ANNUAL REPORT 1989

CAP GEMINI SOGETI

EXPERTISE IN INFORMATION TECHNOLOGY

1989 Annual Report of Cap Gemini Sogeti

CAP GEMINI SOGETI
EXPERTISE IN INFORMATION TECHNOLOGY

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LETTER FROM THE EXECUTIVE CHAIRMAN

1989 was a year of extraordinary events throughout the world: the "Tiananmen Square massacre," Mikhail Gorbatchev's remarkable rise to power, the death of the Ayatollah Khomeini, the dismantling of the Berlin Wall, the rise of the "popular" democracies in Eastern Europe and the demise of the Communist "myth," the execution of the Ceausescus, the arrival of a South African president committed to eliminating apartheid ... In contrast to these earthshaking headlines, the fate of global information technology hardly seems to warrant a back-page mention. Yet that is precisely the subject I wish to talk about here, because information technology and the computerization of the business world continue to represent important factors in the long and medium-term development of the free-market economies.

The situation presents itself in several lights, depending upon your point of view:

- On one hand, there is verifiable evidence — by measuring the newly installed processing power, and by the continual and striking decline in the cost of DP equipment — that 1989 was another **record-breaking year** for information technology worldwide.
- On the other hand, there are those who insist — by observing and sometimes extrapolating the deceptive results reported by a large number of DP manufacturers — that we are in a state of crisis.

These conflicting viewpoints stem from the often overlooked fact that the same cause can produce diametrically opposite effects on different economic "players."

- For users — as well as for the professional services companies which help them implement their computer resources — price reductions in the manufacturers' offering have as much influence on progress and savings as do increases in quality and reliability.

These savings in hardware resources are most often invested in new applications (i.e., new software), underscoring the current reversal in the DP profession between manufacturing activities and the software and services business (1). Furthermore, these new applications, which are most often "strategic" in nature, provide a measurable competitive advantage to the companies that install them.

- For suppliers of computer power, the decrease in the sale price of their products has a few simple causes, **none of which** — and this is important — **can be blamed on a sudden loss of appetite on the part of customers.** Those who got on the computer bandwagon early, and who today claim to be "fed up" or saturated, are in a very small minority. Quite the opposite is true in fact: most customers continue to use the new resources offered by the DP industry more than they did previously to innovate, inform, organize, develop and control. And the number of **new users** — those who came aboard later but whose interest in information technology is, if anything, more acute — is increasing daily.

What, then, are the reasons for this growth crisis (however relative and in most cases temporary it may be) which is currently overwhelming the computer manufacturers? I see two principles at work:

- **The first is technological**, a matter of more and more advanced miniaturization of electronic components and memory, and its immediate corollary, the multiplication of computer performance. To borrow an image from an excellent article by Françoise Vaysse in the February 28th issue of *Le Monde*: Less than ten years ago, the most modern minicomputer on the market was able to process one million instructions per second (2). Today most microcomputers can handle ten times that number, and in less than a decade we will have miniaturized equipment that can process — most likely for the same price — 200 or 300 MIPS. Of course part of this additional power is eaten up by the machines themselves and by the networks through which they communicate with each other. Features such as the sophistication of the most powerful hardware, access to multiple sources of information, and user-friendliness actually consume a great many MIPS that are not all accounted for in the "useful power" of computers. But it is also true that this ongoing technological explosion (at current cost, we are talking about an increase in power of 20% or 30% a year) goes a long way to explaining the problems being confronted by the manufacturers; they are, in a sense, victims of their own ingenuity. Thus, when a manufacturer announces "only" a 5% growth in revenue, it means that during the year he delivered machines with power 25% to 35% higher than those installed the year before. It has already been demonstrated that if this same "progress" had occurred in the automobile industry, Rolls Royce would be selling its most beautiful cars today at the price of a box of matches.
- **The second principle is commercial.** The trend toward miniaturization, the search for economies of scale through the use of common components, and the pressures leading to increased standardization are all factors which are turning these machines into basic tools at low unit cost and greatly reduced profit. The consequences of such a phenomenon are well known. Manufacturers can no long-

(1) *The figures speak for themselves: in 1986 hardware and maintenance represented 60% of the information technology business volume, as opposed to 40% for software and services. In 1994, this ratio will be exactly the reverse because of the strong difference in the growth rate between the former activities (an average of +7% a year for the next five years) and the latter (18% to 20% a year, depending on the business sector).*

(2) *For the last decade or so, "millions of instructions per second" (or MIPS) has been the most widely-used measurement unit for comparing computer power.*

er handle distribution themselves. Product life-cycles are extremely short (about 18 months for a microcomputer, compared to three or four years for the mini, and longer still for the first computers that appeared at the beginning of the '60s — who doesn't remember the long life of the IBM 1401?). Practically anyone can enter this market at minimal expense. The competition is fierce ... And so on. It is easy to see why the manufacturers who were around before the advent of the microcomputer, i.e., before 1980, are the ones most vulnerable to this incredible evolution, and why they must be willing to make staggering changes in order to survive the process of natural selection common to all prolific species.

It has already been noted that the consequences of this process tend to work in the users' favor (3): the best price/performance ratio, product standardization, wider choice, the assurance of always finding answers at hand as technology keeps one step ahead of the demand, etc. And for two reasons, at least, these consequences also work to the advantage of the computer services companies:

- **The first** is that in information technology the expensive and hard-to-find resource is no longer the hardware but the people. The rate of absorption by clients of the additional processing power delivered each year by the manufacturers is limited only by the ability to implement new applications. And this ability is in turn limited only by the number of qualified DP professionals who can be mustered — either by the client or by the computer services firms. In the software services sector, productivity is increasing much less rapidly than in industry. Obviously programming is faster and more automated, but this coding phase currently represents only a small percentage (an average of about 15%) of the work required to implement a new application. All the remaining tasks call for skills that take far longer to acquire; skills that are compatible with those of the business that is using them, its way of operating, its special restrictions, its intrinsic processes. It hardly seems possible to train people in increasingly more complex and diversified techniques much faster than we are already doing today. However, what is true for the computer services business is even more so for the user companies, whose aim is certainly not to add to the number of software technicians on their payroll. Such companies — which operate according to the sacred principle, "to each his own business" — are turning with increasing regularity to the computer services companies for the extra skills they need.

- **The second** consequence is the concentration in the computer services sector and the appearance of large professional software services groups. Some may question the merits of mere size, but it is clear that these large firms have access to supplementary skills such as:
  — the ability to select, train, integrate and motivate thousands of software professionals who find unparalleled career possibilities in the large professional services firms;
  — the ability to engage in the necessary research and development effort, and to extract the software tools that will play a key role in the intelligent distribution and use of the hardware that manufacturers are putting on the market;
  — the ability to bid on large projects and to assume responsibility for the complex developments demanded by users. The credibility thereby achieved by the most prominent software services companies increases the confidence of users and their willingness to subcontract more and bigger assignments. And this in no way diminishes what was once the foundation of the computer services business, namely, technical assistance. Users are grateful — as are the hardware manufacturers — for the skills provided by the professional services companies, and this has an unmistakable effect on the growth in business volume of the information technology industry as a whole.

No doubt the reader will have gotten the message by now: that I am more confident than ever in the development of the computer services business. Technological progress will not slow down (as the following pages of this Annual Report amply demonstrate). Being in possession of more powerful electronic components is becoming a vital strategic asset, but that is a problem for the hardware manufacturers and for governments, not for users and computer services companies. Hardware is becoming the target of current consumerism, making **differentiation**, so dear to the hearts of the industry strategists, the rightful endowment of software and services. And that is precisely the market in which CAP GEMINI SOGETI has chosen to serve — and to serve exclusively — for the last 23 years.

The foregoing analysis also confirms (if confirmation is needed) that the real value of a group such as ours is its professionalism, represented by the 14,000 employees who make up its workforce, and whom it collectively supports through its methods, references, tools, procedures and company spirit. Our challenge is to cultivate and enrich this individual and collective experience and to place it at the service of users, while we assure the continued growth and profitability of the Group in keeping with its past performance.

What we achieved in 1989 (revenue growth of 21.3% without major acquisitions, a record profit margin of 7.4%, 1250 new employees in one year) is positive proof that this challenge continues to be the driving force in our progress.

Grenoble, March 18, 1990
Serge KAMPF

(3) *There are also other factors less favorable to users which should not be overlooked, but which weigh less heavily in the balance.*

INFORMATION IN TH

"THE CENTURY is dying! Long live the Century!" These seem to be the words of everyone watching the 20th century come to a close. It's understandable: having just moved into the home stretch, people are starting to let their imaginations ponder the mystique that always enshrouds a change of century. After all, aren't the 1990s the magic password to the 21st century?

The pundits are saying that this is the dawn of "the information society." Everyone can see it, after all: production and distribution of information are growing at lightning speed. In the United States, 58% of the active population is already working in a field in which their jobs consist of capturing, handling or distributing words and numbers. Communications, too, are being transformed. Telephones, radio, television, data processing are being merged into a single worldwide network. Optical fibers are carrying animated images along with voice, sound and text. The language of image synthesis is reaching the consumer market in everything from the automobile to the video clip.

Today's technical developments are full of promise. Having unburdened man of his most tedious tasks, the machine is now going to increase his intelligence. Witness the use of computers: not content with automating our massive, repetitive processing activities, **computerization** is now striving to help man create,

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simulate and decide. Interestingly, this revolution is silent, intangible, fueled by an invisible technology, itself launched in the race for miniaturization. Such is the paradox of progress in data processing: the higher its performance levels, the greater its benefits, the less we notice it. Is it imaginable that this industry could win over 350 million users in just forty years? And that it will conquer seven times as many in the coming decade?

Development of **information technologies** is going to accelerate significantly between now and the year 2000. We are speaking of a constant growth factor for this sector: every fifteen or twenty years, a conjunction of technical advances comes along to give it a shot in the arm. Between 1945 and 1950, it was the first computers; the '60s saw the spread of transistors, the first high-level languages and the third generation of computers; the '70s and '80s, integrated circuits, microcomputers and the convergence of data processing, telecommunications and the audiovisual media.

What can we expect from the 1990s? Will technological progress continue? At the same pace? What advantages will we get out of it? To what end? How will we put them to work? These are some of the questions that will keep observers guessing throughout this decade.

By introducing "Computerization In The 1990s," CAP GEMINI SOGETI's Annual Report takes a voyage in search of new technologies, their applications and the challenges posed by their use. The reader will easily grasp that we are taking a reasoned approach, inspired by the prudence of an old Chinese proverb: "Prediction is a difficult art, especially when it deals with the future." In other words: none of the developments described in the following pages is unheard-of, or material for a science fiction thriller. The achievements anticipated for 2000 will be the reflection of present-day research and invention. The trends we will observe throughout the decade are clear:

- **The pursuit of innovation** is the dominant feature : computing power will rise, memories will become Gargantuan, telecommunications will carry increasing volumes of information, and computers will be injected with human intelligence thanks to expert systems.

- **The dissemination of technology** will place powerful, user-friendly and appropriate tools in the hands of individual users and corporations alike. At the same time, concern for efficiency – intensified by increasing competitiveness – will encourage corporations to integrate their DP applications into a continuous process.

- **The reign of complexity,** arising from the interconnection of computer resources, will be the focus of new challenges such as standardization and security, and will make it necessary to master the integration of DP systems.

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THE PURSUIT OF INNOVATION

The year 2000 will be built on the technologies developed during the 1990s. The future of data processing, its performance and its potential, is being written at this very moment. Innovations are following upon one another, more or less hastening the dates upon which they will come into everyday use. Although we cannot predict the regularity of their future occurrence, fundamental developments are destined to shake the landscape of information technology: the race for power, the explosion of memory capacities, total communications and new breakthroughs in software ■

THE RACE FOR POWER

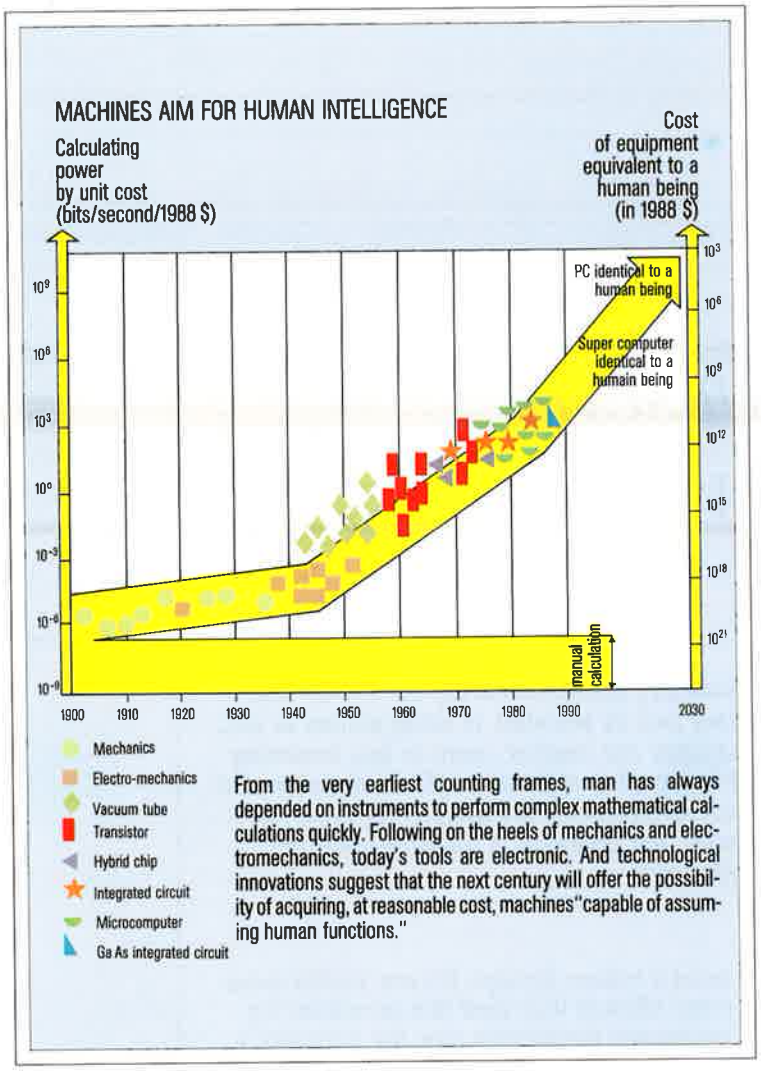
To simulate the behavior of an airplane in flight or an automobile accident, to interpret complex images, to design sophisticated integrated circuits or to examine the behavior of a molecule or a neural network, our aerospace, automobile, electronics and nuclear industries, our telecommunications and biotech research centers — to name only a few — are increasingly hungry for more computing power, and increasingly avid for higher-performance computers. Tomorrow even more so than today.

The rapid and large-scale spread of computer resources that we all observe in our everyday environment owes its existence to the miniaturization of electronic circuits. And, in particular, to the manufacture of integrated circuits.

First appearing in 1959, integrated circuits have gone from one transistor per chip to several million. Today's ICs are 10,000 times more efficient than their first ancestors: by decreasing component size, the transistor's maximum operating speed is increased and, with it, the speed of microprocessor throughput. At the same time, prices are falling. Memory cost has been divided by five every five years; workstation price-performance ratios have improved by 70% to 100% during the past two years alone; and, according to a study by the Gartner Group, the cost per MIPS (million instructions per second) will have fallen by a factor of 100 between 1981 and 1993. The future of the information technologies is a fantastic race for power, spurred on by miniaturization and the ascent of parallel microprocessor architectures.

MINIATURIZATION

Any increase in computer power must pass through a narrow gate: increased calculating speed. To achieve this, circuits have to "react" faster. Today, circuit transistors can switch an electrical signal in a few tens of picoseconds (1 ps = 1×10^{-12} s or one trillionth of a second), while they routinely per-



form operations in 10 to 100 nanoseconds (1 ns = 1 × 10^{-9} s or one billionth of a second). This switching speed is a direct function of the number of components per circuit.

Component density has virtually doubled every year since 1960. We have moved from one transistor per circuit to several hundred thousand or several million, depending on whether logic circuits or memory circuits are involved.

At this rate, we can anticipate a density of one billion components per chip by the end of the century, which will mark the beginning of "gigascale integration" (GSI). By then, the fastest microprocessors will be capable of 100 MIPS, or twenty times their current performance levels. They will outstrip the most powerful machines currently being offered by IBM (3090-600, etc.), and approach the possibilities of the human brain (see inset left).

If electronics integration is the motor of computer technology, semiconductors will continue to be its fuel. First, let us look at silicon. Abundant in nature, lending itself to high levels of integration, silicon will remain the most widely-used material during the coming decade. It will win the field over gallium arsenide which, while "faster" and less sensitive to radiation and temperature extremes, is ten times more expensive than silicon. Research is being aimed at a combination of the two, but concrete results are not expected until some later date.

By the year 2000, semiconductors might well push back the limits of miniaturization by joining forces with superconductors. With the discovery in 1987 of high-temperature superconducting materials, two IBM researchers revitalized interest in the application of these materials in electronics. Since these new superconductors function at the temperature of liquid nitrogen (-196 C), it is possible to envision chips that unite semiconductors with superconducting ceramics. To grasp the advantages of such combined systems, it should be recalled that increased performance is directly related to increased miniaturization. The smaller a component, the more heat it dissipates, with the rise in heat being caused by the resistance of connections. This is precisely where superconductors would enter the picture. Deposited at connection points, thin layers of these materials would allow current to flow without meeting any resistance. Such transistors would show much faster response times and consume less energy than their conventional counterparts. Circuit switching times would drop to as little as 1 × 10^{-14} seconds, paving the way for computers 1,000 times faster than today's machines. We have yet to develop materials and manufacturing techniques based on these new superconductors, and to implement the high-speed interfaces between semiconductors and superconductors. During 1989, however, Japanese

researchers succeeded in assembling 21,600 units made of superconducting materials on four chips functioning at -269° C.

THE ASCENT OF PARALLEL ARCHITECTURE

Faced with increased demand for power, computer manufacturers have a choice between two approaches: await the arrival of higher-performance components, or connect microprocessors in parallel to multiply available power. Parallel architecture will be used primarily in very complex applications capable of being broken down into simultaneously-executable tasks. Simulation of processes affecting the global climate, vision, graphic display and voice processing are among the most frequently-cited areas of application. This is why manufacturers are working on machines capable of parallel-processing multiple instruction sets. In today's state of the art, parallelism within a **single central processing unit** can include:

– organization of memory into multiple, separately-accessible units, or "banks," facilitating simultaneous data retrieval;

– "pipelines," or arithmetic units capable of performing an operation simultaneously on multiple data items. This feature is primarily useful for vector calculations;

– Very Long Instruction Word processors, which simultaneously execute multiple program instructions consolidated into extended words.

End-of-the-century machines, however, which aim to raise performance levels by a factor of 100 to 1,000, will show a much higher degree of parallelism. They might adopt one of the following structures:

Multiple Instruction Multiple Data (MIMD) machines in which the number of processors is multiplied, with a single task assigned to each. The system works as though separate, individual programs were acting on individual data items. The Achilles heel of such machines is the communications network which physically interconnects their processors.

Single Instruction Multiple Data (SIMD) machines in which processing subunits are multiplied, while the overall number of entire processors remains unchanged. Instructions are sent to the processing subunits, which execute them on their own data. This structure will be applied particularly to image and signal processing, aerospace uses and digital wind tunnels. The most eloquent example of this technique is the "transputer," which squeezes all of the components of a calculator — a two-kilobyte memory and a 32-bit processor — onto a single chip. In a present-day vision application, implemented by ITMI,* transputers manufactured by APTOR* detect defects in uranium fuel pellets moving past at a rate of five per second, taking just 200 milliseconds to do a job which required 21 minutes on an 80386 microprocessor.

Cellular machines, where a single elementary task is executed on each cell processor. The architecture derives its power from the fact that an instruction is simultaneously repeated by a thousand, or fifty thousand, or — why not? — 50 million cells. The "Connection Machine," designed at the Massachusetts Institute of Technology and built by Thinking Machine, is thus capable of executing an elementary instruction on all of its 65,536 processors at the same time. These processors are divided into groups of 16 at the 4,096 corners of a 16-dimensional cube (hence the name "hypercube"). Similarly, the Ncube 2 supercomputer, with its 8,192 paralleled processors, reaches a speed of 65 billion instructions and 27 billion floating-point operations per second. Sample application? Crunching satellite image data, these machines can map the relief of a mountain chain so accurately as to virtually pinpoint the ideal site for a TV transmitter.

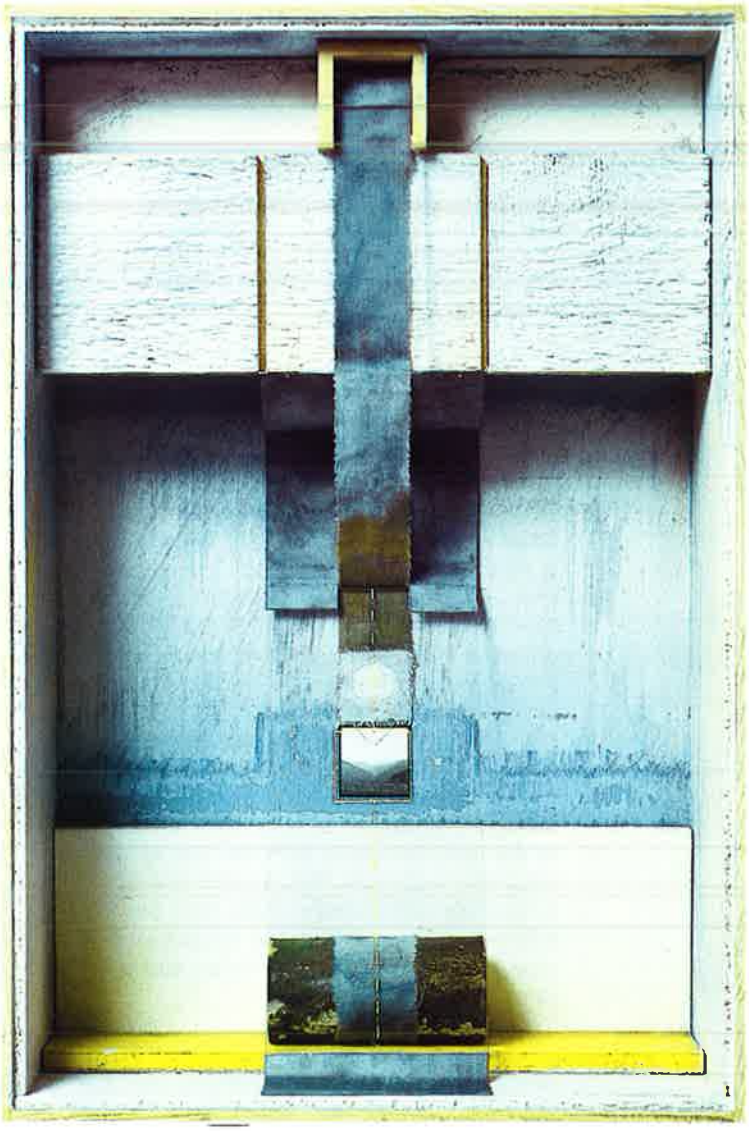
Neural networks: directly inspired by the working of the human brain, which contains about 40 billion neurons, these devices still exist largely as theoretical models. In these configurations, all artificial neurons — as active or inactive binary elements — simultaneously make decisions on the basis of the global state of the network. Using this sort of architecture, tomorrow's computers could work wonders, solving problems ranked among the most difficult: pattern recognition, vision or natural language processing. Combined with expert systems, neural networks will automatically transcribe handwritten documents into ASCII characters, or recognize and classify complex images.

