coordinate production of specific devices. Sporck, a long admirer of Alfred Sloan's management techniques at General Motors gave each manager of Fairchild's six semiconductor plants wide authority to decide which products he would make. Sporck was arguing that a product oriented organization-such as that at Motorola-with product managers; marketing, manufacturing, and their own engineering, is the correct way to run a semiconductor business. G. Moore vehemently rejected such a plan, and when Noyce and John Carter refused to go along with the reorganization, a frustrated Sporck realized that Bob Noyce would be unable to coordinate operations as the company needed. At the beginning of February 1967, Sporck submitted his resignation to Noyce. Robert N. Noyce said that "the loss of five top men won't hurt Fairchild's operations. Fairchild is not just a few people; we are not scraping the bottom of the barrel for talent." Talent is certainly very important, but more important is to make money. In less than six months Noyce's talents were driving the company performance into red ink.

Fairchild failed to bring to market new and competitive products because the R&D group produced nothing. Successful competitors forced Fairchild to lower prices and very quickly it became apparent that the company was in trouble. In the fourth quarter of 1966, Fairchild's profits dropped significantly due to "problems encountered in the introduction of new processing facilities and new semiconductor devices."

Exercises

Translate the following phrases into English.

1. saturation voltage
2. oscilloscopes
3. test equipment
4. dual slope integrating digital voltmeters
5. mechanical engineer

C. Extracurricular Knowledge

The Management of Fairchild

Texas Instruments, the second largest producer of integrated circuits, was gaining on the leader, Fairchild Semiconductor. TI's sales had climbed more than 60% from their 1966, while Fairchild had increased only slightly. With Widlar's gone, the very profitable linear business of the 700-series began to erode as a result of competitive products. Fairchild's fortunes plummeted quickly. In July 1967, the semiconductor operation lost money for the first time since 1958. The situation needed action and as always in similar situations, some of the personal scores may be adjusted. Roswell L. Gilpatric, Fairchild's board member, the New York attorney and former Deputy Secretary of Defense, who did not like John Carter, the chairman of Fairchild Camera, suggested that a committee should study the company's performance. Carter was a man who was primarily a financial man. He was hired by Fairchild from Corning Glass. He was a very affable guy but liked to live the high life and didn't pay much attention to the semiconductor business. He came out to Mountain View maybe once or twice a year to see the group, but his main interest was to build the company up and other activities, in printing, graphic arts and instrumentation.

The committee consisted of Gilpatric, Walter Burke (Sherman Fairchild's personal financial advisor) and Joseph B. Wharton Jr. (who was a financial and tax advisor). The committee attacked Carter's acquisitions policies and after a bitter conflict broke out, Carter, sensing a power play, resigned.

The Carter resignation caught Sherman Fairchild by surprise. For a while, Richard Hodgson, the President of Fairchild Camera, acted as the company CEO. Hodgson was a good manager and he favored the semiconductor division; the problem was that the committee, which was only financially oriented, did not approve his plan for company growth. In spring of 1968, the committee, persuaded Sherman Fairchild that he had made a mistake in making Hodgson chief executive and S. Fairchild removed Hodgson as CEO of the company. Instead the committee suggested running the company as a team with S. Fairchild and R. Noyce, group vice-president in charge of the semiconductor and instrumentation division, acting as operating officer. Sherman Fairchild needed time to find a new chief executive.