The DYSTAL (DYnamically STable Association Learning) program has already demonstrated that computers can "learn" patterns; for example, they can memorize letters of the alphabet and subsequently recognize them in complete or fragmentary form. Applications facilitated by neural networks will include optical character recognition (OCR), personal identification, robot guidance in hazardous environments, and financial analysis, which will be implemented by appropriate software.

The interconnection of processors will be a distinctive feature of parallel architectures. Processors might be linked by a bus, a local area network or a "hypercube" network. In the continuing effort to boost computer speed and processing capability, light beams will be increasingly used in place of hardwired connections for signal transmission. In contrast to electrons, photons travel at the speed of light (186,000 miles/sec); and, again unlike electrons, photons do not interact. In other words, any number of light beams can cross a space without interfering with one another. Optics is thus the ideal approach to the interconnection of parallel

* ITMI and APTOR are subsidiaries of CAP GEMINI SOGETI.

processors. Since the CYBER 205 supercomputer has no less than 5,000 kilometers of metal wire linking its four parallel processors, how will it be possible to deal with the Connection Machine's 65,536 processing units?



GARGANTUAN MEMORIES

Tomorrow's computers will not be able to make real use of their power unless they have access to much greater volumes of data than they do today, and at much higher rates of speed. The quantities of information to be handled and the speed at which it is moved around and processed will require storage media with capacities increased by several orders of magnitude, reduced access times, compact dimensions and lowered prices. We have already moved an impressive distance along this path: the first computer, ENIAC, built in 1945, could memorize twenty digits, while a single CD-ROM optical disk today holds all 345,000 titles shelved in the French National Library, or 250,000 pages of text.

Existing storage media — memory chips, magnetic and optical hard disks — must therefore undergo significant change.

MEMORY CHIPS

Electronic memories are direct beneficiaries of the advances made in the semiconductor industry. Miniaturization, which now makes it possible to etch circuit paths 0.8 micron in width (that is, 150 times narrower than the edge of a sheet of paper), will further whittle this figure down to the 0.1 micron range. As a result, billion-bit (gigabit) memory chips will usher in the next century. CMOS technology, already favored for its integrative capability and its low power consumption, will apply three-dimensional etching techniques. Instead of being deposited on wafer surfaces, individual transistors will be stacked inside the tiny silicon chip.

Space gained means increased capacity. Memory chips — static and dynamic random-access memory (RAM) chips on one hand, read-only (ROM/EPROM) on the other — will keep step with the increasing power of microcomputers and the spread of local area networks. With a single four-megabyte chip providing access to 400 pages of text in 80 nanoseconds, it is obvious that these devices will facilitate graphics and voice applications,

document management and information interchange in business and industrial environments.

MAGNETIC DISKS

Like all magnetic media, hard disks are well-suited for the permanent storage of large amounts of data. Their storage capacity is much greater — and much less expensive — than that of semiconductors. Today, hard disks can hold 800,000 characters (or about 400 typed pages) per square centimeter, yielding capacities of over six billion characters in multidisk units. Such systems can access stored information in one fifteen-thousandth of a second, with transfer speeds of three million characters per second. These storage capacities are expected to quintuple in the next five years with the use of new magnetic materials. Thin-layer metal alloys (especially nickel and cobalt) have recently come into use, offering the advantages of easier magnetization and higher storage density.

Another area of progress lies in the development of read-write heads capable of traveling closer to the disk surface (borne on an air cushion 0.25 micron thick, the head skims over the magnetic surface at nearly 100 mph). A reduction in head elevation enhances storage density and reduces data access time. In an experimental product unveiled this year, IBM has reduced this elevation by a factor of five — down to less than two millionths of an inch — yielding a transfer rate of 3.5 million bits per second.

MAGNETO-OPTICAL DISKS

Instead of superseding magnetic disks, the optical disk could prolong their life by the infusion of its two chief selling points: high capacity and very low storage cost. The magneto-optical disk uses a laser beam to read and write data from and to an erasable and rewriteable magnetic medium. Storage densities ten times greater than those for magnetic disks (10 million characters per square centimeter) may be achieved by storing data on extremely fine tracks. Magneto-optical recording combines the advantages of both techniques, and should replace magnetic storage sometime during the next decade, as soon as better access times have been achieved.

OPTICAL DISKS

Since the introduction of the compact disk in 1983, the optical disk has continually been associated with the notion of the future of information technology. The optical disk offers some incontestable qualities:

- storage capacity: equivalent to 1,600 diskettes,
- multimedia capability: image, sound, data,
- retrieval ease and speed,
- reduced cost of information access,
- inviolability of recorded data,
- portability of medium.

Areas for development are numerous, both in document base management, technical documentation, programs for simulation and aid to decision-making (financial analysis, bank balances, actuarial depreciation tables, estimating), and in the implementation of educational software and training assistance tools.

An extraordinary component in the dissemination of information, the CD-ROM is the encyclopedist's dream: the history of the 20th century is brought to life through the voices of de Gaulle, Stalin and Roosevelt, or Neil Armstrong on that first moonwalk. Mozart's genius is carried to the reader's ears by an excerpt sung from *Don Giovanni*. The future is already with us, as demonstrated by the multimedia encyclopedias being published independently by Bordas in France and Compton in the United States. There is no question that the optical disk will be the data archiving medium of the '90s.

TOTAL COMMUNICATIONS

Forecasts indicate that, as we approach the year 2000, 80% to 90% of all corporate processing power will be dispersed among remote devices. In light of this, telecommunications and data processing will converge in a development of extreme significance to users. An explosion in services is taking place. In the wake of the telephone and telex, telecommunications are now transporting not only words, but data, written matter and images. Telephone exchanges are no longer limited to circuit switching, but are capable of storing, retrieving and processing data, and have become multiservice facilities. In turn, computers are integrating switching and transmission functions. This computer/telecom convergence is causing a fundamental change: the main source of productivity will not come from a speeding up of information processing, but in the speed and ease with which this information is transmitted. During the coming decade, communications will be faster, local and cellular.

HIGH-SPEED DATA TRANSMISSION

Users have not yet reaped the rewards of advances in telecommunications. Data

transfer speeds have hardly changed over the past fifteen years. Digital links via telephone or satellite are making their appearance with data transfer rates ranging from 64 kilobits/second to 2 megabits/second. The Numeris (ISDN) network is multiplying these rates by a factor of ten. Transfer of files, images and high-quality sound has become possible, but remains expensive.

Data transmission rates on the order of 100 times faster are required for connecting computers separated by some thousands of miles. These wideband networks will bring high-definition television, visiophone and interactive television into homes throughout the world. They will accelerate the exchange of information between users within the corporate environment and those on the outside. Faxing of a one-page document will take one-thousandth of a second, in contrast to today's 30 seconds. The race for speed will boost the performance levels of Integrated Service Digital Networks during the years to come.

LOCAL AREA NETWORKS

The explosion of personal computing, the distribution of functions to the intelligent workstation and the ease and flexibility of change will lead corporate users to distribute traditional central functions to microcomputers connected to a local area network. "Downsizing" is already beginning to alter the computer landscape of large organizations. Local area networks provide a high-speed transmission facility which can be shared by all users within an organization, regardless of workstation type or nature of information to be transferred: text, graphics, images. As a link between multiple workstations, the local area network is supervised by a "server" station. The server is a microprocessor tasked with managing network activity, authorizing or denying file access, handling data transfers and facilitating exchanges with the outside world.

Data transmission takes place via cable (twisted pair, shielded coax or optical fiber cable) interconnecting the network's microcomputers. Local area networks might have a bus, star or token ring topology.

The role of local area networks should show significant change over the next ten years, as they become the tool of choice of working groups, expanding to encompass the entire business information system. They should become the chief means of communications between workers in the same department whose PCs will be interconnected. They will share disks and printers, and will communicate with the outside via network "bridges" or "gateways."

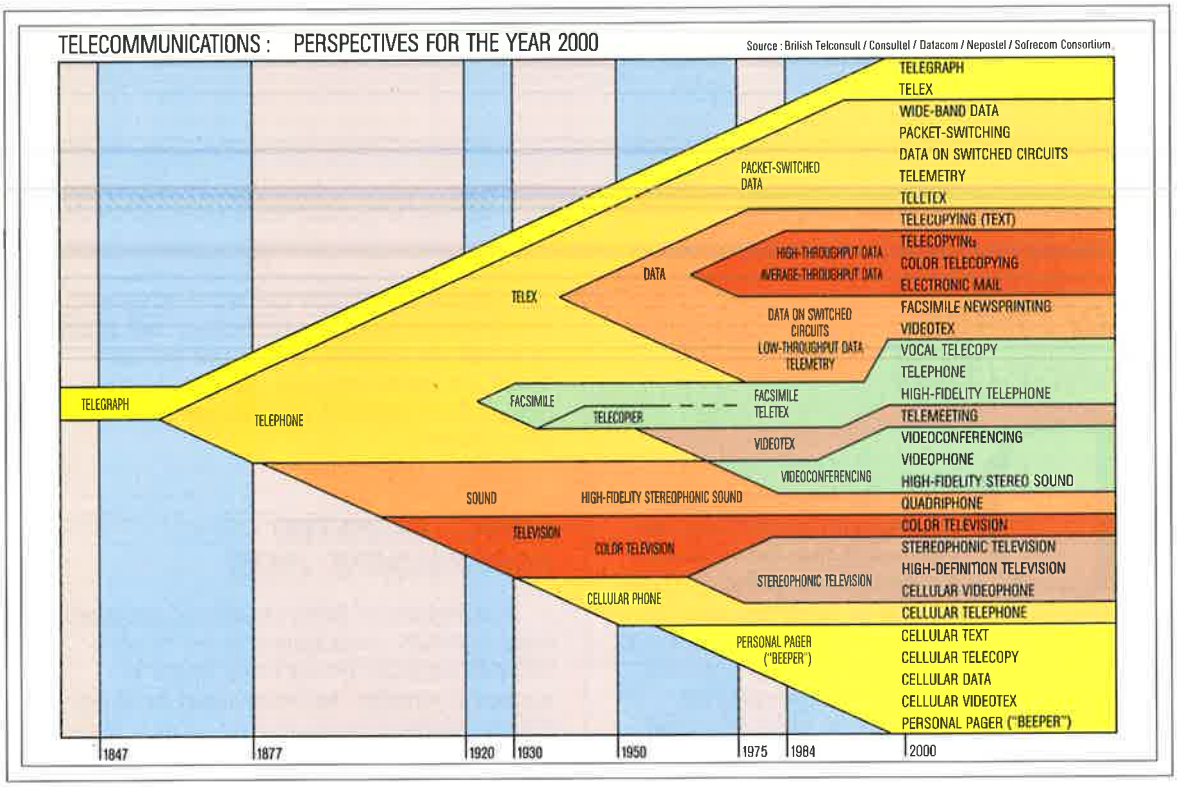
With extended corporate networks, PCs will be able to access the working team's own resources as well as the corporate information system. In particular, the communications server will permit:

- connection between local area networks, either through a point-to-point link or via a centrally controlled network. In view of its performance, the optical fiber link will be the long-distance transmission medium of choice;

- links with isolated computers, with a choice of three functionalities: terminal emulation, file transfer or peer-to-peer communications;

- access to value-added networks which — besides transporting data — will offer services such as database inquiry, electronic mail, etc.

Structural changes arising from takeovers and mergers — and from the building of a united Europe — will create a need for compatibility among local area networks. User-transparent information transfer will be implemented by software "bridges" (APPC interfaces for PS/2-type intelligent workstations). These interfaces will then be able to contact the server of their choice and put together the file of information required for the user's job. Within the framework of a "client-server" model (see inset page 24), compatibility will be managed at the level of the corporate database, accessible by means of information queries.



CELLULAR COMMUNICATIONS

The most recent ATT surveys tally 423 million telephones throughout the world. The experts believe that 30% to 50% of all sets sold in 2000 will be cellular models. In other words, the blossoming of cellular phones in cars, airplanes, restaurants and other public places is not about to slow down. British analysts have extrapolated some trends, supported by hard figures. The number of mobile phones at the end of the decade should increase from today's figure of 800,000 to 10 million in Europe, and from 2 million to 20 million for the American market. Thus, there is a strong possibility that the car phone will be as common an accessory as the car radio. The technical aspects of this revolution are well-known:

- Digitizing will provide unparalleled auditory quality, data security, access to databases or information servers, and recognition of the ISDN standard, permitting direct file transfers and electronic mail from mobile units. Users will ultimately be able to receive messages in any country in the world. Before that, however, cellular telephones will abandon analog transmission only very gradually, as it is estimated that 50% of cellular units will still be analog at mid-decade.

- The cellular structure has been pioneered in the United States where regions are divided into a honeycomb structure of communications cells. Each cell contains a transmitter, which relays communications with the mobile unit on a specific frequency. As the mobile unit moves to another cell, communications control is switched over to a new relay operating on a different frequency, thereby eliminating the problem of interference between adjacent or nearby cells.

For people away from home or office, communications will be facilitated by yet other resources: personal pagers (13 million in 2000) and, above all, fax machines. Descendant of the *"bélinographe"* (which was already enabling press agencies to transmit facsimile photographs back in 1907), the fax machine is overrunning the world: 6 million units, 3.5 million of which are in Japan. Because it is convenient, fast and inexpensive — a page can be faxed from New York to Paris for about one dollar, one-fortieth the cost of express mail — the fax machine is taking over as the favored medium of people in a hurry. It is portable enough to be taken on the road, and is penetrating into the increasing number of "home offices" found wherever there are telephone lines. Digitization of the telecommunications network will soon transform any personal computer fitted with a fax board into a multifunction facsimile terminal.

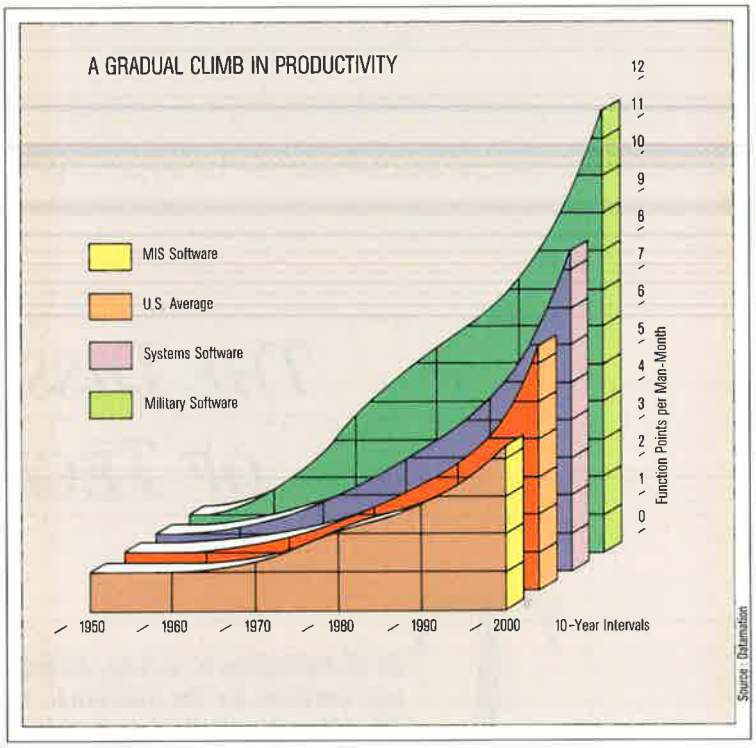
SOFTWARE INNOVATION

Despite the inherent risks in dealing with predictions, we can assert that the demand for software is going to show strong growth over the coming decade. On one hand, the list of computer applications is getting longer and longer: the gap between demand and satisfaction can already be measured in man-centuries, while the need to maintain existing software remains ever-present. On the other hand, the development of new man-machine interfaces and the absorption of new technologies are requiring increasing numbers of higher-performance software products: products that will transform the potential of computers into implementations tailored to the user's needs.

Without significant software advances, the dissemination of technology will grind to a halt. At present, two major software development techniques are gaining momentum: object-oriented programming and expert systems.

OBJECT-ORIENTED PROGRAMMING (OOP)

In a departure from structured programming — which consolidates a set of computer-executable instructions into a sequence of smaller, self-contained modules — object-oriented programming takes a hierarchic approach in which software design is viewed as the combination and extension of existing modules. These modules break the data-processing environment down into multiple independent objects capable of communicating with one another. In a way, each object is a specialized, standalone "computer," capable of reasoning with its own



data and its own procedures. Among programming languages, Lisp and Prolog are familiar names; we will now have to become acquainted with Smalltalk, C++ and Objective C (the latter adopted for use on Steve Jobs' "NeXT" machine). In view of the increasing complexity of architectures and projects, recourse to object-oriented languages will help overcome the three major challenges facing programmers:

- to represent and model complex problems within the computer;
- to organize and manage programs to meet requirements of quality, maintenance and adaptability to change;
- to reduce manipulations, allowing users to concentrate on the conceptual aspects of their tasks.

EXPERT SYSTEMS

Expert systems place the most advanced knowledge and reasoning of experts at the disposal of the user. The computer is made "intelligent" through the knowledge that it conveys, and not through any intrinsic reasoning ability. From this viewpoint, expert systems empower the user. All expert systems include:

- a language for knowledge representation which, based on rules of logic, describes human expertise;
- an operating mechanism – often called an "inference engine" – which simulates reasoning on the basis of knowledge;
- an expert interface, through which the knowledge base is updated;
- a user interface, for entering problems to be solved and retrieving proposed solutions.

Expert systems are ideal for tasks for which there are no prior formal definitions of anticipated results, as in pattern recognition, natural language and, generally speaking, complex problem-solving. Expert systems do encounter certain difficulties, such as the integration of in-depth knowledge (which presupposes differing and changing viewpoints with regard to a given field of knowledge), and knowledge maintenance on the basis of simple rules.

Expert systems are going to become familiar tools in the following areas:

- management, which combines numerical calculation with the processing of large volumes of rapidly-changing information. Financial simulation will be a major user of expert systems;
- insurance, with assistance to policy writing which combines legal, financial and statistical data;
- intelligent monitoring and control of industrial processes, where real-time information must be acquired from sensors and dialogue established with programmable-logic controllers; or intelligent robots, able to make decisions on the basis of changes in their process environment;
- computer-assisted design of complex systems, such as conductor assembly in printed circuits packed with GSI components.

Whether hardware or software, these new developments are lavish in their use of power, memory and communications. **Technology** – always ready to expand into the corporate sphere at the command of the end user – **is going to keep its appointments with demand.**

2

THE DISSEMINATION OF TECHNOLOGY

The globalization of society, an information economy, unbridled communications, new horizons for the individual: these are the foreseeable contours of the 1990s. The intrinsic effects of each of these major trends are joining forces to accelerate the dissemination of information technologies. Miniaturized, powerful, open and accessible, technology will be omnipresent. Attracting increasing numbers of users (75% of installed computing power is being consumed by newcomers to the field), computerization will assist them in information retrieval, simulation and decision-making. The new technologies will penetrate every sector of activity and every corporate function. Data processing will be a participant in corporate competitiveness, integrating both production and marketing functions into a single continuous process (large American corporations state that 25% of their new applications will target marketing and sales functions) ■

THE INTELLIGENT USER

The data processing market was given its first big jolt by the microcomputer at the end of the '70s. Since that time, we have gone from 60,000 computers installed worldwide in 1960 to 60,000 computers produced daily in the 1990s. The 40 million installed PCs of 1990 will proliferate into 150 million by 2000. Whatever the level of technical prowess, this spread of computing power will not occur without a strategic shift. It is already being stated that end-user computing will account for 75% of installed power in 1998, in contrast to today's 35%.

The individual user is going to assume power, assisted by the personal computer, the cellular phone and the fax. These devices will facilitate the acquisition of information and the investigation of possible choices; they will optimize decision-making and ensure follow-up on selected options. As producers of information and creators of added value, individuals will be wielding tools which adapt themselves to their needs and blend discreetly into their working environment.

THE INTELLIGENT WORKSTATION

In 2001, the workstation will be a greatly enriched version of the current models in terms of performance, functionalities and applications.

The performance levels of the workstation of the future will make it a computer for which the "micro" label will fit only its name, size and price. Intended for professional use, its computing power squeezed into a single chip, the microprocessor will handle data in

32-bit or 64-bit units, with an execution speed in excess of 100 MIPS. The user will also want on-board memory capable of hosting larger and more sophisticated programs, together with the more voluminous data and calculation results generated in the processing of increasingly complex problems. And the user will get this power: the 4 megabytes commonly available today will increase to 256 megabytes, created by plugging in 64-megabyte memory chips.

The high-performance workstation will also be more user-friendly. It will move effortlessly from alphanumeric processing (where the screen displays only digits and letters) to image mode. Computer-assisted design (mechanical engineering, electronics, architecture, etc.), desktop publishing, graphic creation and animated drawing will all be within the scope of these machines. Microprocessors will produce the inexpensive synthesized images that are now generated on much more powerful and costly machines. Display technology will undergo further improvement, with emphasis on liquid-crystal, plasma and electroluminescent screens. And manufacturers are planning to quadruple display resolution from 1 million to 4 million pixels.

Printing will also adapt itself to the era of color and graphics, using the thermal transfer technique, in which three or four inks (the basic colors and black, as applicable) are successively transferred from ribbon to paper by the action of a thermal printhead which heats the inks to liquefaction. On paper as on screen, tomorrow's microcomputing will offer images at the price of yesterday's text.

Thus endowed with hardware, users are going to demand **a wide range of software products** compatible with the performance of their new tools. The levels of power and memory capacity noted above will require changes in the operating system managing the computer's internal resources.

MS-DOS, the most widely-used standard of the '80s (it is installed on 80% of the 40 million PCs in use), will no longer match up to these new demands. Its successor, OS/2 (introduced in 1987), emphasizes the multitasking function and the graphic environment which give the PS/2 some of the flair of a Macintosh. The somewhat uneasy compatibility between the two operating systems, together with the desire shown by some manufacturers to shift the installed computer inventory toward the EISA architecture, are indicative of the "war of the standards" (see Section III), which will be reflected in the simultaneous development of different systems.

Despite the more than 10,000 software products already on the market, the catalogue of new microcomputer resources will continue to expand each year. Microcomputing will mount a massive attack on the areas of simulation, 3-D image synthesis and even reasoning. Whatever the task — diagnosing a mechanical failure or our cholesterol problem, planning a soybean harvest or evaluating a financial risk — expert systems will be assisting users in the acquisition of knowledge and the modeling of their reasoning processes.

Finally, tomorrow's workstations will no longer be isolated, but instead will be connected by a **local area network** to a vast assemblage of computer resources: other personal computers, machines dedicated to specific applications, servers. Bridges will enable them to exchange information with machines connected to yet other networks and to large central mainframes. As a tangible sign of the strategic shift mentioned above, the personal computer will stand on equal footing with more powerful machines. Hasn't it been said that the mainframe of the future will be a mere server for millions of connected PCs?

EN ROUTE TO NATURAL LANGUAGE

If it is to become that electronic colleague, that tool for the reflection and amplification of human thought anticipated since the 1981 announcement of Xerox's STAR project, the computer will have to make great forward strides in its ease of use. Millions of microcomputers were sold in the past to executives and employees sufficiently motivated to agree to adapt themselves to the quirks of data processing. The new generation of users — managers, in particular — will not make this sacrifice. The most effective means for improving man-machine dialogue will involve:

Image

As vehicles of information, diagrams and graphs are at once quite "natural" and extraordinarily revealing. The goal being to enable man to work at the speed of thought, the development of "artificial realities" — as pioneered in computerized flight simulation — will revolutionize the way in which computers are used.

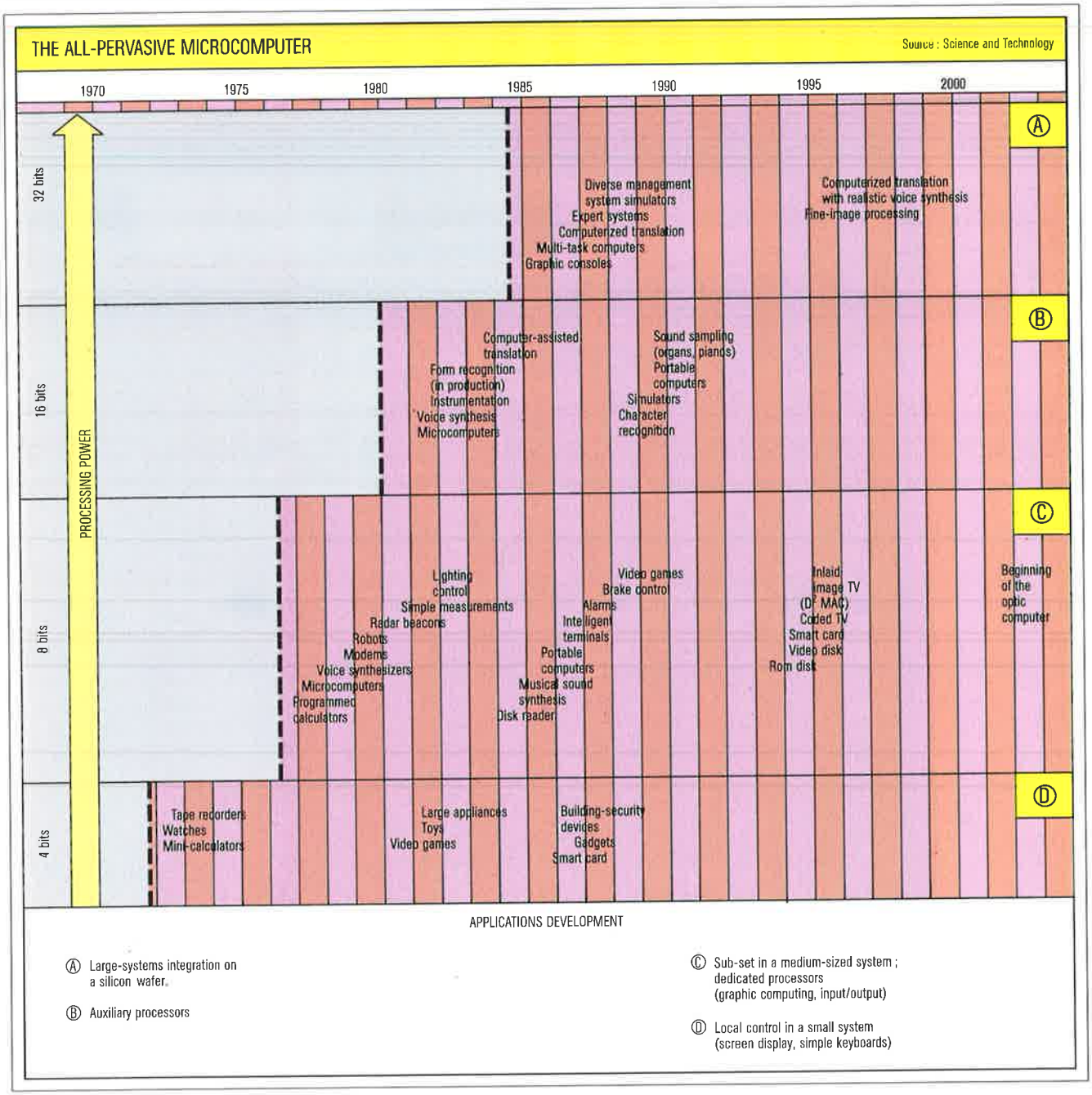
There are numerous advantages to this approach. In the first place, the more closely visual appearance imitates reality, the better the user interprets the information provided. Images do not become realistic unless a) they behave like the objects they represent, and b) the interactions between the user and these artificial realities reflect the existing interactions between the user and the real world. Computer displays now confront us with icons of our desktop, our desk drawers, our file folders... even our wastebaskets! Steve Jobs' NeXT workstation perhaps prefigures the personal computer of the year 2000. NeXT draws its originality from its software: the icon-based spirit of the Macintosh, spiced with a dash of multimedia, on a computer which skims the cream of the UNIX environment.

In a boldly innovative move, NeXT's designers have separated the machine's operating system from its application programs by a layer of screen management software which masks all of the intricacies of commands from the user. This interface, called "NextStep," itself builds the screen images with which the user works.

Comprehension

Speaking, listening, writing and reading in one's native language are the simplest and most self-evident means of communication. The computer, however, is more gifted at handling figures than words. Natural-language processing by machine is a complex procedure. Starting off with text input — a newspaper article, a technical data sheet, a command or a question — the machine might respond in one of two ways:

By determining the meaning of the text in order to index it, trigger a computer response to the command or collect information in reply to the question. The problems to be solved before arriving at this stage are extremely complex. All language is choked with metaphors, ambiguous expressions and idiomatic phrases. Another constraint lies in the immense amount of knowledge that has to be manipulated in order to comprehend a phrase, whose meaning frequently lies in its context. Individual words share many meanings: a "key" might be a musical key, a device to open a lock, a means of solving a code or a puzzle, or anything of importance. In order to get from the individual word to the meaning of the text as a whole, a series of analyses must be made of the word's structure, its syntax and its semantics. And all of this must be accompanied by pragmatic knowledge. Systems of the



'90s, with the faculty of syntactic and semantic comprehension, will be endowed with databases (dictionaries, grammars) and with deductive capabilities derived directly from expert systems.

IBM-France researchers are now working on a 200,000-word dictionary. In the long run, this research will be extremely significant for document indexing, automated thesaurus compilation, machine translation and automatic dictation. Most probably, however, the generalized application of natural-language processing will depend on the connection-based approach of neural networks and massively-paralleled computers. Such long-term prospects will require a substantial research effort and – above all – guarantees of economic feasibility.

Or translating the text into another natural language. To translate from one language to another, the translating machine must first analyze the syntax of the source phrase, then translate its words with the assistance of a dictionary. Next, another program generates an intelligible phrase composed of syntactic elements in the target language embodying the understood meaning of the source statement. While computer-assisted translation is no longer a dream, real-time machine interpretation is a more distant goal. This technology presupposes increased amounts of computing power and greater mastery over neural techniques and cognitive sciences, capabilities not to be expected before the turn of the century.

Multimedia

Besides numbers, characters and graphics, the multimedia computer processes images and voice. We are entering the era of

total digitization, with high-definition imaging and voice communications laying the groundwork.

Advances in high-definition television (HDTV) will make a contribution to the computerized processing of animated images. With conventional television, transmitted electromagnetic signals are received, amplified and processed at the receiving set; interference and distortion are introduced at every stage. In HDTV, signals are first "dissected" into their component characteristics (frequency, amplitude, etc.), and information about these characteristics is broadcast in digital form. Processed by the receiver's electronics, this information is used to precisely reconstitute the original signal, yielding matchless quality of image and sound. Applied to end-user computing, we can envision a time when — problems of data packing solved and network data transmission rates increased — users will be receiving TV programs in a workstation window.

Voice, man's most natural mode of communication, is one of the hardest to handle with computers. Going beyond present-day industrial applications — ranging from jet fighters which respond to voice commands, to automobiles which recognize their owners' speech, open doors and comment on the vehicle's functioning — multimedia workstations are going to completely change the user-computer relationship.

Configured around a high-speed microprocessor, the workstation will include an HDTV display, a videodisk unit (supporting sound and images), and an amplifier and loudspeakers for delivering synthesized speech and sound.

An electronic system will mix video images stored on a laser disk with graphic and digital data held in the computer, allowing the user to manipulate screen pictures at will. This approach to total interactivity will enable a stockbroker to view the day's share listings and a press conference by the Chairman of the Federal Reserve Bank simultaneously; or an executive to scan the newspaper while watching the TV news; or a Sorbonne student to take a guided tour of San Francisco; or a traveler in Beijing to consult a dictionary for that elusive word, with correct Mandarin pronunciation.

ON-LINE INFORMATION

Local processing and ease of use are important to the user as electronic information becomes a strategic necessity. The coming decade will be accompanied by a new logic: the "transmission-message-reception" triad will be replaced by an "action-communication" diad. It will favor on-line information systems, which offer greater speed, ease of access, relevancy and low unit cost of information, and the possibility of formulating sophisticated inquiries.

As might be expected in a speed-oriented environment, data banks will be the technology of choice. Bringing together an ensemble of coherent, structured data, the data bank is stored in computer memory. Appropriate inquiry software is used to combine search criteria in a more or less complex manner in order to display or print out selected documents. A distinction is made between full-text data banks and bibliographical reference data banks. There are 3,500 data banks available today, distributed by 600 information servers. Three-quarters of their income is derived from the sale of economic and financial data. This gives a hint of tomorrow's corporate information consumption: technical questions, documentation on companies, quantitative market data, reports by international organizations. Reuters currently serves 184,300 clients, using a system that can read and file a document in less than five seconds. Likewise, thanks to the computerization of documentation taking up ten miles of shelf space, a French firm, SVP, answers 5,000 inquiries daily, 90% of them placed by business executives.

With the proliferation of information servers, the massive use of networks and the large-scale integration of workstations, **users will have access to trillions of items of information.** But there is a continuing con-

The Client-Server Model

In response to the growing autonomy of individual corporate computer users, a new approach to applications development will take place between now and the end of the century: the client-server model. Contrary to current usage, applications will no longer be designed or implemented at a central location accessible by means of connected workstations. The process will be completely reversed. End users will model their own applications and define the processing equipment and peripheral configuration of their systems to suit their individual requirements. Then, by using the network, they will take the information they need from the central location. Therefore, diverse user needs will be handled at an individual level, while maintenance of the uniformity of information will be assured by means of a company's central databases.
Before we actually see mainframes "at the service" of PCs, however, a technological condition of transparency must be established in operating systems, document and printing formats, security of data access and network administration.

cern: how does one speedily ferret out an item buried somewhere in the heart of this mass? We know, for example, that a Boeing 767 is built of 3.5 million separate parts, and that the 797 of ten years hence will possibly have twice as many. For the ground maintenance engineer, as for any other user, suitable information-retrieval tools remain to be developed. Manual inquiry will have to be replaced by the effort of automated agents, working around the clock to track down information. A cross between a robot and a computer drudge, these devices will go hunting for our data after hours, through the night and during our absences. They will perform selective searches, sifting out redundant or trivial responses.

To reap the full rewards of this work, however, our robots will also have to conduct inquiries by analogy. Human creativity is as much a product of chance as it is of logic. The idea of printing struck Gutenberg as he was watching coins being minted. Future systems will have to sort through enormous masses of documentation to extract nuggets of multidisciplinary significance. For example, a question in biology might be answered by notions derived from military strategy. By the end of the century, computers will have the power needed to make good servants out of our "inforobots," which will be no more expensive than today's word processing systems.

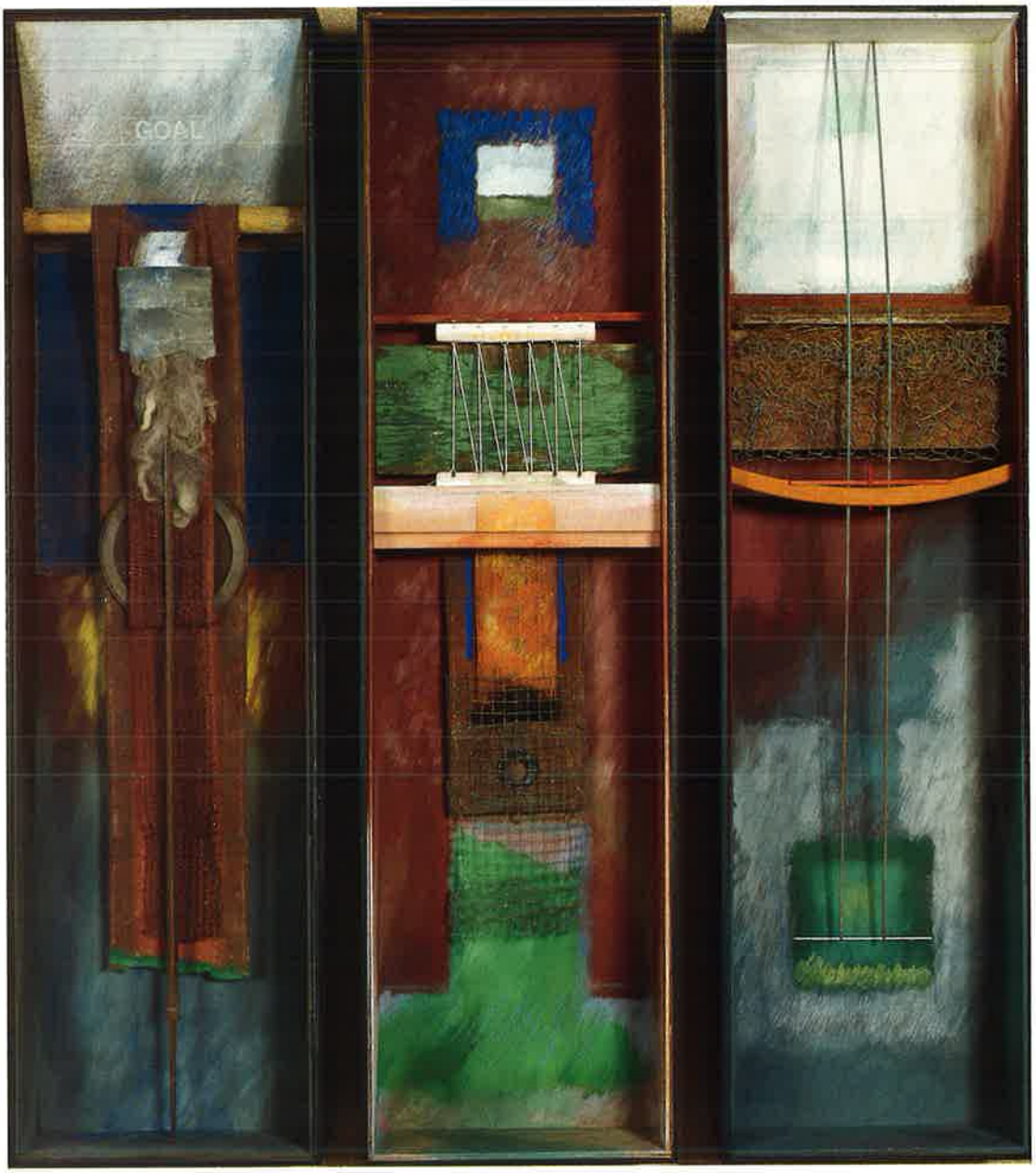
THE INTEGRATED CORPORATION

To enrich its creative output, the corporation of the '90s will include increased amounts of information and knowledge in its products, services and decisions. At the same time, expanding technology will provide users with a wider range of possibilities for acting on information such as computer-assisted design, document handling, simulation, and so on. Corporations will thus face a dual challenge: **nurture human intelligence and channel it.**

Computerization offers many features to meet this challenge: the continuing advance of technology, the development of internal and external communications facilities, the proliferation of available data and user-friendly applications. But computerization also has a more targeted contribution to make. After having improved corporate productivity and honed a company's efficiency, the information system will increasingly work to enhance its competitiveness. In a recent survey, 71% of the officers of large French companies responded that their decisions regarding computerization were motivated by improved customer service and satisfaction. "Competitive computerization" will move through a stage of strong integration of corporate services and departments, extending both internally and externally.

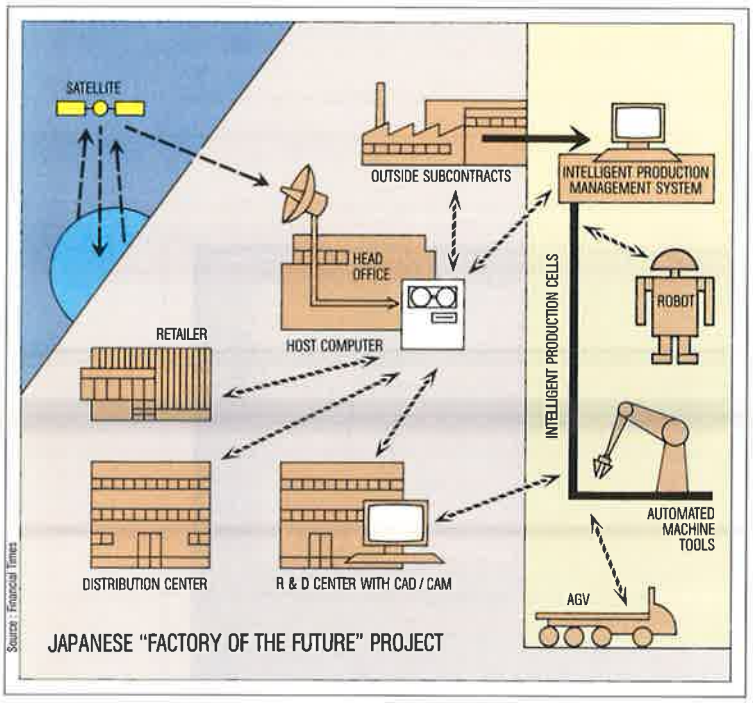
COMPETITIVE COMPUTERIZATION

Under the combined pressures of hardware downsizing, user demand and the obvious decentralization of data and resources, the architectures of information systems are going to undergo significant change. Following in the footsteps of today's pyramids and star-linked systems, we will see the advent of mesh networks which will interconnect data and resources (including computing



power, applications, printers) distributed throughout the corporation. This mesh architecture will support a substantially horizontal organization, considerably reducing the number of hierarchic levels. Individual initiative, creativity and responsibility will be encouraged, while users will increasingly be working in groups. On a company-wide basis, technical computer skills will grow weaker. High-level expertise will have to be sought outside, particularly from software consulting firms.

The information system will constitute a formal expression of management options in



JAPANESE "FACTORY OF THE FUTURE" PROJECT

terms of corporate goals, technologies, architectures, standards and methodologies. It will mark the boundaries within which users may exercise their individual power, while reflecting the determination to foster and maintain coherence.

Full integration of the varied aspects of corporate activity will make it possible to customize products and services to meet the wishes of the increasingly individualized consumer, to handle complex requirements and to accelerate response times. **Speed is a competitive advantage** in sectors subject to incessant change in technology, in government regulation, in customer demand. By automating purchasing management, for example, a distributor can optimize his choice between manufacturers' promotional offers. If this distributor were purchasing 2,000 products from 100 suppliers weekly, he would have to make a buying decision every thirty seconds. In this particular case, automation could improve his gross margin by up to 10%. This is why computer experts must place increased emphasis on understanding demand and understanding the environment when defining information systems (see Section III). The information system will soon be weaving a seamless web between a company's departments, its suppliers and its customers.

For two examples of tomorrow's integrated data processing, we look to the industry of the future and electronic information interchange.

THE INDUSTRY OF THE FUTURE

Computerization has frequently penetrated the industrial world in the form of isolated solutions to specific problems, delineating "islands of productivity."

The service bureau generates a flow of information which becomes enriched as it travels, feeding production start-up and management departments, manufacturing shops, robots, handling and warehousing systems, test units, purchasing and after-sales service departments, all the way to the company's economic and financial departments. Tomorrow, all of these "islands" will be integrated into a coherent whole. There is a name for this concept: computer-integrated manufacturing (CIM). The idea is simple: complete computerized tracking of a process from inventory management to fabrication. CIM integrates the design/manufacturing/management range of industrial activity, including:

- actual physical work performed by machines,
- monitoring and control of production tools,
- computers for real-time production line control,
- central file servers,
- administrative and financial DP systems.

Computerization adopts the "five-zero" policy (zero inventory, zero delivery time, zero defects, zero down time, zero paper). The percentage of Japanese firms already making use of CIM has gone from less than 10% in 1987 to over 30% in 1989. This computerization of Japanese industry shows that coherence of the whole is the crucial point, that smooth operation requires full information for all participants, and that gains in productivity are less spectacular than decreases in completion and delivery deadlines. The time required to design and produce a new model of an automobile is going to shrink: 7 years in 1990, 4 years in 2000, and 1 year in 2010. Toyota is already delivering cars with custom options to any dealership in Japan in less than 12 days.

The application of CIM by all of the world's automakers raises several questions. How can you integrate without standardization? (None of these gadgets will be able to communicate smoothly with one another without clearly-defined and universally-respected protocols). Where does integration stop? (At a time when communications are increasingly integrated with computers, it becomes more difficult to conceive of a production unit outside of the corporation's relational network). And how do you retrain a workforce molded by decades of task-oriented specialization?

ELECTRONIC INFORMATION INTERCHANGE

Management of corporate information will be a future priority, for satisfying the aspirations of employees as well as the desires of outside partners. Internal communications account for 80% to 90% of an organization's total information volume. It is recognized that the informational relationship between a company and its environment is a continuous process. Organizations are thus looking forward to the replacement of paper by electronic media. Gone will be the order form, the waybill and the invoice sheet (80 billion documents yearly in France). Imagine the results! Company administrators will no longer have to fill out astronomical numbers of forms for tax officials, social security agencies or health plans; they will be generated and transmitted automatically. They will no longer have to wait for a bill or an order form, then post the information to their accounts or order books. They, too, will be recorded automatically.

In a dozen years, Electronic Data Interchange (EDI) will be routine.

Beyond the often-cited fiction of a "paperless" society — in fact, paper will remain the support for 95% of our information — Electronic Data Interchange will provide business with a savings of 7% to 15% on the price of goods sold.

Electronic Data Interchange will presuppose:
— an infrastructure of networks to transport information from one company to another. These will employ electronic mail systems in which each member of an inter-business group will have a mailbox for sending and receiving electronic documents;
— transparent dialogue between differing computer types thanks to EDIFACT (Electronic Data Interchange for Administration, Commerce and Transportation). The development of this software required a decade of work, and its final development should be completed three to four years from now. It will catalogue all of the components used in written or computerized correspondence, covering virtually every field of activity, country and language.

The universal spread of electronic mail will no doubt be slowed down by insufficiencies in security systems, by the profusion of existing standards and by the cost of document duplication during the start-up period. Looking beyond these technical contingencies, however, this process is going to change the very thinking of corporations.

It will be necessary to think in terms of extended organization and vertical integration. The stakes go beyond the simple framework of automation of administrative tasks (which could save in the neighborhood of $1,000 per vehicle produced by the French auto industry alone) to terminate logically with the "home salescounter." Thanks to the smart card, consumers will be able to perform most of their transactions (travel reservations, ticket purchases, shopping, etc.) from their homes. We are witnessing the birth of the interconnected society.

As they proliferate throughout the decade, technological innovations are going to change the environment of business and industry. Equipped with appropriate tools, individuals will be able to make better use of their intellectual resources. And corporations will strive to channel this intellectual energy to improve their performance.

3

THE REIGN OF COMPLEXITY

The 21st century will dawn on a social landscape of great complexity. Reduction in the size of computers will be a contributing factor in this direction, as will human determination to solve increasingly complex problems. Universal interconnection will raise new challenges, such as continuous adaptation, standardization and information security, all requiring our mastery over the integration of computerized systems ■

INTERCONNECTION AND COMPLEXITY

WORLDWIDE INTERCONNECTION

Tomorrow's great economic challenges are going to consume vast quantities of data processing and telecommunications, whether in the name of the general good or the competitive struggle. Problems will be so complex that only the consolidation of computer resources belonging to multiple organizations will be capable of solving them. A perfect illustration of this may be found in the areas of automotive and air transportation.

Automobile traffic is the target of a great deal of futuristic thinking based on a very simple underlying notion: mobility is one of man's fundamental needs. And the automobile is the favored instrument of this mobility.

We can all measure the advantages of this mobility, but its drawbacks are becoming unbearable. In Europe alone, accidents take 50,000 lives yearly and cause 17,000,000 injuries, leaving 150,000 people handicapped for life.

Congestion in our cities is a matter of serious concern. In the German Federal Republic, its estimated annual cost to the economy is over DM 20 billion ($11 billion). As if this were not enough, the environment is polluted by traffic noise and exhaust fumes.

Solutions may be approached from a number of directions: from the individual standpoint, with the compulsory wearing of seatbelts and observing speed limits; from the technical standpoint, with the catalytic converter, lead-free gasoline and ABS brake pads; and from the standpoint of the infrastructure, with the overhaul of highway systems.

But advances in sensors, microelectronics, man-machine interfaces, expert systems and mobile communications allow us to

anticipate a more encompassing and reliable approach to the problem:

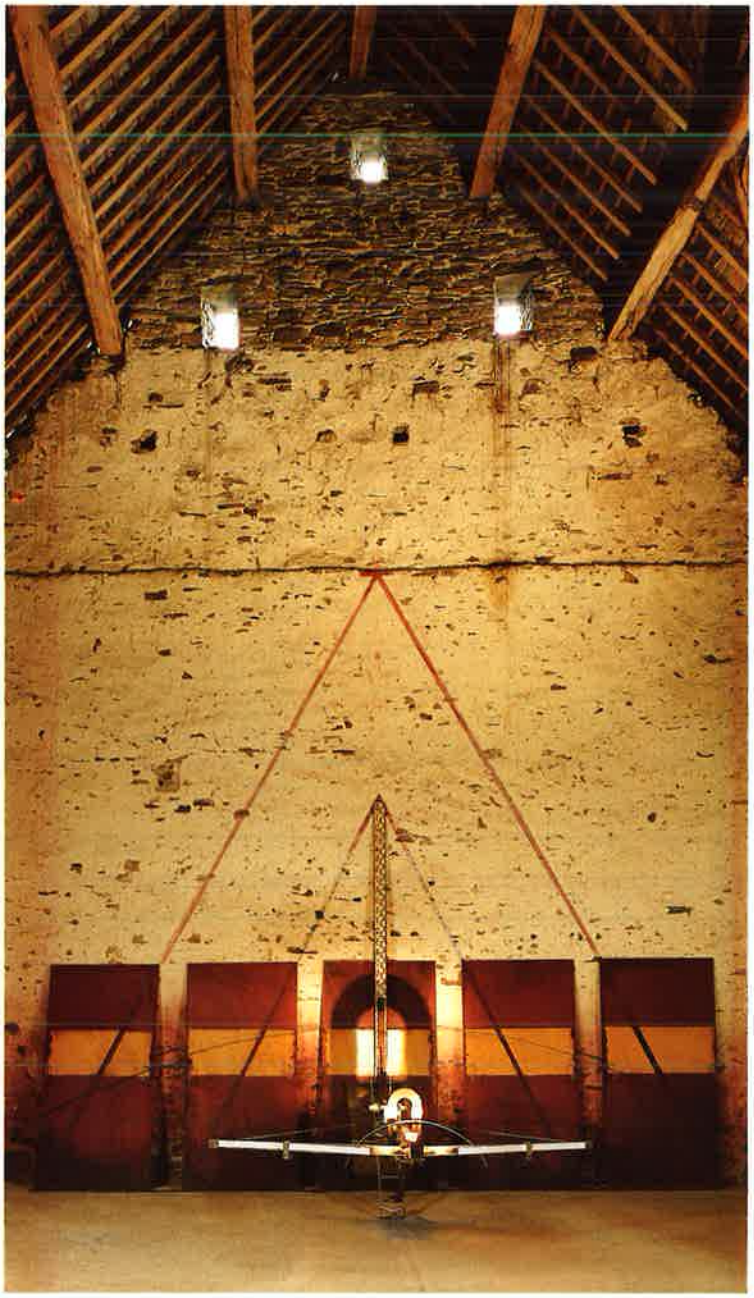
- by developing computer-assisted systems to help drivers monitor roadway conditions and the state of their vehicles; or even turning the steering wheel over to a robot (a joint Mazda/ITMI project);
- by interconnecting onboard systems to provide electronic "safety barriers" between vehicles;
- by informing drivers of traffic conditions along their planned routes.

These are all research areas of the European Prometheus program, whose initial applications are expected for the year 2000.

Air transportation will offer another example of this interconnection of computerized resources, the most obvious of which relates to reservation systems. Airlines are combining their efforts to weave networks — Amadeus and Galileo, in Europe — which will provide direct access, response times under two seconds, and "impartial" flight listings (not by carrier name). A single session at a terminal will set up an entire itinerary: airplane seats, hotel rooms, rental cars, and any other travel requirements.

Under the pressures of deregulation — of demand (one billion European air passengers in 2000, in contrast to 400 million in 1990), and of restructuring due to takeovers and fare wars — the players involved will push computerization far beyond its present boundaries. Optimization of flight routes, estimation of required fuel quantities, design of roomier passenger cabins, cockpit automation (accounting for one-third of the cost of an Airbus A310), and aircraft maintenance through in-flight data transmission are all items on the competitive agenda.

In turn, airport authorities are going to modernize their infrastructures in preparation for the airport of the future (a CAP GEMINI GEDA project), and this will lead to the further automation of air-traffic control. Paradoxically, air-traffic control is still based primarily on human know-how. Tomorrow's computerized systems will lighten the air-traffic controller's burden in three areas. First, as an assistance to decision-making. Thanks to tools packed with artificial intelligence, the controller will be alerted whenever two airplanes move into an unacceptably-confined zone. Next, the controller's communications facilities will also be enhanced, with direct links between aircraft and control tower, onboard computer and traffic-control computer. And, finally, flight operations will be monitored by systems such as STAR, under development by CAP GEMINI SOGETI for the French aviation administration. This sys-



The Intelligent Home

Electronics is invading the home: the programmed coffee-maker, television, tape recorder, stereo system, telephone answering machine, fax, minitel and security alarm system were among the early arrivals. Others are no doubt on the way. That at least is the conviction of the ***home design specialists*** *who are predicting that the fully automated dwelling, controlled and monitored by computers able to communicate on their own with the outside world, will soon be with us.*

The "intelligent" home of the 1990s will function around two simple principles: centralization of information and the creation of a single network.

– Centralization of information, controlled by a household computer, will make home management "a piece of cake." For example, upon leaving your house, all you will have to do will be to enter a code and press a button to signal the system of your departure. Your instructions regarding entry and exit, water supply, answering machine, etc. will all be issued at once, at the same time that your property is placed under total surveillance.

– The home network is the real nervous system of a building using fiber optics to link all available equipment: washing machine, microcomputer, sliding garage door, and so on. It does away with the need for unsightly and expensive cables, connects sensors and activators which until now could only handle a single task (opening a window or turning off the heat, for instance). A sensor to "pick up" the presence of the occupant, and a light switch to illuminate the premises will be automatically synchronized. This single network will also act as a multimedia support for sound, image and numerical data.

The industrial and economic stakes are high, leading to projects that combine occupations such as electronics and building construction: for example, the "Intelligent Home System" in Japan, the "Smart Home" in the U.S., and the "Integrated Home System," which is part of the European EUREKA program. These projects will not make real headway, however, until greater strides in standardization and changes in housing construction also occur.

Whenever they actually do arrive, domestic systems such as these are positive proof that technology in the '90s will penetrate the walls of our daily lives.

tem will manage traffic-control data, flight plans filed by pilots or airlines prior to each takeoff, traffic regulation and processing of fees.

THE AGE OF COMPLEXITY

The involvement of information systems in all of society's functions is going to lead to certain difficulties. A flood of information can result in saturation. Multi-user conflicts will have to be managed. The growth of networks will make society more fragile. Everything from electronic banking to air conditioning and remote control is going to depend on the smooth operation of electronic links and their corresponding servers. We will be living in a world of increasing interdependence. This will be the age of complexity, marked by some clearly distinguishable features:

– The pioneering computerization of virgin territories will be a distant memory. Corporations everywhere will have created tools and skills, stockpiled information, made software investments. It will be a matter of exploiting these resources by making internal and external information as flexible as possible.

– Consumer networks will be transformed. Information technologies (personal computing, networking services, electronic banking and payment, sales robots, value-added networks, etc.) will change the distribution economy:

- by encouraging the separation of production and distribution functions in the realm of intangible goods and services. Travel and tourism, banking, entertainment and leisure reservations, real estate, insurance, health and human services will be governed by patterns in which distribution will cease to be organically tied to production. The result will be competition between the dedicated or multipurpose network, accessible from the home or on a self-service basis, and the added-value network;
- by modifying the status of goods in order to harmonize them with interactive consumer habits. We will witness the development of computerized shopping; flexible, personalized production; product design by placing CAD tools in the hands of consumers. We want things fast, and we will be buying **time**.

– Private domains will be abolished: computer networks will uproot existing commercial, informational and cultural sanctuaries. Universal communications will breach boundaries, decompartmentalize businesses and occupations. Financial markets will ignore old concepts of time and space. Banks will find themselves in competition with insurance companies... and even with department stores.

— A new realm of research will unfold: the intellectual workings of man. Its disciplines will be artificial intelligence, linguistics, logic, educational psychology and the neurosciences. Linking investigations into the brain, languages and robotics, these cognitive sciences will be associated with all phases of basic research in computer science. We shall move from physics to biology, with its concepts of intensity of information, microdimensions, introversion, adaptability and globality. Ever more computing power will be required for delving into the unknown. Computers ten thousand times more powerful than today's models will be needed to decode the meaning of those three billion marks on the strands of DNA which make up our chromosomes.

A sign of the times: philosophers will be teaming up with mathematicians, physicists and computer scientists to unravel the complexities of future systems. The farther science advances, the more important ethics become. Dr. James Dewey Watson, 1962 Nobel laureate for his co-discovery of DNA, has requested that 3% of funds allocated to GENOME, the American project for genetic mapping, be devoted to a study of the project's ethical implications. The Institute for Complex Systems, recently established in Santa Fe (New Mexico) to study the design of a computer capable of simulating any living being, has already blazed a trail by recruiting specialists in all of the fields mentioned above.

THE CHALLENGES OF COMPLEXITY

There is no denying that we are witnessing an acceleration of progress. Fifty years separate the initial study for the Channel Tunnel from the ground-breaking swing of the pick, whereas the first lunar voyage took place a century after publication of Jules Verne's celebrated novel. Data processing is no stranger to this pattern: 90% of the products listed in Digital Equipment Corporation's current catalogue did not exist four years ago. In this context, continuing adaptation could become a necessity for all players at the computer chessboard. At the same time, they must not overlook the paramount importance of standards and the need for security.

CONTINUING ADAPTATION

COBOL programmers will not be the only ones stymied by the year 2000. In most programs, dates are recorded in six digits, the last two being reserved for the year. The arrival of the year 2000 will apparently require the writing of new code at an estimated average cost — in England, for example — of £100,000 ($160,000). This anecdote aside, all projections are showing that, from now on, we are going to be constantly confronted with complexity and change. We are all aware of the difficulty which organizations — which never behave like an aggregate of individuals — have in adapting to new times. Data processing experts often work to fill in the gap between technological potential and real applications, between requested functionalities and existing resources. In a world reduced to the scale of a village by advances in communications, corporations will demand that their information systems be capable of incorporating technological innovations, dealing with strategic or structural change and accelerating their response times.

This ability to adapt will be based on:

- Organization: the sites where information is created, stored and manipulated must be brought close to the centers of decision-making.

- Financial commitment: it must keep in step with reduced product life cycles, accept larger investment levels, and be reviewed every two or three years.

- Management involvement: a DP committee, including the CEO, information system manager, project managers and top operational executives will define MIS strategy, monitor its implementation and report on its results.

- People: continuing training must be provided for end users who must get used to meeting new applications every day, as well as for the DP experts themselves as they move from consultant, to implementor, to architect in office automation, to knowledge engineer, to networker, and so on.

STANDARDIZATION

Integration of applications, empowerment of users, increased capacity of value-added networks and internationalization of business will make open systems a necessity. And this will be possible in 2001 only if the technological components of these systems — hardware and software — are able to communicate with one another. In parallel with the development of inter-computer communications networks, then, we will need official or de facto reference standards. Expansion is conditional upon standardization. The stakes are clear, and the challenge is ambitious.

The stakes are clear. Users will no longer bend to manufacturers' whims and will demand full freedom in their choice of products. And this freedom will be limited only by considerations of price, investment durability, upward compatibility and ease of maintenance. In many countries, government agencies support activities for standardization, thus perpetuating their exercise of national independence. No government anywhere likes to be dependent on anyone. Following the American example, various European associations have been formed to make users' voices heard (EMUG in the production sector, OSITOP for office automation and RARE for scientific users). For vendors, it is a matter of encouraging competition under well-established, universally-recognized rules. As no one of these parties is able to provide solutions for every problem, standards are necessary in order to reduce the energy wasted in implementing interconnecting bridges. Under the aegis of the ESPRIT Program, and based on OSI standards, leading European manufacturers are working together on the industrial implementation of the multi-source networks desired by users. And collaboration is taking place on a worldwide level in the Corporation for Open Systems (COS) and Promotion for Open Systems Interconnection (POSI) programs.

The challenge is ambitious: to achieve the integration and standardization of applications. In other words, to enable users to access a desired resource (data, application, peripheral unit) without having to concern themselves with its location or the routing or procedure required; and to ensure software portability by writing application programs that will run on any system. This challenge can be met only by intensive standardization activity and after many industrial and political battles. At present, it would be risky to try to predict the outcome of this challenge, and tedious to detail its content. Still, a few sample casefiles might be mentioned:

• Workstations. Present users are wavering between IBM's MS-DOS and OS/2 operating systems, EISA and Macintosh architectures. No one knows which will win out. It is probable that they will all co-exist for a long time to come, if only because the vast majority of pioneer users, entrenched in their familiarity with MS-DOS, will resist change. The weight of existing software investment will be an additional brake on this evolution.

• Compatibility from application to application. This will be achieved through the opening of in-house architectures and defining user interfaces on the kernel of the UNIX portable operating system (goal of the X-Open group). The spread of object-oriented languages will also result in application portability and the utility of existing building-blocks.

• Man-machine dialogue will be synchronized on the basis of identical interfaces, of common formats for data presentation, by agents that memorize users' working styles, and so on.

• Intercompany exchange of documents, under EDIFACT, will require installation of EDI standards in the fields of government, business and transportation.

• The bus, which will carry signals and data between a building's telephone, heating, alarm and lighting systems, will perhaps be compatible with one of two recently-unveiled standards: Instabus and Batibus.

SECURITY

The economic world of 2001 will be like an upside-down pyramid teetering on its apex. With the interconnection of systems, whole great segments of information will be at the mercy of malfunction and mischief. The reader will no doubt remember Monday, October 19, 1987, when thousands of orders, generated by overly-zealous computerized trading programs, caused a near crash on Wall Street. Or two years later, on Friday the 13th, 1989, when the media were running sensational stories about a fatal computer virus poised to attack millions of workstations on that ill-omened date.

Tomorrow, even more than yesterday, every organization – business, banking, research, law enforcement, military, diplomatic – is going to need sophisticated security systems. Product development (CAD), funds transfers, criminal investigations, order of battle analyses, intelligence activities will all demand high levels of security in data transmission.

Outlays for security, estimated at FF8 billion ($1.2 billion) in France, will go beyond the level of operational safety: i.e., reliability, protection against accident and failure by means of redundancy, fire-prevention systems, backup systems, fault-tolerant computers, etc. To handle security in the sense of data confidentiality and integrity, access control at processing and communications sites, control over information and resources responsible for system operation, the future system will have to provide:

• Access protection using passwords or smart-card key systems. Interface software (CAP GEMINI SOGETI's MULTICAM) will handle functions for bearer identification, card authentication, management of attempted intrusion and inquiry of watch lists. More personalized identification may be obtained

The Virus Syndrome

Known by various intriguing names such as Datacrime, Jerusalem or Columbus, computer viruses are pieces of DP code which disrupt programs and data files before going on to proliferate from one PC to another.
Behind the media headlines, the struggle to combat these viruses goes resolutely on. Some of the steps being taken include:
– reinforcing companys' data security mechanisms;
– extending the range of these protective measures;
– encouraging greater user mobilization through organizations such as the ESF (European Security Forum);
– promoting skill specialization in fields such as diagnostics and implementation (as practiced at CAP GEMINI SOGETI, for example);
– establishing and applying legal measures to track down and punish the perpetrators of these "crimes."

from biometrics: digital fingerprints, palmprints, voice characteristics, iris images and signatures will all be computer-recognized.

• Data security: data will be encrypted to prevent theft or unauthorized reading of information. Following transmission, encoded files are decoded by addressees using decryption algorithms.

• Certification of transaction: in telemarketing, each transaction must be verified for completeness and accuracy at both the seller's and purchaser's ends. Proof of purchase (or of sale) will always be a necessity.

Looking beyond products, communications security will affirm the "system" dimension of the problem. In fact, the complexity of systems requires:

• that security be built into the communications systems at the levels of architecture, communications protocols and system management;

• that security management maintain the system in a satisfactory state, with distribution of keys, event monitoring and remedial action. All of this should be as highly automated and as economical as possible without sacrificing reliability and security.

THE ART OF INTEGRATION

The computer and society are converging: the age of **total communication** is only a step away. Miniaturization and digitization are joining forces to refine the link between people and endow machines with a more human face. The goal is praiseworthy, but the task is complex. The simpler data processing becomes for the user, the bigger the headaches it creates for the DP expert.

The fact that this science achieves "transparency" by piling up layer upon layer of software and hardware is not the least of its paradoxes. To turn this technology to profit, it is necessary to reconcile hardware and software, computer systems and telecommunications, innovations and existing applications, personal needs and corporate requirements. In the 1990s, businesses will strive to master their DP systems by using sophisticated software resources and the fine-honed expertise of people who will put them to work.

WHAT IS INTEGRATION?

Technological prowess and users' hunger for cutting-edge tools are not enough to motivate the effort for integration required of corporations in preparation for the new century. Integration of DP systems is governed by external and internal factors as well, including:

– globalization of markets which, in view of heightened competition and mounting R&D costs, is producing economies of scale and increased product lifetimes;

– European unification, which is accelerating the race for market share and necessitates the dissemination of know-how among all of a multinational firm's employees, taking into account national personalities and the need for overall cohesion of a corporate group;

– progressive loading of networks as a medium for corporate integration into its environment: partners, suppliers and customers;

– affirmation of the information system as watchdog of a company's goals, its organization, and the conditions under which this organization may be implemented;

– specialization of business activity, which builds technology into applications specific to individual markets (or individual companies);

– multiplicity of skills involved (consulting, auditing, technical assistance, training, maintenance, etc.);

– diversity of technologies implemented (telecommunications, artificial intelligence, vision, human engineering, array processing, etc.);

– variety of applications to be handled or combined (management, computer-assisted production, robot technology, scientific computation, etc.);

– need to share resources and data between multiple hardware levels;

– industrial efficiency, which demands prime contractors capable of designing and implementing solutions meeting the needs of their client firms.

Systems integration thus takes the form of a three-stage rocket in which the system (hardware and basic software), the application and the network are tightly interwoven. By definition, these projects are complex in nature, demanding expertise in the following fields:

- feasibility studies,
- system specifications writing,
- selection of hardware, software, network,
- overall project management,
- coordination of subcontractors,
- integration, testing, implementation.

A recent study by Input indicates that on this type of project, the relative costs of hardware and software represent less than 40% of the total investment. This means that the largest share represents added value, i.e., professional integration services.

SOPHISTICATED SOFTWARE RESOURCES

The cruising speed at which we move into future computerization will be that of our software engine. Regardless of the output of research laboratories, or the productivity of assembly lines, products will be usable only

if the "software gap" is bridged. This expression describes the natural discrepancy between the short cycle of technological advance and the long cycle of adaptation by human organizations. Aren't 70% of programmers working on the maintenance of existing programs? Haven't 56% of all existing systems been installed behind schedule (Ernst & Young study, April 1989)?

This trend is no news to computer experts, who know just how much customer

requirements can change during a project's lifetime. It has also spurred some strategic decisions on the part of corporate clients and the data processing industry as a whole. In response to a Price Waterhouse survey, the great majority of DP managements listed the following priorities for the '90s: compliance with completion deadlines, weeding out of superfluous applications, and improved productivity in software development. This is the only way to pull the rug from under an argument all too frequently raised by management to justify postponing an investment: how can you evaluate the profitability of computerization? On the other hand, can you imagine a local bank branch without an automatic teller window? Faced by a slowing of demand, hardware manufacturers have grasped the meaning of client expectations and have formulated software responses (IBM's ADCycle, Unisys' Linc and Mapper) that they plan to implement with the assistance of software service firms with expertise in this area. Hence the international agreement between IBM and CAP GEMINI AMERICA, signed in September 1989.

In addition to expert systems, object-oriented languages and portable operating systems (UNIX), software production during the '90s will also benefit from expertise accumulated in software engineering workshops.

In fact, quality implementations are achieved through the three components of software engineering:

- methods, which organize the process of software development by defining the rules and procedures for management of development activities;
- techniques, which indicate precise steps to be taken in carrying out specific segments of the implementation;
- tools, which assist engineers in their activities by automating technical applications.

With software engineering systems, quality is apparent thanks to their analytical mechanisms, the completeness and coherence of their specifications, and to the automatic generation of the indicators required for setting up quality control operations. For example, GAMMA INTERNATIONAL, a subsidiary of SOGETI,* has developed a set of integrated software tools known as MEGA. Its main advantages include the complete modelization of powerful graphic tools, automatic generation of control files and, for the end user, a transparent operating system.

THE PEOPLE BEHIND DP EXPERTISE

Systems integration and software development are closely intertwined: they are implemented by people. And the people who make a career of DP expertise know that none of the developments described in the preceding pages will take place without their skills and know-how. Their clarity has been forged out of experience. From flights of technological fancy to discreet, stabilized and everyday applications, all these developments are founded on countless hours of listening, discussing, imagining and doing. These people do not visualize the computer of 2001 with the features of Stanley Kubrick's HAL; to them, the computer is not self-sufficient.

Each passing day shows that **their expertise is the mainstay of computer intelligence.** The advent of new technologies, the growing diversity of applications and the complexity of problems to be solved will widen the spectrum of their skills in three main directions:

- expansion of basic knowledge to artificial intelligence, object-oriented languages and man-machine interfaces;
- specialization in data structuring techniques, systems architecture, knowledge bases, non-compatible networks and large-project implementation;
- familiarization with one of eight major sectors of activity (finance, industry, business,

* SOGETI S.A., the parent company of CAP GEMINI SOGETI.

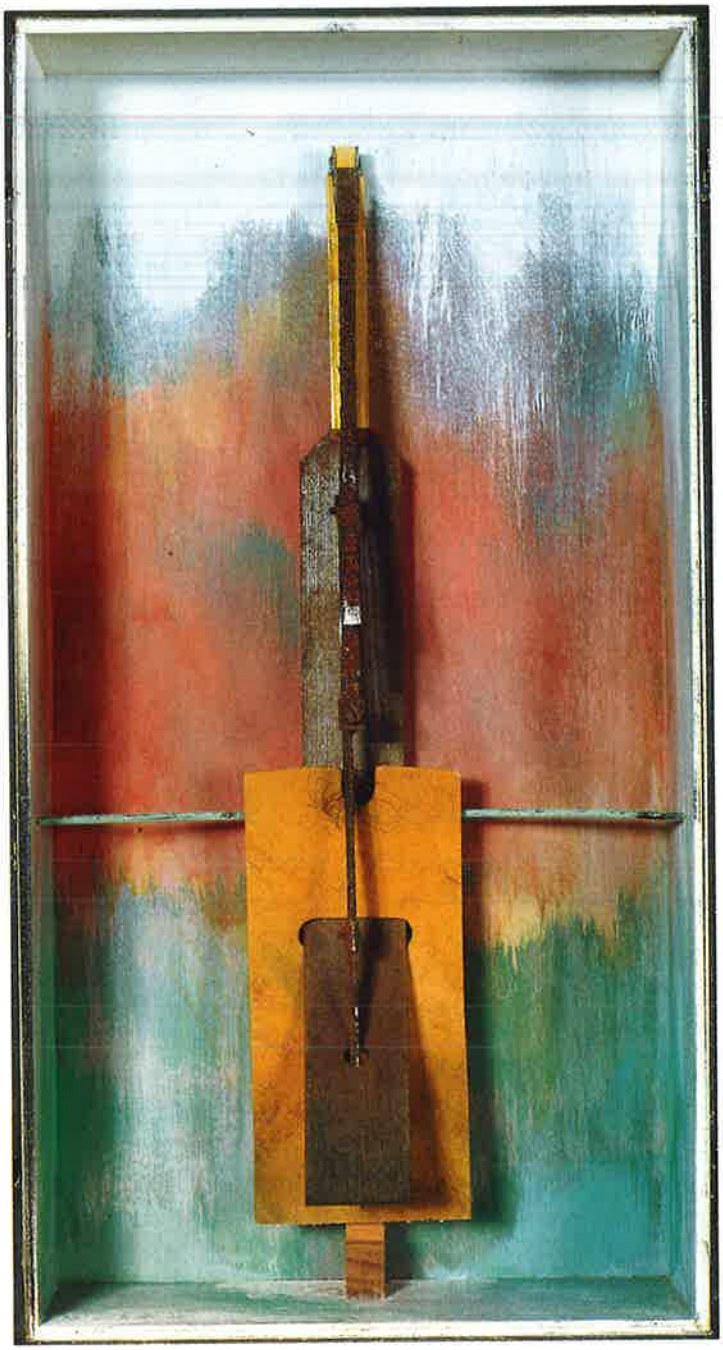
telecommunications, defense, government, data processing, science), including acquaintance with typical applications.

Moreover, the dissemination of technology among millions of users is going to "dilute" corporate computer skill, shifting its center of gravity toward the individual and group expertise of software service firms. Concentration by businesses on their prime (or most profitable) activities, flooding the market with easy-to-use machines, and diversification of techniques and products will all combine to alter the role of corporate DP experts. In charge of in-house techniques and procedures, they will become problem-solvers, trainers and strategists. More than mere implementors, they will specialize in targeted fields of activity (accounting, financial analysis, etc.), providing guidance and support for users. According to a Butler-Cox Foundation forecast, they will also have two additional responsibilities:

- to assist users in the development and use of personal computing;

- to employ their company's information-system master plan as a technological support for corporate goals.

The richness in content of DP expertise, its dynamism and its relative scarcity (Japan is projecting a shortage of one million DP professionals in 2000) all add to the appeal of these careers. But the people who follow this path must also be given opportunities to carry out varied assignments, to expand their knowledge and to accelerate their career progress. Thanks to their collective expertise, large software service firms will be offering an environment increasingly favorable to these ambitions. They will be the prime contractors for large projects, partners in major international implementations, and the most in-demand systems integrators. This favored position — for both the DP expert and the client company — will be based primarily on many years of investment in the fields of training, research, methods and transfer of know-how.



The diffusion of information technology during the years to come will be a sure sign of its vitality. A participant in society's new complexity, information technology will become a resource of choice in meeting the challenges raised by that complexity. And it will profit from a greater command of systems integration, in the firm grasp and capable hands of its DP experts.

Reading the preceding pages might foster a sense of disillusionment: Won't the future be what it was supposed to be? Where are the jack-of-all-trade robots, the space platforms, the radio-controlled vehicles so dear to the hearts of science fiction illustrators? Where are the computers that talk, compose music and interpret for us, leaving us the leisure to sit back and watch them work?

Let's be serious: the future, that's tomorrow! Especially for those of us who are busy adapting today's technologies to yesterday's needs. Looking at the future with eyes wide open, this Annual Report has simply noted the facts, observed the trends and listened to the voice of common sense.

What have we learned? That very-large-scale electronic integration, practical implementation of artificial intelligence and man-machine communications will be DP's inventive sparks at the outset of the 21st century. That computerized intelligence will penetrate every layer of the social fabric, to the greatest possible advantage of the corporation and the working person. That computerization will obey the laws of history,

which teach us that progress is often achieved in waves. And each of these waves may be said to correspond to a technological innovation: the 15th century discovered printing; the 18th century, the steam engine; the 19th century, electricity. Information technology, the brainchild of 20th century data processing, will enter the 21st century in full force, ready to satisfy the greatest of humanistic aspirations: to know, to understand and to communicate.

What can we surmise? That, far beyond the mingled imaginings of manufacturers and users, the dissemination of technology is going to produce complexity – from the standpoints of design and implementation as well as of maintenance – of computer networks, applications and information systems. That standardization, security and systems integration will be able to handle this complexity. That human knowledge will attempt to dismantle this complexity by bringing a range of disciplines to bear on the comprehension of phenomena such as the workings of the brain, the mechanism of intuition, the parallelism of tasks. That none of this will take place without the huge consumption of software capable of generating DP expertise.

What don't we know? Something simple, and yet decisive in terms of future progress: the rhythm with which all of this will take place. It is impossible for an observer to conceal his humility before the imponderable acceleration of history experienced by the world at the end of 1989. We know, for example, that the Soviet Union's demand for microcomputers between now and 2000 will be 28 million units, a number approaching the world's current installed inventory. It might very well be necessary to revise the figures given in Section II.

Another area of uncertainty: the speed with which data processing and telecommunications will merge with media. MIT's Boston Media Lab is working to develop an interface between computers, television, cinema, publishing... and people. The idea? A TV news program that selects and presents its information to match the viewer's personality. Such a development is not without significance in the "information century."

Confident in the dynamics of innovation, attached to a profession in which creativity is the offspring of the unknown, experts in information technology share a single conviction: that the adventure is going to be an exciting one. Their occupational environment will continue to renew itself and demand that they adapt themselves to it. They undoubtedly have high hopes that they will meet the challenge laid down by Henry Miller: "Maybe progress will manage to change the face of the earth until it is unrecognizable; but where is progress, where is change, if we human beings stay the way we are?"

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In this vast world of information technology, CAP GEMINI SOGETI is involved in a very clearly-defined business, calling on the talents and skills of more than 14,000 technical professionals performing within an efficient, well-run organization.

ITS BUSINESS

CAP GEMINI SOGETI is a computer services company, or what is most often referred to as a "professional services" company. This is to distinguish what it does from the manufacture and distribution of hardware and standard software packages, which are not part of its offering.

Obviously, this business is not composed of one monolithic structure, but has evolved gradually alongside the overall development of information technology. It is made up of diverse activities: the design and implementation of customized software, systems integration, consulting, operations management, training, maintenance, etc.

For many years the annual growth rate of the computer services market has been between 15% and 20%, depending upon industry sector and country. The preceding pages have demonstrated that within the foreseeable future, this growth rate will remain steady, technological progress will continue, users will go on renewing their demands, and new requirements will arise everywhere. In other words, the computer services business has a very promising future.

THE TALENTS IT NEEDS

CAP GEMINI SOGETI's strong dependence on the capabilities of all its professionals calls for their skills and talents to be constantly revitalized. This means that in every country in which the Group is located, it must be able to

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attract large numbers of both experienced DP professionals and recent university graduates, all of whom will be assured of ongoing training, effective management, and exposure to the most up-to-date methods and tools. There is also the added attraction of being involved in exciting new projects, and the adventure and personal challenge of being part of an expanding international Group.

These talents, however, are in short supply in the Western World. The growth of information technology has been so rapid that there is not enough "brainpower" available to keep up with the pace. Efforts are underway everywhere to train more DP professionals, and CAP GEMINI SOGETI is taking on its fair share of the burden. But it is a worthy effort because these talents are the real motor of the Group, its primary asset. And all possible resources are being set in motion to create, maintain and develop this twofold – both individual and collective – expertise, which the Group then places at the service of its clients via a highly functional organizational structure.

THE ORGANIZATION IT HAS CREATED

From its very beginnings, CAP GEMINI SOGETI has opted for a very decentralized organization, represented by operational units known as branches. This structure enables those in charge of each unit to stay in close touch with both their customers and their staff.

With growth producing branches of increasing size, with an expanding international presence, and with advances in technology, it was necessary for CAP GEMINI SOGETI to reinforce this decentralized structure with support systems designed to uphold the unity of the Group, assure effective coordination, and fairly allocate whatever supplementary resources were needed. It is a dynamic, flexible, often-modified organization, its most recent adaptations having been implemented at the beginning of 1990. It is this latest version that will be presented in the following pages.

EXPERTISE IN INFORMATION TECHNOLOGY: THE REASON WE'RE IN BUSINESS.

Ever since it was founded, CAP GEMINI SOGETI has chosen to concentrate on one business: data processing professional services. This determination to stay rooted in one business has been a constant surprise – even a disappointment – to those who saw in the natural growth of the information technology market an open invitation to widespread diversification. Yet this conviction is easily justified. DP professional services, whether in the form of **consultancy** and/or **implementation**, are the basic links in the business computerization process. It is a profession in a state of continual development, one that calls for a passionate commitment from those who practice it.

AN ESSENTIAL LINK

Corporate efficiency depends more and more on the proper use of information technology which is a strict, exacting science calling for precise efforts at adaptation before being applied to the human – and by nature imprecise, diverse and changing – organizations that need it. This is CAP GEMINI SOGETI's role, one it assumes by virtue of its knowledge, experience and the expertise of its technical professionals. These services are the building blocks in the relationship between business and new technology. And they require the most advanced skills to carry them out in response to very specific user needs. As the following paragraphs demonstrate, for CAP GEMINI SOGETI the development of such expertise is both a collective responsibility and an individual requirement.

A PROFESSION IN A STATE OF PERPETUAL DEVELOPMENT

By anticipating the technological and economic developments of users, CAP GEMINI SOGETI continues to reinforce its expertise in the following directions: mastery of techniques, acquisition of skills, penetration of all business sectors, and enlargement of its range of assignments. This very broad range of professional services, illustrated on the table opposite, extends from strategic studies to the delivery of turnkey systems.

Thus, CAP GEMINI SOGETI can assume responsibility in:

- **Consultancy:** assisting its clients in analyzing new or existing problems, developing possible scenarios, planning and organizing their information systems, recommending and implementing solutions;
- **Implementation:** designing, developing, and maintaining DP applications, as well as running DP centers or providing the training needed to handle information systems;
- **Systems integration:** acting as prime contractor on complete projects in which both the hardware and software components may be either standard or specific, with a commitment to price and deadline.

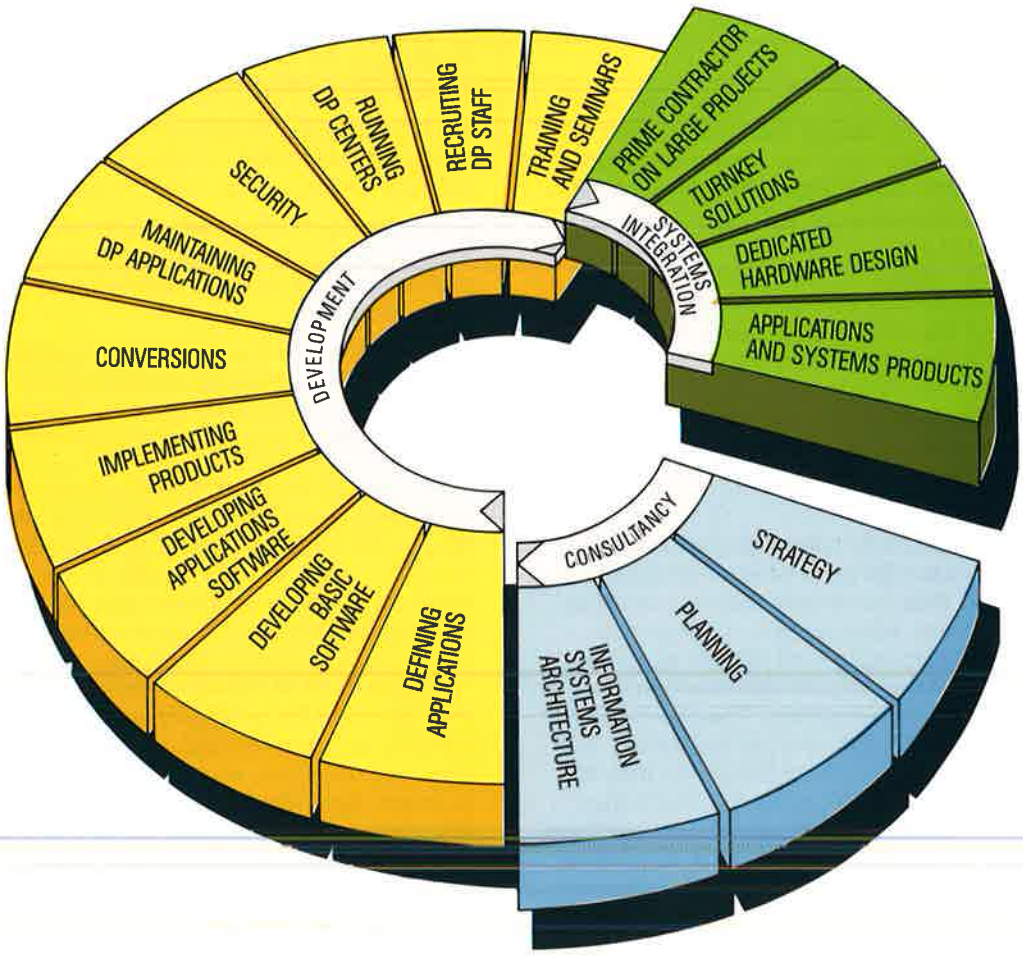
AN EXCITING PROFESSION

CAP GEMINI SOGETI's experts in information technology are taking part in a lively adventure. Aware that they are working in a

favorable marketplace, they also know that in this business nothing is forever. Each day acquired knowledge and accumulated expertise are reexamined and reordered to meet the demands of the real world. Each day, too, the professionals in the Group, be they technicians, administrators or sales people, are confronted with new technologies, plunged into the heart of the business world, faced with new and unexpected challenges, called upon to participate in projects of all sorts, and perpetually drawn into a creative working team environment. It is an experience savored by all those who may initially join the Group for wholly practical reasons, but who remain there out of a sense of dedicated commitment. By an insistence on technical quality, by the diversity of occupations and variety of business sectors covered, through a working environment emphasizing individual autonomy and responsibility, and the "human" dimension of the branches, the Group keeps vigil over its most precious asset: the dynamism and aspirations of its people.

TYPES OF CONSULTING AND DP SERVICES

offered by CAP GEMINI SOGETI



INDIVIDUAL AND COLLECTIVE EXPERTISE

At CAP GEMINI SOGETI teamwork and unity, implemented by **professional men and women,** continue to strengthen the company's expertise in information technology.

TEAMWORK

Teamwork in the CAP GEMINI SOGETI Group finds its natural habitat in the branch structure, which encompasses a community of economic and human interests. For example, branch managers, among their other duties, are responsibile for developing the Group's "capital assets in expertise." Thus, they recruit their own people and make sure they get the training they need, provide them with the resources to increase their skills and efficiency, and guide their career development. Because of its manageable size, the branch offers an ideal setting for exchanges of experience.

To successfully carry out their missions, DP professionals from various disciplines combine their know-how. Within a working environment, which project managers do their utmost to make both efficient and pleasant, consultants acquire the experience so vital to their development. This is where they find the satisfaction of a job well done, where they tie bonds of friendship that will serve them on future projects, where they learn to interact with many different partners (users, computer manufacturers), and where they learn to surmount the basic problems inherent in their business.

FOSTERING UNITY

In order to distribute its expertise, CAP GEMINI SOGETI has intensified its concern for fostering unity within the Group through training, methodologies, and the transfer of know-how.

Anxious to maintain a significant technical advantage, the Group provides continuous training along three major lines:

- DP techniques, including the quality plan, systems development methodologies, and all subjects related to the "state of the art";
- application of information technology to various sectors of the economy, especially problem-solving implementations intrinsic to each sector;
- methods related to the service business generally, and in particular conducting interviews, evaluating technical tasks, performing project audits, managing human resources, etc.

As part of their job, which consists of structuring, encoding and processing information, the professionals at CAP GEMINI SOGETI employ specific **methods** and tools which have been refined through years of experience. These methods must be rigorous enough to assure the quality of the final "product," and at the same time leave enough room for professionals to exercise initiative and function with creativity, speed, logic and relevance when faced with a given problem. As a result of this discipline, employees and clients alike know that their work in software development is being performed under the best conditions of efficiency and security.

In order to facilitate the **transfer of know-how** within the Group, some actions have been taken right from the beginning. They include:

- the Experts' Club, which assembles the most outstanding specialists in the most sensitive fields to form multi-discipline teams serving the entire Group;
- technical publications *(Systems Review, Cogitas Special Reports, Technical Newsletter, Experts)*, which analyze specific assignments and applications for the benefit of all Group members;
- reference databases, which offer a wide-range of information on individual projects;
- competence centers, which furnish the operational units with the resources to tackle problems related to a given technique or type of application with maximum efficiency. These centers include the CIM Software Products Support Center, the conversion centers (in Munich, Paris, New York and Los Angeles), and the "Networks" department of CAP GEMINI INTERNATIONAL SUPPORT.

PROFESSIONALS OF QUALITY

More than the growth of the market and the effectiveness of its organization, CAP GEMINI SOGETI's real strength lies in its 14,000 employees. Their quality, their motivation, their demand for excellence are what generate the expertise and success of the company.

Their basic educational level is high: nearly two-thirds of the technicians are graduates of top American and European colleges and universities. They are young: 33 is the average age of the Group.

As survivors of a tough recruitment process, they have met the technical criteria. They have also demonstrated creative imaginations, a taste for hard work, open minds, and the ambition needed for a career in a far-reaching international group. But intelligence, education and energy are not enough.

Three other qualities, which contribute to the professional profile of CAP GEMINI SOGETI employees, have to be constantly developed, namely, competence, experience, and know-how.

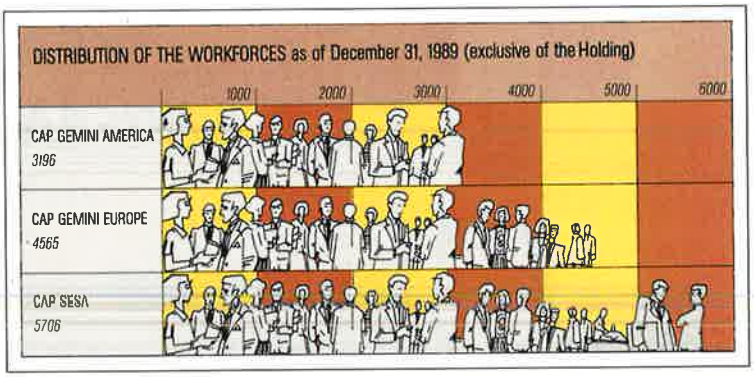
Competence links the understanding of a customer's business to basic DP techniques and command of a speciality.

Experience in such a diversified profession offers many possibilities for effectively using and enriching one's knowledge.

Know-how, in the framework of computer services, means:

- **listening** attentively and with a clear head to what users have to say in order to identify and give shape to their needs;
- **conversing** with many intermediaries to deepen the analysis and settle ambiguities;
- **being inventive** in the search for new applications and the implementation of unusual solutions;
- **performing** in accordance with prescribed specifications, controlling costs, and completing the job within the deadlines announced at the level of competence promised.

In a world marked by innovation and complexity, the men and women of CAP GEMINI SOGETI are committed to cultivating their DP expertise because they know that it is the key to new technologies, as well as the key to the satisfaction of their customers and their own professional growth.



Standing, from right to left: Serge KAMPF, Executive Chairman - Daniel SETBON, Chief Financial Officer - Christer UGANDER, Chairman and CEO CAP GEMINI INTERNATIONAL SUPPORT - Alain LEMAIRE, Chairman and CEO CAP GEMINI EUROPE.

Sitting, from right to left: Jacques ARNOULD, Chairman and CEO CAP SESA - Michel BERTY, Secretary General - Michel JALABERT, Vice President Development and Control - Robert J. SYWOLSKI, Chairman and CEO CAP GEMINI AMERICA.

GENERAL ORGANIZATION

CAP GEMINI SOGETI began 1990 with more than 300 branches located in 14 countries. The Group is organized by companies and countries within a clearcut organizational structure described in detail on the following pages and illustrated in the diagram opposite.

AN OPERATIONAL ORGANIZATION

Consisting of three groups:

- **CAP SESA** combines all the French operational companies. CAP GEMINI SOGETI has achieved a size in France which justifies a separate group of companies organized according to customer type (banking, industry, etc.) or technical speciality (operations, maintenance, training, etc.).

- **CAP GEMINI EUROPE** unites the companies located in the other 12 countries of Europe (apart from France). As a result of the size attained in two of these countries (The Netherlands and Sweden), a national holding company was set up in both these countries to coordinate the activities of several units specialized according to economic sector.

- **CAP GEMINI AMERICA** today is the product of strong internal growth and a number of key acquisitions since 1981. To deal with a geographic area 16 times the size of France, CGA operates through 4 areas, 14 regions and over 50 branches.

A UNIT TO SUPPORT OPERATIONS

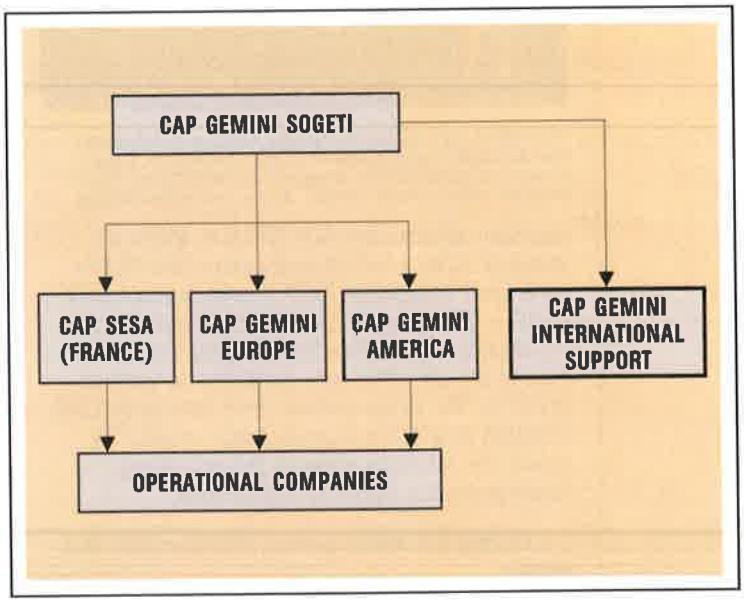
Over the years, commercial and technical support teams have been formed here and there as the need arose: Corporate Marketing at the Holding level, a Business Development department in Group Europe, the CAP SESA INNOVATION research laboratory in France. As of the beginning of this year, all these support teams will be joined within a new company, **CAP GEMINI INTERNATIONAL SUPPORT**, with a mandate to serve all companies in the Group.

CENTRAL SERVICES

These include: Financial and Legal Management, Corporate Development and Control, the Secretary General, Communications, Human Resources, and Internal Business Affairs.

THE EXECUTIVE COMMITTEE

The Executive Committee provides a forum for Serge Kampf to meet with the Group's seven principal managers. It defines **CAP GEMINI SOGETI's** major strategic directions, drafts and votes on decisions applicable to the entire Group, and is guardian of the basic policies which govern the actions of all the operational units. These managers also meet regularly with their closest associates and chair Management Committees to keep a highly decentralized corporation running smoothly, thus assuring that the maximum amount of information is disseminated to the greatest number of people in the shortest possible time.



FINANCIAL MANAGEMENT

For Financial Management, 1989 will be remembered as a year of change of dimension in the Group. The capital increase of more than FF 600 million, which occurred at the end of 1988, was just the first step in this process, which should put CAP GEMINI SOGETI in a position to achieve its growth ambitions over the coming years.

A change in the Group's capital distribution was put into effect in order to assure

From left to right: Nicolas du PELOUX, Planning and Budgets - Hervé MARIN, Internal Audits - Philippe HENNEQUIN, Legal Counsel - Manuel JAVARY, Treasurer - Daniel SETBON, Chief Financial Officer - Pascal GIRAUD, Group Accounting Manager.

stronger control by SOGETI S.A. (60% instead of 52%), which is itself controlled 58.5% by a new company, SKIP (Serge Kampf and CGIP – Compagnie Générale d'Industrie et de Participation). This new capital ownership opens the door to new partners at various levels of the organization, and increases CAP GEMINI SOGETI's shareholders' equity by nearly FF 5 billion without relinquishing management's majority ownership.

During the same period the decision was made:

- **to integrate about FF 907 million of retained earnings,** bringing this figure to more than FF 1 billion by raising the face value of the share from FF 20 to FF 200;
- **to divide the new face value of the share by 5,** with each shareholder taking ownership of five new shares at FF 40 for each outstanding share.

Finally, in order to provide CAP GEMINI SOGETI with the resources needed to resume its external growth policy, a debt of FF 1,530,000,000, represented by 2,550,000 convertible bonds – one-third of which were set aside for international subscribers – was launched during the first quarter of 1990, and subscribed to well before the end of the subscription period.

COMMUNICATIONS AND HUMAN RESOURCES

Because they have such a direct influence on two of CAP GEMINI SOGETI's most precious assets – its image and its employees – Communications and Human Resources have always been, and continue to be, among the Group's most serious concerns. In both of these areas, available resources were reinforced in 1989. In response to the many demands of its increasing role as a leader, the Group expanded its participation in a variety of forums devoted to information technology. Likewise it continued to address the media about the constant changes taking place in a profession which has become highly instrumental in the development of businesses and in an ever-evolving profession.

From left to right : Catherine THOMAIN, Press Officer - Philippe DREYFUS, Vice Chairman-External Relations - Michel BERTY, Secretary General - José BOURBOULON, Cap Gemini Sogeti University - Jacques COLLIN, Communications.

In the area of Human Resources, 1989 saw the unveiling of the "CAP GEMINI SOGETI UNIVERSITY." Targeted to the Group managers – currently numbering more than 500 – it will provide a meeting ground for exchanges of experience and new ideas. A large-scale program of training seminars is being launched, in French and English, to be attended by all the Group's managers and department heads.

Corporate Development and Control

For Corporate Development and Control, 1989 was a year in which priority was given to managing growth rather than to generating external growth opportunities. This consolidation effort at the internal control level was justified by the Group's strong expansion in 1987/88, either through internal development, or as a result of the integration of new companies. In this respect, actions carried out subsequent to the audit recommendations took many different forms, depending upon the individual situations encountered: reinforcement of local administrative and financial departments, reorganization of billing procedures, implementation of the Group's DP management system, training in responsibility project management, etc. Also in 1989, a new Group Policies and Guidelines Manual was prepared and distributed to all managers and department heads. It includes both basic rules of conduct, and a description of how business is conducted in the Group.

As is the case each year, a careful, comprehensive "pulse" was taken of the market. 1989 estimates, from a wide range of source material, indicate that growth in the demand for DP professional services will continue, taking account of certain variable factors such as the strong development of the demand in southern Europe, or the slowdown in the government sector in The Netherlands or the financial services sector in New York.

While 1989 was not a year characterized by very large acquisitions, the following ones should be noted:

From left to right: Hervé CANNEVA, Business Control - Eric LUTAUD, External Development – Jean-Louis MICHELET, Business Control – Pierre MARTINET, Market Studies – Michel JALABERT, Vice President Coporate Development and Control – Pierre de WAZIERS (Appointed General Manager, CAP SESA INDUSTRIE as of April 2, 1990).

- SYSTEMATION, one of the leaders in the State of Ohio, specializing in systems integration, joined the USA group.
- ACCEPT DATA, in Sweden, will solidify our skills in financial market systems.
- APSIS and APTOR will complement our advanced-technology teams in France by contributing their skills in robotics and local area networks.

To conclude this brief 1989 activity report, mention should be made of CISI's outstanding recovery. For the first time in its history, this company in which CAP GEMINI SOGETI holds a 36% capital interest, achieved significant financial results (FF 54 million in net profit on revenue of FF 1,150 million).

Principal companies in which the Group holds a minority interest:

- the BOSSARD GROUP (management consultants), reporting 1989 revenue of FF 718 million (CAP GEMINI SOGETI's interest: 43%).
- CISI (DP professional services), reporting 1989 revenue of FF 1.1 billion (CAP GEMINI SOGETI's interest: 36%).

Also note that SOGETI S.A., the Group's parent company, has taken a 67% interest in:

GAMMA INTERNATIONAL (management consultants), reporting 1989 revenue of FF 120 million.

CAP GEMINI INTERNATIONAL SUPPORT

The team in charge of launching CAP GEMINI INTERNATIONAL SUPPORT.

Standing from left to right: Paul HOFMANN, Francis BEHR, Alain GHERSON, Fernand PONCET, Christer UGANDER.
Sitting from left to right: Klaus FEKETE, Aad UIJTTENBROEK, Jean-Jack LOUDES, Roland VARENNE.

Since the beginning of 1990, CAP GEMINI INTERNATIONAL SUPPORT has combined the operational support units of CAP SESA, CAP GEMINI EUROPE, CAP GEMINI SOGETI International Marketing and CAP SESA INNOVATION.

The aim of this new group is to provide a single international support system to all of CGS's European operational companies and their clients at a time when:

- The European marketplace in general is changing rapidly, and, in particular, that of the 12 member-countries of the European Economic Community preparing for the single market of 1993.
- The needs and demands of our present and future clients are becoming more international every day, meaning that tomorrow's information systems have to be designed and developed to function in many different countries.
- The complexity of information technologies has reached a point where we must be able to offer our subsidiaries and their customers, wherever they are based, the enormous know-how currently existing in the CAP GEMINI SOGETI Group as a whole.

Staffed with 200 top-level professionals working at various locations throughout Europe, CGIS will furnish its services in three areas: technical development, marketing and sales support, and large international accounts.

TECHNICAL DEVELOPMENT

Is made up of two departments:

- **RESEARCH AND DEVELOPMENT.** Under the aegis of CAP GEMINI INNOVATION (also renamed to emphasize its European orientation) these R&D activities will focus mainly on:
  - assuring our participation in the European research programs (ESPRIT, EUREKA) and our affiliation with universities and research institutes;
  - pursuing our efforts in areas such as artificial intelligence, man-machine communications, word and image processing, etc.;
  - disseminating acquired know-how throughout the Group.

- **TECHNICAL SUPPORT** will develop methods and software tools, take charge of quality assurance, oversee the audits and certifications of completed projects, and identify CGS experts in order to make their experience available to the entire Group.

MARKETING AND SALES SUPPORT

This unit includes:

- **INDUSTRY-ORIENTED or VERTICAL SUPPORT,** which coordinates services by business sector and provides the operational companies and their customers with access to CGS's Groupwide experience and know-how: brochures, software packages, training, etc.

- **CROSS-INDUSTRY or HORIZONTAL SUPPORT** is intended to provide specific technological expertise in areas such as EDI (Electronic Data Interchange), databases, networks and videotex to clients in all business sectors.

- **THE INFORMATION CENTER** will gather and distribute information such as references, market studies and various other types of documentation.

LARGE INTERNATIONAL ACCOUNTS

This unit will handle relationships with:

- **THE HARDWARE MANUFACTURERS,** by creating a European framework for cooperation in which projects can be developed and implemented from country to country;

- **LARGE INTERNATIONAL CUSTOMERS,** whose volume of business outside their own countries calls for specific collaborative programs.

Christer Ugander

CAP GEMINI INTERNATIONAL SUPPORT


Jean-Claude AMIEL
Hardware Manufacturers


José BREVAL
Cap Gemini Innovation
Deputy General Manager


Sandy CLAIREAUX
Command and Control Systems


Claude Pierre DENIAUD
Methods


Dan DEVILLE
International Clients


Dominique KIRSNER
Banking and Finance


Kai MARTHINSEN
International Clients


François MAZON
International Clients


Jean PRADES
Technical Support


Fred Van POELGEEST
Distribution

Eric Xavier BARRERE	Videotex	John McKENZIE	Cap Gemini Innovation Netherlands Research Center
Pedy BENISTY	Software Engineering	Didier MITHOUARD	Networks
Christian CONSCIENCE	Quality Audits	Patrice PERRIN	Quality Audits
Paul DECITRE	Cap Gemini Innovation Grenoble Research Center	Maurice SCHLUMBERGER	Cap Gemini Innovation Scientific Manager
Meinard DONKER	Communications	Serge SOUDOPLATOFF	Cap Gemini Innovation Paris Research Center
Claude DRAY	Office Automation	Gérarld VIAN	Software Engineering
Daniel HAJAGE	Technical Support	Peter VOS	International Projects
Christophe JUSTEAU	Products		

CAP SESA

Standing from left to right: Jean-Claude BUSELLI, Chairman CAP SESA EXPLOITATION - Joseph GUEGAN, Chairman CAP SESA FINANCE - Jean-Marc CLAUDON, Chairman CAP SESA INDUSTRIE - **Jacques ARNOULD**, Chairman and CEO CAP SESA - Jean-Paul FIGER, General Manager CAP SESA - Yves VERET, Chairman CAP SESA DEFENSE - Maxime DONAL, Chairman CAP SESA TELECOM.

Sitting from left to right: Jean-Philippe GAILLARD, Chairman CAP SESA REGIONS - Dominique ILLIEN, Administrative and Financial Manager CAP SESA - Alexandre HAEFFNER, General Manager CAP SESA - Jacques BERTHELOT, Chairman LOGISTA - Jean-François DUBOURG, Secretary General CAP SESA - Henri STURTZ, Chairman CAP SESA TERTIAIRE.

For CAP SESA 1989 was a highly successful year. Finishing touches were put on the merger, objectives were met, some top-quality projects were completed and important deals signed, all of which is very promising for the future.

The merger of CAP SOGETI FRANCE and SESA, which took place at the beginning of 1989 and which produced the new CAP SESA group, has been an outstanding success, referred to in the press as "an unprecedented achievement... progress without incident." But these observations focus only on the visible effects of what was otherwise a remarkable job, accomplished in great depth at every level. A major transformation was carried out with the aim of creating solidly united teams. Employee policies, a common management system, a single set of procedures were all implemented very quickly, and a company culture, unifying the two original cultures, is gradually emerging. The organiza-

tion put in place on January 1, 1989 has been only very slightly altered to reflect practical realities. The quantitative objectives set at the time of the merger have been surpassed, with total consolidated revenues for 1989 greater than FF 3 billion. Signed orders reached FF 3.5 billion, a clear indication of client confidence.

1989 also saw the first quality labels awarded to CAP SESA companies by outside, independent associations – an even greater honor in that CAP SESA was the first French computer services firm ever to receive this distinction. AFAQ (French Quality Assurance Association) presented its certification first to CAP SESA TERTIAIRE, then to CAP SESA TELECOM, and at the beginning of 1990 CAP SESA DEFENSE was awarded the RAQ 1 label (Quality Assurance Regulations in the Military). All the CAP SESA companies will be audited and checked by the AFAQ in accordance with very strict guidelines. AFAQ and RAQ 1 certifications are presented to companies whose working methods and business practices have been subjected to detailed examination and continuous monitoring. These designations attest to the level of quality achieved on our projects.

CAP SESA employees, the driving force of the company, are constantly adding to their store of knowledge and adapting to new developments in information technology. In this spirit, a special training program has been set up which will enable each participant, in conjunction with his or her immediate superior, to define an individual, multi-year training schedule before the end of 1990. The plan will include technical aspects, as well as those of behavior, expression and interpersonal relationships.

The dynamics of CAP SESA's development are very strong in each of the areas cited above – i.e., reinforcement of its culture, technical skills and human relations – and emphasize its desire to be recognized by both its clients and staff as the reference in its profession. However, we are well aware that this leadership role carries with it certain obligations: quality, openness, honesty and efficiency. And we are committed to respecting these obligations in the service of our clients.

Jacques Arnould

CAP SESA, France's number one professional services company in information technology and telecommunications, is engaged in solidifying its command of advanced technologies and its skills in all aspects of systems integration. This ongoing effort, which depends heavily upon the development of ***internal expertise****, prompted the recent acquisition of three new teams:*

- *APSIS/APTOR specialize, respectively, in robotics and local industrial and heterogeneous networks. Located in Grenoble, these two companies employ about 120 people.*

- *COPERNIQUE is involved in the analysis, implementation and marketing of high-performance systems integrating hardware, software, research and data transmission. It currently employs 175 people based in Rennes (not far from Paris) and London.*

- *INTELLVISION is a specialist in quality control through sound analysis and vision. Its professionals have joined CAP SESA's subsidiary ITMI, a leader in computer vision, artificial intelligence and robotics. ITMI now represents the largest specialized workforce in these fields in France.*

CAP SESA

CAP SESA REGIONS

Jean-Philippe GAILLARD
Chairman

Michel FAINGOLD
General Manager

Jean-Loup BOUDINEAU
Deputy General Manager
Marketing Administration

Bertrand de TROGOFF
Deputy General Manager
Marketing Services

Jean ROCHET
Deputy General Manager
Marketing Industry

Christian GLEYO	AFM
Jacques LAGORCE	Administrative Division Manager
Alain GIRAUD	Services Division Manager
François de la PORTE	QTSM

François RIAS	DM
Yvon ROY	Consulting Branch
Bernard RIBART	Agro-Food Support Center
François RIAS (Acting)	Support Center - Small/Medium - Sized Companies
Philippe GIRARDOT and Jean-Yves OLLU	CIM Software Products Support Center
Raymond PAWLOWSKI	Computer-Assisted Maintenance Support Center
Bernard REGNAULT	ARCADE Support Center
Jean HARIVEL	Prime Contracts & Systems Dept.

NORTHERN REGION

Marcel de TAEVERNIER

Jean-Paul LEPRAND — RTM

Xavier ROY	North Industry 1
Xavier ROY (Acting)	North Industry 2
Jean-Marie THIBAULT	Lille Tertiaire
Michel TURPYN	Lille Administration & Finance
Jean-Jacques NICOLLE	Rouen
Jacques CAUSSIN	Senlis
Jean-Paul LEPRAND (Acting)	Conseil

WESTERN REGION

Bertrand de TROGOFF

Jean-Marc PONTHUS	DSM
Patrick de BOISFOSSE	OSM

Jacques RASCOL	West Industry
Patrick de BOISFOSSE (Acting)	West Tertiaire
Patrick de BOISFOSSE (Acting)	Nantes Administration
Bernard GUEHENNEC	Rennes Industry & Networks
François LEPETIT	Industry Center
Gilbert BAURIN	Tertiaire Center
Hubert NOYER	Brest
Philippe de BEAUCHAMP (Acting)	Le Mans
Philippe de BEAUCHAMP	Conseil

SOUTHWESTERN REGION

Jean-Loup BOUDINEAU

Jacques FELIX	RTM
Joseph HURTUT	OSM
Roland WILLHELM	OSM
Charles-Henri LIMOUSIN	OSM

Christian COLMANT	Space Applications
Christian COLMANT	Space Industries
Jean-Pierre GLEYSE	Space Systems and Telecom
Charles-Henri LIMOUSIN (Acting)	Toulouse Industry 1
Guy MARCEAUX	Toulouse Industry 2
Joëlle MEKIES-VANDAME	Toulouse Tertiaire & Administration
Jean-Louis BURDET	Bordeaux Industry
Yvon LEBORGNE	Bordeaux Tertiaire & Administration
Jean-Pierre MAZIN	Pau/Bassin de l'Adour
Christian PLUMET	Conseil

MEDITERRANEAN REGION

Paul CHAFFARD

Jean-Louis LOMAGNO	DM
Alain GIRAUD	OSM

Paul CHAFFARD (Acting)	Marseille Industry
Patrice HENRY	Marseille Tertiaire & Administration
Philippe BRACONNIER	Nice
Jean-Marc BERNABEU	Montpellier
Alain GIRAUD (Acting)	Montpellier - CIM
Jean-Louis LOMAGNO (Acting)	Conseil

RHONE-ALPES REGION

Jean ROCHET

Christian SOUCHON	RTM
Patric BARBEROUSSE	HRDM
Jean-Pierre REY	OSM

Alain VINCENT	Rhône Industry
Brigitte CAPLAT	Lyon Industry Auvergne
Michel BASTIAN	Lyon Tertiaire
Raoul RUIZ	Grenoble Industry Valence
Gilles COPIN	Grenoble Tertiaire & Administration
Luc DUSSART	Isère Industry
Jean ROCHET (Acting)	Conseil

EASTERN REGION

Denis SERGENT

Alain MATHECOWITSCH	Mulhouse
Jean-Pierre DRACA	Strasbourg
Eric BRIDE	Luxembourg
Marc MINISINI (Acting)	Lorraine Tertiaire Champagne
Marc MINISINI	Lorraine Industry

CAP SESA DEFENSE

Yves VERET
Chairman

Albert RAGOT
Deputy General Manager
Operational Support

Jean-Marie BARRE
Deputy General Manager
Development

Claude CHANGARNIER	AFM
Yves PITON	SSPM
Jean-Jacques CHAUVIN	QTSM
Jean-Paul PELISSIER	QTSM
Olivier ROSSIGNOL	MM

Olivier BARRÉ	Telecom
Claude DEFARGE	Command Systems
François CHOLLEY	Airforce
Jean-François de LAGASNERIE	Navy Var
Jean-Marie CAMMAS	Navy Paris
Gérard HINAULT	Systems

CAP SESA FINANCE

Joseph GUEGAN
Chairman

François HUCHER
Deputy General Manager
Operational Support

Frédéric de PRECOURT	AFM
Stanislas COZON	DMM
Bernard SARRAZIN	SSPM
Jean-Marc LANFRANCHI	QTSM
Francis DROUIN	QCM
Miguel de FONTENAY	SSSP
Paul BOUVIER	Trading Rooms
Daniel PREVOST	Networks & Security

Roland QUET	Large Banks 1
André CICHOWLAS	Large Banks 2
Jean-Pierre RENAULT	Large Banks 3
Dominique HENRY	Banks and Financial Establishments 1
Dominique LENORMAND	Banks and Financial Establishments 2
Patrick NAVARRO	Banks and Financial Establishments 3
Jacques RICHER	Financial Markets

CAP SESA INDUSTRIE

Jean-Marc CLAUDON
Chairman

Pierre de WAZIERS
General Manager

Gilbert ELOIRE
Deputy General Manager

Christian BOURRIAGUE	AFM
Eric PIAT	QTSM
Gilbert ELOIRE (Acting)	SSPM

ENERGY AND TRANSFORMATION DIVISION

Jean-Pierre FOUSSIER

Jean-Louis JACQUET	Petro-chemical & Food
Anne HUGUET-BOSMORIN	Electronics & Engineering
Jean-François MUNIER	Chemical & Pharmaceutical

MECHANICS AND AERONAUTICS DIVISION

Alain WILBOIS

Yannick GONNEAU	Mechanics and Automobile
Marie-Christine PICARD	Space and Communications
Tanneguy de FROMONT	Aeronautics & Nuclear

SYSTEMS AND TELECOMMUNICATIONS DIVISION

Alexandre LEVY

Bernard MOULENE	Telecom Industry
Jean-Luc GUERIN	Air & Navy
Dominique GUINET	Arms Industry

ENGINEERING AND INFORMATION TECHNOLOGY DIVISION

Bruno CHAPUIS

François LANGLAIS	DP Manufacturers 1
Xavier RODDE	DP Manufacturers 2
Yves POUSSIN	Computerization & Instrumentation
Bruno CHAPUIS (Acting)	Engineering & Equipment

CAP SESA TELECOM

Maxime DONAL
Chairman

Jacques TIXERANT
Deputy General Manager
Operational Support

Jean-Paul VAUTREY
Deputy General Manager
Development

Anne TRIZAC	AFM
Alain GERSET	MSSM
Pierre KRAUS	QTSM
Michel BERTON	QM
Jean-Claude DUBOURG	Assistant Manager
Michel FERRAGU	Public Information Systems 1
Pierre SEMUR	Public information Systems 2
Alain DUMONT	Systems 1
Xavier CHAMPION	Systems 2
Richard BARROY	Systems 3
Jean-François LEFEBVRE	Telematics
Raymond COMMAULT	Telecom Advanced DP

CAP SESA TERTIAIRE

Henri STURTZ
Chairman

Laurent BALLY
Deputy General Manager
Operational Support

Pierre DURAND
Deputy General Manager
Development

Yann GROLIMUND	AFM
Christian RENARD	QTSM
Christian BERLEUR	Large Projects Manager
Bruno PERRIN	Assistant Manager
Fernand WINKLER	Assistant Manager
Pierre-Emmanuel RICHARD	MM
Jean-Michel PETOLAT	Telematics
François PHULPIN	Administration
Michel ROUZAUD	Energy
Dominique SILVESTRE	Transportation
Hervé GRIFFON	Insurance
Gérard PAYEN	Services

CAP SESA EXPLOITATION

Jean-Claude BUSELLI
Chairman

Jacques AUGER
General Manager

Luc-François SALVADOR
Deputy General Manager
Sales Promotion
and Support

François NEANT
Deputy General Manager
Development

François Xavier FLOREN	AFM
Eric BOIVIN	Special Project
Jean-Marc BY	Assistant Manager

FINANCE DIVISION

Dominique DUFLO

Didier PETIT	Banking 1
Philippe BELPERCHE	Banking 2
Claude CHIABRANDO	Finance
Jean GARCIA	Lille
Alain REYNAUD	Geneva

TERTIAIRE DIVISION

Luc-François SALVADOR (Acting)

Jean-Pierre LE SEC'H	Public Services
Philippe CHARMANTRAY	Insurance
Jacques JOIRIS (Acting)	Services
Jacques JOIRIS	Nantes

INDUSTRIE DIVISION

Jean-Pierre POUTEAU

Michel BERJAMIN	Electronics
Claude FORSANS	Aeronautics
Philippe BEUGNIET	Petro-chemical/ Engineering
Gérard STEFAN	Toulouse
Christian TOURNIER	Lyon

LOGISTA

Jacques BERTHELOT
Chairman

Hervé CAPTIER
Deputy General Manager

Eric MICHEL	AFM
Bernard KROTIN	QTSM
Hervé CAPTIER (ff)	MSSM
Christophe CAPELLE	Management Applications 1
Bassam BAKDACHE	Management Applications 2
Michel LE QUERE	Management Applications 3
Pascal LEROY	Technical Applications 1
Hubert PAJOT	Technical Applications 2
Christian DESCHEEMAEKERE	Technical Applications 3
Hervé CAPTIER (Acting)	Orléans
Eric LEJEUNE	Videotex

CAP SESA MAINTENANCE

Jean-François DUBOURG
Chairman

Jean-Michel PARMENTIER	Sales Manager
Philippe WINSBACK	Production Manager
Olivier MERY	Administration & Finance

CAP SESA CONSEIL

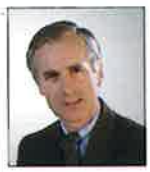
Emmanuel ADER
Chairman

Jean-Pierre LEVY
Deputy General Manager

Alain SARRAZIN
Deputy General Manager

Guy EREL AFM

CAP SESA FORMATION



Bernard JOULIE
Chairman

Cornel SIMIU
Deputy General Manager

Michel GINET AFM

Jean SAINT-HUBERT	Cap Sesa Selection
Alain LE BRETON	Information Technology Center
Alain SAUZEY	DP Applications Center
Cornel SIMIU (Acting)	Management and Communications
Cornel SIMIU (Acting)	Cap Sesa Institute

ITMI

Gérard MEZIN
Chairman

Michel GINET	AFM
Yann GALLAIS	MSS
Bruno DUFAY	Artificial Intelligence Dept.
Roland PESTY	Technology Dept.
Pierre MONTCUQUET	Vision/Automation Dept.
Gabriel NARDUZZO	Intell Vision Dept.

APSIS

Claude OTRAGE
Chairman

Gérard BURACCHINI
General Manager

Martine BIGE AFM

Dominique LEFEVRE	Services
Claude ROCCA	Engineering

APTOR

Claude OTRAGE
Chairman

Gérard DULAC
General Manager

Martine BIGE AFM

Georges OUDJAOUDI	Local Industrial Networks
Gérard MICHEL	Real-Time Network Analyses

AFM	Administration and Finance Manager
AM	Administration Manager
DM	Development Manager
DMM	Development and Marketing Manager
DSM	Development Support Manager
HRCM	Human Resources and Communications Manager
MM	Marketing Manager
MSSM	Marketing and Sales Support Manager
MSS	Marketing and Sales Support
OSM	Operational Support Manager
QCM	Quality Control Manager
QTSM	Quality and Technical Support Manager
RTM	Regional Technical Manager
SSPM	Support and Sales Promotion Manager
SSSP	Sale Supporty Special Projects
SSSPM	Sales Support/Special Projects Manager

CAP GEMINI EUROPE

Standing from left to right: Adolfo CEFIS, Vice President - Werner ZÜLLIG, Secretary General - Jean RONCERAY, Area Vice President - Chris van BREUGEL, Vice President.

Sitting from left to right: Kai GREEN, Area Vice President - **Alain LEMAIRE**, Chairman and CEO - Pierre DALMAZ, Administrative and Financial Manager.

With revenues of FF 2.4 billion, CAP GEMINI EUROPE, which combines the Group's non-French European subsidiaries, recorded a 1989 growth rate somewhat lower than in previous years (12%). However, the year was one of increased demand on the part of European customers. It also bore witness to the exceptional capacity of an operational group numbering more than 4500 employees speaking eleven different languages to adapt to such an incredibly diverse client base.

In fact, in an environment marked by national reorganization and the formation of new multinational and multi-sector interaction, companies are demanding more fully-intregrated, time-saving solutions that give them advantages over their competition. CAP GEMINI EUROPE's project teams have been in demand everywhere to take charge of increasingly complex assignments, using expert technicians who have often mastered their skills through exchanges of know-how from one country to another.

Among the projects completed during the year, a few are especially worth mentioning:

- Design and development of software support for a cellular telephone system covering 60 million subscribers in Germany.

- Analysis and installation in Belgium of a database for monitoring fishing quotas in the European Economic Community.

- Design and introduction of a decentralized architecture for 31 Vax systems, for the Swedish highway authorities.

- Supply of command and control systems for the Strathclyde (Scotland) police forces to assure quick and thorough incident detection and to optimize available resources (also developed for the Hong Kong police force).

- Development by one of our Italian subsidiaries of an integrated analysis system for data gathered on the motor test board for Ariane V (future launcher of the Hermes space shuttle).

The complexity of our profession, however, cannot be understood simply in terms of the techniques it employs. It also reflects a continual transformation which changes its very nature. The "solution" approach presupposes an in-depth knowledge of our clients' business and the development of "business-sector DP expertise" which crosses national boundaries. To meet these demands more effectively, in 1989 CAP GEMINI EUROPE underwent a major reorganization of its operations in those countries in which its large, firmly-rooted companies have a strong national market share.

The Netherlands is a case in point. In the middle of 1989, the Group's Dutch subsidiary – which until then had conducted business under two separate banners, CAP GEMINI NEDERLAND and PANDATA – merged to form one entity, CAP GEMINI PANDATA, based on the successful model of the CAP SOGETI/SESA merger carried out in 1988. The teams making up the new company have been organized in six market or technically-specialized operational units: Finance; Telecom & Services; Trade, Distribution & Transport; Industry; Informatica Institute; and Public. The holding company assures consistent overall supervision and provides financial, human resources, technical quality and communications support.

Likewise in Sweden, the acquisition of ACCEPT DATA prompted a similar restructuring. Under the CAP GEMINI LOGIC holding company, the activities of CAP GEMINI BRA, DATA LOGIC and LOGIC TECHNO have been merged to form three specialized operating companies: Finance (into which of course ACCEPT DATA has been incorporated), Service, Industry, and a fourth company, LOGIC TECHNO, specializing in training and consultancy.

This double reorganization during the second half of the year called for considerable effort at both the company and Group Europe levels. It was possible because of the Group's remarkable ability to mobilize its forces.

Once the decisions to restructure were made, combined working teams were set up to review the organization, identify, and then plan the operations generated by the mergers: legal structures, personnel policies, common DP resources, internal procedures, etc. Throughout the process, employees were kept abreast of what was happening. The care taken to see that this was done – which is one of our strong corporate skills – made it possible to begin 1990 with renewed strength in both these countries.

In preparing for the future, CAP GEMINI EUROPE is also seeking to provide its people with interesting work, and the training they need to grow within an international structure adapted to tomorrow's realities. By expanding the skills and know-how inherent in each operational company, by combining them with the international support of the other Group companies, we thereby assert our commitment – stronger now than ever – to serve our clients better and to advance their development at the same time as we do our own.

Alain Lemaire

CAP GEMINI EUROPE

CAP GEMINI SUOMI — *FINLAND*

Markku SILEN
General Manager

Heli UUSI-ILLIKAINEN	AFM
Pirjo PITKÄNEN	AM
Sirpa CREUTZ	DTSM
Hannä NIKKILÄ	Finance & Insurance
Erik GUSTAFSSON	Trade/Industry
Pekka SARKKINEN	Public & Telecom

CAP GEMINI DANMARK — *DENMARK*

Jan JOHANSSON
General Manager

Soren CLAUSEN	AFM
Elin HAALAND	DTSM
Allan JORGENSEN	Public Sector
Hans Jorgen BECK	Industry Sector
Niels Erik CLAUSEN	Private Sector

CAP GEMINI DATA LOGIC — *NORWAY*

Arne OEN
General Manager

Erik RINGSBY
Deputy General Manager

Roar SKOGVOLD	AFM
Svein WEINHOLDT	DTSM
Bjørn SØVIK	Bergen
Jan Erik NORHEIM	Finance
Kjell WARHOLM	Trade/Industry
Per HETLAND	Stavanger
Leif BREKKE	Public
Jens Petter MATHISEN	Regions

CGS (UK) — *GREAT BRITAIN*

John W. MARSH
General Manager

Mark S. CUNNINGHAM	AFM
Adrian G. PURCHASE	BDM
Adrian PURCHASE (Acting)	Public Services
Michael J. EATON	Finance
John W. MARSH (Acting)	South
Robert CAVAN	North

SWEDEN

CAP GEMINI LOGIC (HOLDING)

Leif NOBEL
General Manager

Lars-Olof NORELL
Deputy General Manager

Jan SCHARIN	AFM
Thomas FALK	MSSM
Bertil MATTSSON	DTSM
Kent PETTERSSON	HRM
Yngre PAVASSON	TSM

CAP GEMINI LOGIC FINANCE

Thomas TROLLE
General Manager

Tore HAGENBLAD
Deputy General Manager

Mats GUSTAFSSON	AFM
Peter KULLGREN	DTSM
Gunnar NORRBY	MSSM
Jouko KANGAS	Insurance
Ulf MELIN	Savings Banks
Thomas RANDERZ	Commercial Banks
Lars Göran NILSSON	South
Per NYGREN	Accept

CAP GEMINI LOGIC SERVICE

Stefan OLOWSSON
General Manager

Hans WIRFELT
Deputy General Manager

Klas ERICSON	AFM
Johan BREDBERG	Public Services
Michael EKMAN	Telecom
Erik FRÖBERG	Post & Energy
Thore SANDBERG	Private Services
Gunnel TOLFES	Transport
Anders HÄGG	Trade 2 + Private Services
Torbjörn LINDH	Trade 1
Hans WIRFELT (Acting)	Regions

CAP GEMINI LOGIC INDUSTRY

Jan EKSTROM
General Manager

Torsten PRAHL
Deputy General Manager

Håkan WILÉN	AFM
Berndt OSMUND	DTSM
Lars LARSSON	MSSM
Claes KEMVALL	West
Anita FRYXELL	Mid
Lars ERIKSSON	East
Peter SVANFELDT	Stockholm
Per Henrik STUREGÅRD	Göteborg 1
Jan BLADH	Göteborg 2
Per CRISTOFERSON	Göteborg 3

CAP GEMINI LOGIC TECHNO

Bjorn NORRBOM
General Manager

Sylvia VAINIKKA	AFM
Leif BJORDELL	Telecommunications
Anders ERIKSSON	Applications Development
Leif GRANE	Education
Lars OLSSON	Management
Goesta STENESKOG	Consulting

CAP GEMINI SESA BELGIUM — *BELGIUM*

Jean MILAN
General Manager

Jean-Pierre DORLHAC
Operational Support Manager

Serge TAILDEMAN	AFM
Johnny HUYSENTRUYT	DTSM
Pierre MONNOYER de GALLAND	Trade
Xavier BREL	Services
Robert MALOMGRE	1 - North Industry
Jean J. PEETERS	2 - South Industry
Aimé D'HELFT	Finance & Internat.
Benoît de la FAILLE	Finance & Internat.

CAP GEMINI DEUTSCHLAND — *FEDERAL REPUBLIC OF GERMANY*

Bernd LANTERMANN
General Manager

Wolfgang KÖHLER
Deputy General Manager

Werner BONGARTZ
Deputy General Manager

Robert GAERTNER	AFM
Robert MAAS	BDM
Frank SCHUKRAFT	BDFM

NORTHWEST-DIVISION

Werner BONGARTZ

Wolfgang PUMP	Hamburg 1
Dieter NOGA	Hamburg 2
Reiner KONITZ	Braunschweig
Gerd HOCKENHOLZ	Essen
Peter WEILER	Düsseldorf
Andreas SCORY	Paderborn

CENTRAL DIVISION

Wolfgang KÖHLER

Paul LEUSCHNER	Frankfurt 1
Horst Dieter WAGNER	Frankfurt 2
Volker JODELEIT	Frankfurt 3
Hans Christof KALLER	Ratingen

SOUTHERN DIVISION

Bernd LANTERMANN

Ulrich REITER	Stuttgart
Dietmar HARTINGER	Munich 1
Hans WEINZIERL	Munich 2
Josef BACKWINKEL	Nüremberg

CAP GEMINI OSTERREICH — *AUSTRIA*

Alex OPRESCU
General Manager

THE NETHERLANDS

CAP GEMINI PANDATA (HOLDING)


Chris van BREUGEL
General Manager


Rob STARREVELD
Deputy General Manager

Hans VISSER	AFM
Derk DUIT	MSSM
Frans VORSTENBOSCH	MSSM
Daan RIJSENBRIJ	DTSM
Jan PIETERMAN	HRM

CAP GEMINI PANDATA - FINANCE


Hans BOOM
General Manager


Dick van VERSEVELD
Deputy General Manager

Rob Du CHATENIER	AFM
André PELS	DTSM
Pieter NIEUWENHUIS	Finance 1
Vincent LUCAS	Finance 2
Antoine PHILIPPA	Finance 3
Dick van VERSEVELD (Acting)	Finance 4
Hans BOOM (Acting)	O & I

CAP GEMINI PANDATA - TELECOM & SERVICES


Peter BARBIER
General Manager

Bram van der DUSSEN	AFM
Roel RAM	DTSM
Nico COENEN	Telecom
Hans van LEEUWEN	Services
Gerard WISSELINK	Telecom & Services

CAP GEMINI PANDATA - TRADE, DISTRIBUTION & TRANSPORT


Wim HEUKELS
General Manager


Theo GIELIS
Deputy General Manager

Arie EDELMAN	AFM
Jan Van der POL	DTSM
Hans VISSER	H 1
Dick van EEDEN	H 2
Alan TATTERS	H 3
Theo PETERS	Eindhoven

CAP GEMINI PANDATA - INDUSTRY


Paul FOCKENS
General Manager


Marten la HAYE
Deputy General Manager

Luc RAAMAN	AFM
Wim MARTENS	DTSM
Jaap BOON	Rijswijk
Peter DUIVEN	Eindhoven
Ronald BERENDES	Amsterdam
Ton POETSMA	Zwolle

CAP GEMINI PANDATA - PUBLIC


Eric PLANTE
General Manager


Henk DREMER
Deputy General Manager

Bert NOLLEN	AFM
Eugène WOLF	DTSM
Theo BOUWMEISTER	OR 1
Paul van ZIJL	OR 2
Tom BRANS	OR 3
Arnold BRUGGEMAN	Zwolle
Harry HAAGEN	O & I

CAP GEMINI PANDATA - INFORMATICA INSTITUTE


Jan van WISSEN
General Manager


Derk DUIT
Deputy General Manager

Herman TESSELS	AFM
Hans SCHEVERS	MSSM
Frans van HAARLEM	DTSM
Hubert KROS	Trade Assoc. Manager
Steef GEENEN	Training
Ronald LANGERHORST	Development Tools
Hans RICHTERS	Products
Herman MOOY	Operations

CAP GEMINI SUISSE

SWITZERLAND


Werner BRODT
General Manager

Jean-Yves GILLET	DTSM Suisse Romande
Martin STUDER	DTSM Suisse Allemande
Werner SCHMID	PDM
Michel ABIKZER	Geneva/Lausanne
Annette SEGESSER	Zürich
WIlli KAUF	Basel
Klaus SOMMER (Acting)	Berne

CAP GEMINI ESPANA

SPAIN


Philippe DANGLADE
General Manager

José AGUILANIEDO	AFM
Francisco LARIOS	TSM
Miguel A. BARNETO	BDM
José-Ignacio CARRIBERO	Banking
Antonio RUIZ LILLO	Public Sector
Philippe DANGLADE (Acting)	Industry
Philippe DANGLADE (Acting)	Barcelona

ITALY

CAP GEMINI SESA


Gennaro de STASIO
General Manager


Guitio Cesare CHIARINI
Deputy General Manager

Betty HALFON	AFM
Edoardo BENELLI	MSSM
Carlo SACCA	MSSM
Caterina CAMBIOTTI	HRM
Giulo Cesare CHIARINI	Systems Engineering
Gianfranco CORINI	DDM Space
Vincenzo GIOVANNITTI	DTSM Finance
Pasquale CAPRIOTTI	Finance
Marcello ANTICHI	Telecom

CAP GEMINI GEDA


Adolfo CEFIS
General Manager


Enrico RUSCA
Vice President

Christopher COLEMAN	AFM
Maurizio FOTI	AFM

PUBLIC SECTOR DIVISION


Ettore ZANAZZO

Luigi DURAND de la PENNE	DDM
Paolo GIORGI	TSM
Pietro ROSSI MARCELLI	Transport
Roberto SAFFONCINI	Public Sector

PRIVATE SECTOR DIVISION


Claudio TELONI

Francesco CAMPAGNA	DTSM
Mario PASTI	Trade/Industry
Ennio ROSSINI	Administration
Enrico MAGANI	Products
Daniele CAVALLERO	Services

SEA INFORMATICA


Manlio PETRIS
General Manager

Francisco BILOTTA
Technical Manager

AFM	Administration and Finance Manager
AM	Administration Manager
BDFM	Business Development and Finance Manager
BDM	Business Development Manager
DDM	Deputy Divisional Manager
DTSM	Development and Technical Support Manager
HRM	Human Resources Manager
MSSM	Marketing and Sales Support Manager
PDM	Professional Development Manager
TSM	Technical Support Manager

CAP GEMINI AMERICA

Standing from left to right: James J. WOODWARD, National Project Support Group Manager - William C. STILSON, Central Area Manager - Ronald EZRING, North Area Manager.

Sitting from left to right: **Robert J. SYWOLSKI**, Chairman and CEO - Ralph A. KING, South Area Manager - Stephen A. CARNS, President - Paul J. FORREST, Chief Financial Officer.

For CAP GEMINI AMERICA (CGA), 1989 was a year of considerable achievement. Consolidated revenues rose 30% to $213 million. Profits increased an equivalent amount and our staff grew to over 3,000 employees.

This occurred while progress continued in implementing the strategic plan created in late 1987. In addition, three acquisitions were integrated into the organization: COMPACT DATA SYSTEMS, SYSTEMATION, and MERIT SYSTEMS. Our branches, the cornerstone of our structure, were further expanded and reorganized into fourteen regions and four areas. To position the Company for further expansion and to improve decision- making, we formed an Executive Committee composed of the Chairman, President, Chief Financial Officer, Area Managers, and National Project Support Group Manager.

From a strategic perspective, CGA made progress in continuing to augment its foundation technical assistance services business with an increasing percentage of work in which complete responsibility is taken for solving the client's information technology problems. We are well on our way to meeting our three- year goal established in 1987, to triple the percentage of business represented by project or solution services. In 1989, we achieved our interim objectives by increasing our project backlog and proposal pipeline by more than 300% over the previous year.

To achieve this objective CGA has focused on three initiatives:

• First, a proprietary project management methodology was created and implemented, providing the fundamental management principles and disciplines needed to satisfy project clients' needs, and to assure timely and profitable delivery of services. This methodology, the Project Quality Systems (PQS), consists of an exacting risk evaluation and approval process, a project manager certification program, and independent quality assurance managers in each CGA region. Client satisfaction remains our first and most important objective. The PQS systems of responsibilities, checks and balances, and quality controls has helped CGA build a record of excellent client references.

• Second, we have continued to build or acquire specialized teams to provide our branches with the solution capabilities most in demand by their clients. We enhanced our existing specialities in platform-to-platform and database conversions, telecommunications, banking, insurance, user documentation, information systems planning, DB2, and UNIX. As a result of 1989 acquisitions, we also added new specialities in CIM, manufacturing, CASE transition planning, AS400, and DEC. Indeed, partially as a result of this strengthening of CASE capabilities, IBM selected CGA as one of four service providers for their AD/Cycle offering. In 1990, new specialities are again planned for development and acquisition.

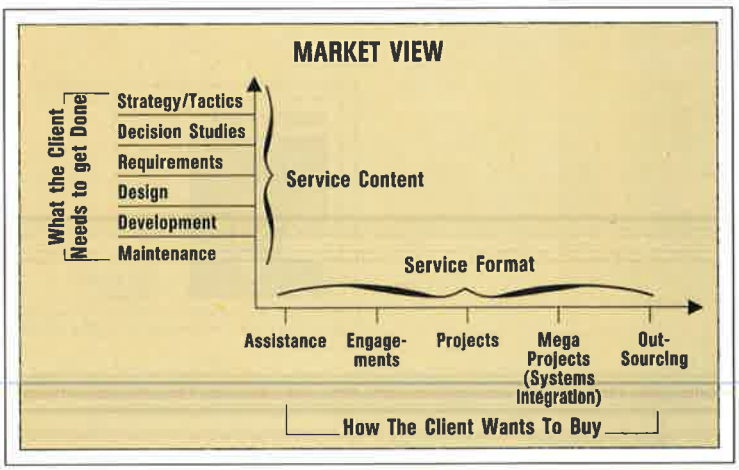
• Third, in terms of strategic outlook, we crystallized our vision of the market as described in the matrix opposite. This grid represents the relationship of the work required by the client along the vertical axis, and the service delivery format along the horizontal axis. Risk, buyer decision level, required management attention, and profit margin potential increase from left to right. Our continued enthusiasm for the growth of these markets and service offerings resulted in the creation of fifty new branch Client Services Executive sales positions. Simultaneously, we have begun cross training our entire sales force to better offer the full spectrum of these service formats.

In a services business almost exclusively based on the knowledge and skills of people, true capital investment leading to business leverage takes the form of training and development. In recognition of this, CGA increased its commitment to the development of its consultants by adding a national technical training function designed to support branch level training programs. This investment will take the form of course improvements, and will make hands-on mainframe access available to all CGA branches.

To assist in meeting the career needs of consultants, CGA also created the new position of Manager Professional Staff (MPS). Sixty-five new MPS are exclusively focused on ensuring the satisfaction and career development of consultants through a newly implemented Employee Satisfaction Program. A task force has also been formed to develop a defined consultant career pathing program.

CAP GEMINI AMERICA looks forward with excitement and enthusiasm to the opportunities in the expanding information technology services market. Because of its achievements in 1989, CGA is well positioned for future success in the '90s.

Robert J. Sywolski



CAP GEMINI AMERICA

NORTH AREA

Ronald EZRING
Area Manager

MIDSTATES REGION

Jon JENSEN
Regional Manager

Thomas SMITH Jr.	Des Moines
Ronald FISCHER	Kansas City
Michael HOGAN	Omaha
Jeffrey F. HITCHCOCK	St.Louis

NORTHEAST FINANCIAL REGION

Howard B. MEDOW
Regional Manager

Matthew J. BEZINSKI	Metro Financial
Henry A. SMITH	New York City Financial

MIDWEST REGION

Roger BANNER
Regional Manager

John V. NOVAK	Chicago Commercial
James M. DUFFY Jr.	Chicago Communications
George PRATL	Chicago Insurance & Finance

NORTH CENTRAL REGION

Gerald J. QUARTANA
Regional Manager

David A. BALLERING	Central Wisconsin
Wayne D. OSTRUSZKA	Milwaukee
Terry L. FRAZIER	Minneapolis Financial & Commercial
Joseph M. REILLY	Minneapolis Manufacturing & Services

NORTHEAST COMMERCIAL REGION

Donald J. KELLY
Regional Manager

Edwin T. CARLSON	NJ Commercial
Barry C. MANDELL	NY Commercial
Donald J. KELLY (Acting)	Stamford Satellite

NORTHEAST COMMUNICATIONS REGION

Thomas M. KLIMUC
Regional Manager

Dale BAKER	NJ Business Communications
Stephen KRANE	NJ Technologies
Frank WINTERS	NJ Telesystems

SOUTH AREA

Ralph A. KING
Area Manager

MID ATLANTIC REGION

Chester A. RUSINEK
Regional Manager

Brian W. SULLIVAN	Baltimore
Jack EFFRAIN (Acting)	Maryland Satellite
William E. BARKER	Washington Federal Branch
Anthony MORETTO Jr.	Philadelphia
Leonard C. ANDERSON	Richmond
Jack EFFRAIN	Washington, D.C.
Kenneth PULLIAM	Wilmington

SOUTHERN REGION

John R. HAMON
Regional Manager

J. Michael MASON	Atlanta
Steven R. SWANSON	Miami
Douglas G. BERRYHILL	Orlando
Richard E. HASTY Jr.	Tampa

CENTRAL AREA

William C. STILSON
Area Manager

NORTHCOAST REGION

Steven H. SPAETH
Regional Manager

John L. BIANCO	Cleveland
Bruce I. FERGUSON	Cleveland
Stephen H. SPAETH (ff)	Pittsburgh
Bruce I. FERGUSON (ff)	Youngstown

MID CENTRAL REGION

Milo E. CHELOVITZ
Regional Manager

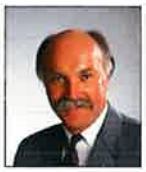
Gerald A. NUZUM	Akron
Wilfred H. COLLINS	Colombus

SOUTH CENTRAL REGION

Glenn E. MILLER
Regional Manager

Michael S. WRIGHT	Cincinnati
Glenn E. MILLER (ff)	Dayton

MERIT REGION



Walter YEAW
Regional Manager

Douglas HAZEKAMP	Western Michigan
James HEDRICK	Southeast Michigan
Daniel R. KOMALSKI	CIM

WEST AREA

Stephen A. CARNS
President, Acting Area Manager

SOUTHWEST REGION

Michael SCHERMER
Regional Manager

William S. WIMBERLEY	Dallas
John DeFILIPPO	Houston

WESTERN REGION

Craig D. NORRIS
Regional Manager

Susan S. LARSON	Denver
Craig D. NORRIS (Acting)	Los Angeles
LaVelle DAY	Portland
Kenneth B. SEXTON	Seattle

NATIONAL PROJECT SUPPORT GROUP

James J. WOODWARD

Project Quality Assurance
Technical Productivity Center
Market Development
External Communications
Conversion Services
National Technical Training

1989...

CALENDAR

For CAP GEMINI SOGETI, describing 1989 does not mean merely enumerating figures, technical skills and commercial achievements. It also provides an occasion to highlight the events that make up the Group's day-to-day life, events that will be remembered by those who have lived through them. ■

JANUARY

Norway: On January 1, 1989, CAP GEMINI DATA LOGIC moved to an old, beautifully restored warehouse in the port of Oslo, formerly one of the Norwegian capital's largest buildings.

France: Following the CAP SESA merger, the new companies organized kick-off meetings for their personnel. These get-togethers were held throughout the month of January.

FEBRUARY

U.S.: CAP GEMINI AMERICA's National Management Consulting Group assisted a federal government agency in preparing a Request for Proposal for buying a large data-processing system for American diplomatic embassies and consulates worldwide.

China: The X25 packet switching network was delivered to the Chinese authorities by CAP SESA TELECOM. This standarized network, a basic necessity for Chinese users working in data transfer, will also enable them to speed up access to international databases.

MARCH

Sweden: CAP GEMINI BRA was elected "Company of the Year" by the French-Swedish Chamber of Commerce. The prize was awarded in Stockholm to CGS Vice President Philippe Dreyfus by Curt G. Olsson, President of the Skandinaviska Enskilda Bank.

France: The first International Communications meeting was held in Paris, bringing together Communications personnel from many countries. It was an occasion for fruitful collaboration and sharing experiences.

APRIL

France: CAP SESA MAINTENANCE signed a contract with the Louvre Museum for complete maintenance of their public information system.

Brazil: 1988's most outstanding Branch Managers spent three days in Rio de Janeiro to celebrate their successful performances. Susan Larson of the Denver (Colorado) branch was named "Branch Manager of the Year."

Spain: In the south of Spain, 50 experts from various countries, selected because of their strong contribution to the development and promotion of Group know-how, participated in Group Europe's Annual Technical Rencontres. Clearly their expertise knew no national boundaries.

MAY

U.S.: CGA sponsored a series of half-day seminars called "Platform Synergy: Computing in the '90s" for corporate executives in Chicago, Dallas, and New York.

Austria: CAP GEMINI ÖSTERREICH was launched in Vienna on May 1, with a staff of 15.

France: The Executive Chairman's annual Press Conference in Paris has become international. For the first time, it assembled French and foreign journalists from many countries, along with the Group's top managers.

JUNE

France: CAP SESA launched its training program, known as the "Cap Sesa School." Its goal is to attract scientifically trained recent graduates (high school + 4 years advanced study). The course consists of two phases: 3 months of intensive course work, and 9 months of applied training at client sites. The plan is to train 200 young graduates in 1990.

Germany: A two-day meeting assembled CAP GEMINI SESA DEUTSCHLAND's managers and staff in Karlsruhe. These first German rencontres were a surprise to many who hadn't realized that the company already numbered 500 people.

Sweden: CAP GEMINI LOGIC, the Group's Swedish subsidiary, ranked 4th in a national poll of college students concerning the companies they would most like to work for.

France: CAP SESA TERTIAIRE obtained the "Quality Label" of the AFAQ (French Quality Assurance Association), which was awarded for the first time to a French computer services company.

SEPTEMBER

The Netherlands: Seventeen sail boats, with a crew of company members, participated in the first CAP GEMINI PANDATA Cup race in Ijsselmeer. The sea was rough and so was the race, but it was such a success that the plan now is to hold it once a year.

France: Shell contracted CAP SESA INDUSTRIE for the realization of a new monitoring-production system at its lubricant dispatch center in Nanterre. As a result of its two-computer architecture, this easily accessible system computerizes inventory from one end of the assembly line to the other, enabling Shell to guarantee on-time delivery.

Finland: At the end of August, the staff of CAP GEMINI SUOMI attended an event called "Caparee." This festivital, while in keeping with Group tradition, was the first of its kind in Finland. It will be remembered by all who attended – especially the tandem parachute competition.

OCTOBER

U.S.: CAP GEMINI AMERICA and DATA LOGIC of Sweden co-sponsored a series of nationwide forums attended by executives from manufacturing, service, and defense firms. Visits from clients such as J.I. Case, McDonnell Douglas, Pillsbury and Bell Labs provided an opportunity to discuss trends in information technology.

Spain: 220 people from CAP GEMINI ESPANA gathered in Palma de Mallorca in the warm autumn sunshine to get acquainted and celebrate the strong current-year growth figures (+ 163%).

NOVEMBER

Belgium: A page was turned when CAP GEMINI SESA BELGIUM left Châtelain Street in Brussels. This building was the first ever purchased by the Group outside its Paris headquarters. The move also represented a change of style: the quaint, creaking wooden stairs have given way to a traditional office building on the Boulevard de la Woluwe – the price of combining the Belgian teams!

Austria: A really successful "premiere": Eight journalists were invited to Vienna by the management of CAP GEMINI ÖSTERREICH to "review" the projects of the new company.

DECEMBER

France: On the occasion of "Hospital Expo '89," the 1989 Hospital Innovation Prize was awarded to THEMA, a videotex system developed by CAP SESA REGIONS for the healthcare units of the Brest Regional Hospital Center.

The Netherlands: At a kick-off party, 1 500 employees baptized the new CAP GEMINI PANDATA company with a collective "handshake."

France: CAP SESA INDUSTRIE took 14 of its clients on a study mission to Japan. By observing the leading Japanese companies first-hand, the participants were able to discover new ideas and methods in information technology.

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HOLDING

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General Management: Paris
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	Cap Sesa Conseil	92 Bd du Montparnasse 75682 Paris Cedex 14	33 (1) 42.79.52.00
	Cap Sesa Défense	30 Quai de Dion-Bouton 92806 Puteaux Cedex	33 (1) 49.00.40.00
	Cap Sesa Exploitation	5/7 Avenue de Bouvines 75544 Paris Cedex 11	33 (1) 40.24.10.10
	Cap Sesa Finance	26 Rue de la Pépinière 75008 Paris	33 (1) 42.93.22.00
	Cap Sesa Formation/ Institut	Tour Mattei 207 Rue de Bercy 75587 Paris Cedex 12	33 (1) 43.46.95.00
	Cap Sesa Sélection	Tour Mattei 207 Rue de Bercy 75587 Paris Cedex 12	33 (1) 43.46.95.00
	Cap Sesa Industrie	86/90 Rue Thiers 92513 Boulogne-Billancourt - Cedex	33 (1) 49.10.51.00
	Cap Gemini Innovation	118 Rue de Tocqueville 75017 Paris	33 (1) 40.54.66.66
	Cap Sesa Maintenance	30 Quai de Dion-Bouton 92806 Puteaux Cedex	33 (1) 49.00.40.00
	Cap Sesa Régions	92 Bd du Montparnasse 75682 Paris Cedex 14	33 (1) 43.20.13.81
	Cap Sesa Télécom	30 Quai de Dion-Bouton 92806 Puteaux Cedex	33 (1) 49.00 40.00
	Cap Sesa Tertiaire	129 Rue de l'Université 75007 Paris	33 (1) 45.55.91.57
	Copernique	6 Mail de l'Europe 78170 La-Celle-Saint-Cloud	33 (1) 30.82.50.00
	ITMI	92 Bd du Montparnasse 75682 Paris Cedex 14	33 (1) 43.20.13.81
	Logista	Tour Anjou 33 Quai de Dion-Bouton 92814 Puteaux Cedex	33 (1) 47.76.21.40
ANNECY	Cap Sesa Régions	Gerco 15 Avenue des Barattes 74000 Annecy	33 50.45.90.23
BORDEAUX	Cap Sesa Régions	31 Rue de l'Ecole Normale 33073 Bordeaux Cedex	33 56.02.00.57
BREST	Cap Sesa Régions	Centre d'Affaires du Ponant 1, Rue des Nereïdes 29200 Brest	33 98.41.45.44
CAEN	Cap Sesa Régions	Immeuble le Péricentre 4 Bât. A 147 Route de la Délivrande 14000 Caen Cedex	33 31.94.51.20
CLERMONT-FD	Cap Sesa Régions	Parc technologique Pardieu 10/12 Avenue Léonard de Vinci 63000 Clermont-Ferrand	33 73.27.44.88
GRENOBLE	Cap Sesa Régions	6 Boulevard Jean Pain B.P. 206 - 38005 Grenoble Cedex 1	33 76.44.82.01
	Cap Gemini Innovation	Avenue du Vieux Chêne ZIRST - 38240 Meylan	33 76.90.80.40
	ITMI	11 Chemin des Prés ZIRST -B.P. 87 38243 Meylan Cedex	33 76.90.33.81
	Apsis/Aptor	61, Chemin du Vieux Chêne B.P. 177 38244 Meylan Cedex	33 76.90.20.03
LE MANS	Cap Sesa Régions	43 Rue Paul Ligneul 72000 Le Mans	33 43.28.11.23
LILLE	Cap Sesa Exploitation	278 Avenue de la Marne 59700 Marcq-en-Barœul	33 20.45.99.18
	Cap Sesa Régions	280/6 Avenue de la Marne 59704 Marcq-en-Barœul Cedex	33 20.72.95.09
	ITMI	326 Rue du Général de Gaulle 59370 Mons-en-Barœul	33 20.56.40.41
LYON	Cap Sesa Exploitation	13 Rue des Emeraudes 69006 Lyon	33 72.74.03.26
	Cap Sesa Régions	190 rue Garibaldi B.P. 3166 69212 Lyon Cedex 03	33 78.62.20.41
MARSEILLE	Cap Sesa Régions	Les Bureaux Borely-Bât. A 40 Avenue de Hambourg B.P. 332 13271 Marseille Cedex 08	33 91.25.11.00
METZ	Cap Sesa Régions	Le Technopôle 2 Bât. B 8 - Rue Graham Bell 57000 Metz-Queuleu	33 87.37.11.23
MONTPELLIER	Cap Sesa Régions	Immeuble Le Triangle Allée Jules Milhau 34000 Montpellier	33 67.92.20.17
MULHOUSE	Cap Sesa Régions	14 Boulevard de l'Europe 68100 Mulhouse	33 89.45.10.60
NANCY	Cap Sesa Régions	25-29 Rue de Saurupt 54000 Nancy	33 83.51.43.96
NANTES	Cap Sesa Exploitation	Immeuble Salorges II 3 Boulevard Salvador Allende 44100 Nantes	33 40.69.66.66
	Cap Sesa Régions	Immeuble Horizon 12 Rue Gaetan Rondeau B.P. 2015 44065 Nantes Cedex 02	33 40.47.80.23
NICE	Cap Sesa Régions	Porte de l'Arenas Entrée B 455 Promenade des Anglais 06200 Nice	33 93.21.01.41
ORLEANS	Cap Sesa Régions	12 Rue Emile Zola 45000 Orléans	33 38.53.86.50
	Logista	8 bis Quai de la Madeleine 45000 Orléans	33 38.43.24.28
PAU	Cap Sesa Régions	Centre Activa Boulevard Louis Sallenave 64000 Pau	33 59.84.12.23
REIMS	Cap Sesa Régions	Galerie des Sacres 18 rue Tronsson-Ducoudray 51100 Reims	33 26.47.38.38
RENNES	Cap Sesa Régions	Rue de la Rigourdière 35510 Cesson-Sevigné	33 99.83.85.85
	Cap Sesa Télécom	ZIRST Rennes Atalante 5 Allée de la Croix-des-Hêtres B.P. 1809 35018 Rennes Cedex	33 99.63.50.50
ROUEN	Cap Sesa Régions	Immeuble Montmorency I Place de la Verrerie Centre Régional Saint-Sever 76100 Rouen	33 35.63.50.45
SENLIS	Cap Sesa Régions	17 Rue Léon Fautrat 60300 Senlis	33 44.60.06.71
STRASBOURG	Cap Sesa Régions	20 Place des Halles Tour Europe B.P. 29 67068 Strasbourg Cedex	33 88.32.22.42
TOULON	Cap Sesa Défense	Z.I. Bassaquet-Nord Immeuble Burotel 83140 Six-Fours-les-Plages	33 94.63.71.71
TOULOUSE	Cap Sesa Exploitation	Burolines Bât. 2 2 ter Rue Marcel Doret ZAC de l'aéroport 31700 Blagnac	33 61.30.48.30
	Cap Sesa Régions	Parc Technologique du Canal 1 Avenue de l'Europe 31400 Toulouse	33 61.73.46.91
	Cap Sesa Régions	Technopolis 8 Rue Mesplé BP 1155 31036 Toulouse Cedex	33 61.31.53.09
TOURS	Cap Sesa Régions	5 Place Jean Jaurès 37000 Tours	33 47.20.67.67
VALENCE	Cap Sesa Régions	Le Métropole 2 10-12 Rue du Parc 26000 Valence	33 75.42.56.19

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FEDERAL REPUBLIC OF GERMANY

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ESSEN	Cap Gemini Sesa Deutschland	Moltkestrasse 29 4300 Essen 1	49 (201) 26 620
FRANKFURT	Cap Gemini Sesa Deutschland	Am Salzhaus 4 6000 Frankfurt 1	49 (69) 29 00 71
	Cap Gemini Sesa Deutschland	Bockenheimer Landstrasse 24 6000 Frankfurt 1	49 (69) 71 00 50
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HØJBJERG	Cap Gemini Danmark	Stenvej 25 8270 Højbjerg	45 (86) 27 44 11

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	Cap Gemini Sesa	Via Benigno Crespi 70 20159 Milano	39 (2) 69 58 269
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	Cap Gemini Geda	Via Galati 71 00155 Roma	39 (6) 406 06 11
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	Sysdata S.p.a.	Corso Marconi 13 10125 Torino	39 (11) 650 46 65

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OSLO	**Cap Gemini Data Logic**	**Havnelageret Langkaia 1 0150 Oslo 1**	47 (2) 42 07 60
SKIEN	Cap Gemini Data Logic	Telemarksgate 8 3700 Skien	47 (3) 52 75 45
STAVANGER	Cap Gemini Data Logic	Kirkebakken 10 4012 Stavanger	47 (4) 52 29 35
TILLER	Cap Gemini Data Logic	Trekanten Vestre Rosten 81 7075 Tiller	47 (7) 88 89 66
TØNSBERG	Cap Gemini Data Logic	Havnegate 2 3100 Tønsberg	47 (33) 18 711

NETHERLANDS

AMSTERDAM	Cap Gemini Pandata Industry	Paasheuvelweg 40 A 1105 BJ Amsterdam	31 (20) 564 37 00
GRONINGEN	Cap Gemini Pandata Telecom	Hereweg 95 D 9721 AA Groningen	31 (50) 27 20 70
RIJSWIJK	Cap Gemini Pandata Industry	Burg. Elsenlaan 170 2283 AF Rijswijk	31 (70) 395 71 71
	Cap Gemini Pandata Public	Same location	
	Cap Gemini Pandata Telecom	Same location	
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	Gap Gemini Pandata Finance	Same location	
	Cap Gemini Pandata Informatica Institute	Same location	
	Cap Gemini Pandata Telecom	Same location	
	Cap Gemini Pandata Trade Distribution & Transport	Same location	
VELDHOVEN	Cap Gemini Pandata Industry	Meierijweg 4 5503 HP Veldhoven	31 (40) 58 61 60
	Cap Gemini Pandata Trade Distribution & Transport	Same location	31 (40) 58 61 80
ZWOLLE	Cap Gemini Pandata Industry	Dr. Stolteweg 68 8025 AZ Zwolle	31 (38) 28 64 44
	Cap Gemini Pandata Public	Same location	31 (38) 28 64 00

SWEDEN

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GÖTEBORG	Cap Gemini Logic Industri	FO Petersons gata 32 42 131 Västra Frölunda	46 (31) 45 03 40
	Cap Gemini Logic Service	Same location	
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LINKÖPING	Cap Gemini Logic	Ågatan 39 58222 Linköping	46 (13) 11 42 20
MALMÖ	Cap Gemini Logic	Stora Nygatan 63 21137 Malmö	46 (40) 772 10
ÖREBRO	Cap Gemini Logic	Törngatan 6 70363 Örebro	46 (19) 10 55 95
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	Cap Gemini Logic Industri	Kungsgatan 34 11135 Stockholm	46 (8) 700 22 00
	Cap Gemini Logic Service	Same location	
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	Cap Gemini Logic Techno	Monitor - Hälsingegatan 2 11323 Stockholm	46 (8) 30 07 10
	Cap Gemini Logic Finans	Floragatan 1, Box 5177 10244 Stockholm (from 01.09.90)	46 (8) 24 24 06 46 (8) 666 25 00
	Cap Gemini Logic Accept	Linnégatan 9/11, Box 5177 10244 Stockholm	46 (8) 666 25 00
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BALTIMORE	401 East Pratt Street World Trade Center Baltimore, MD 21202	1 (301) 837-0343
CHICAGO	2 Westbrook Corporate Center Westchester, IL 60154	1 (708) 531-1300
CINCINNATI	10560 Ashview Place Cincinnati, OH 45242	1 (513) 563-6622
CLEVELAND	Three Commerce Park Square 23200 Chagrin Boulevard Cleveland, OH 44122	1 (216) 464-8616
COLUMBUS	2572 Oakstone Drive Columbus, OH 43231	1 (614) 898-3044
DALLAS	2 Galleria Tower 13455 Noel Road - L.B.66 Dallas, TX 75240	1 (214) 385-3290
DAYTON	Sand Lake Plaza Office Building 6450 Poe Avenue Dayton, OH 45414	1 (513) 890-1200
DENVER	5613 DTC Boulevard Englewood, CO 80111	1 (303) 220-1700
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DETROIT	5800 Crooks Road Troy, MI 48098	1 (313) 879-7600
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HOUSTON	1700 West Loop South Houston, TX 77027	1 (713) 622-0105
KALAMAZOO	5380 Holiday Terrace Kalamazoo, MI 49009	1 (616) 372-1170
KANSAS CITY	6900 College Boulevard Overland Park, KS 66211	1 (913) 451-9600
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LOS ANGELES	5120 West Goldleaf Circle Los Angeles, CA 90056	1 (213) 624-0855
	COMPACT DATA SYSTEMS 21107 Vanowen Street Canoga Park, CA 91303	1 (818) 992-4361
MADISON	International Office Center 2317 International Lane Madison, WI 53704	1 (608) 244-4880
MARYLAND	8757 Georgia Avenue Silver Spring, MD 20910	1 (301) 587-0771
MIAMI	1000 West McNab Road Pompano Beach, FL 33069	1 (305) 942-6522
MILWAUKEE	10150 West National Avenue Milwaukee, WI 53227	1 (414) 546-4644
MINNEAPOLIS	7300 France Avenue South Edina, MN 55435	1 (612) 835-7779
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	Raritan Plaza III Raritan Center Edison, NJ 08837	1 (201) 225-7880
NEW YORK	369 Lexington Avenue New York, NY 10017	1 (212) 883-0900
OMAHA	10810 Farnam Drive Omaha, NE 68154	1 (402) 333-2863
ORLANDO	2700 Westhall Lane Maitland, FL, 32751	1 (407) 660-8833
PHILADELPHIA	150 Monument Road Bala Cynwyd, PA 19004	1 (215) 668-4626
PITTSBURGH	302 McKnight Park Drive Pittsburgh, PA 15237	1 (412) 364-2080
PORTLAND	6915 Southwest Macadam Avenue Portland, OR 97219	1 (503) 246-4777
RICHMOND	808 Moorefield Park Drive Richmond, VA 23226	1 (804) 320-0787
ST. LOUIS	1034 South Brentwood Boulevard St. Louis, MO 63117	1 (314) 721-0123
SEATTLE	16400 Southcenter Parkway Seattle, WA 98188	1 (206) 575-4911
STAMFORD	1177 High Ridge Road Stamford, CT 06905	1 (203) 321-1250
TAMPA	100 West Kennedy Boulevard Tampa, FL 33602	1 (813) 273-0059
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WILMINGTON	209 Baynard Building 3411 Silverside Road Wilmington, DE 19810	1 (302) 478-1295
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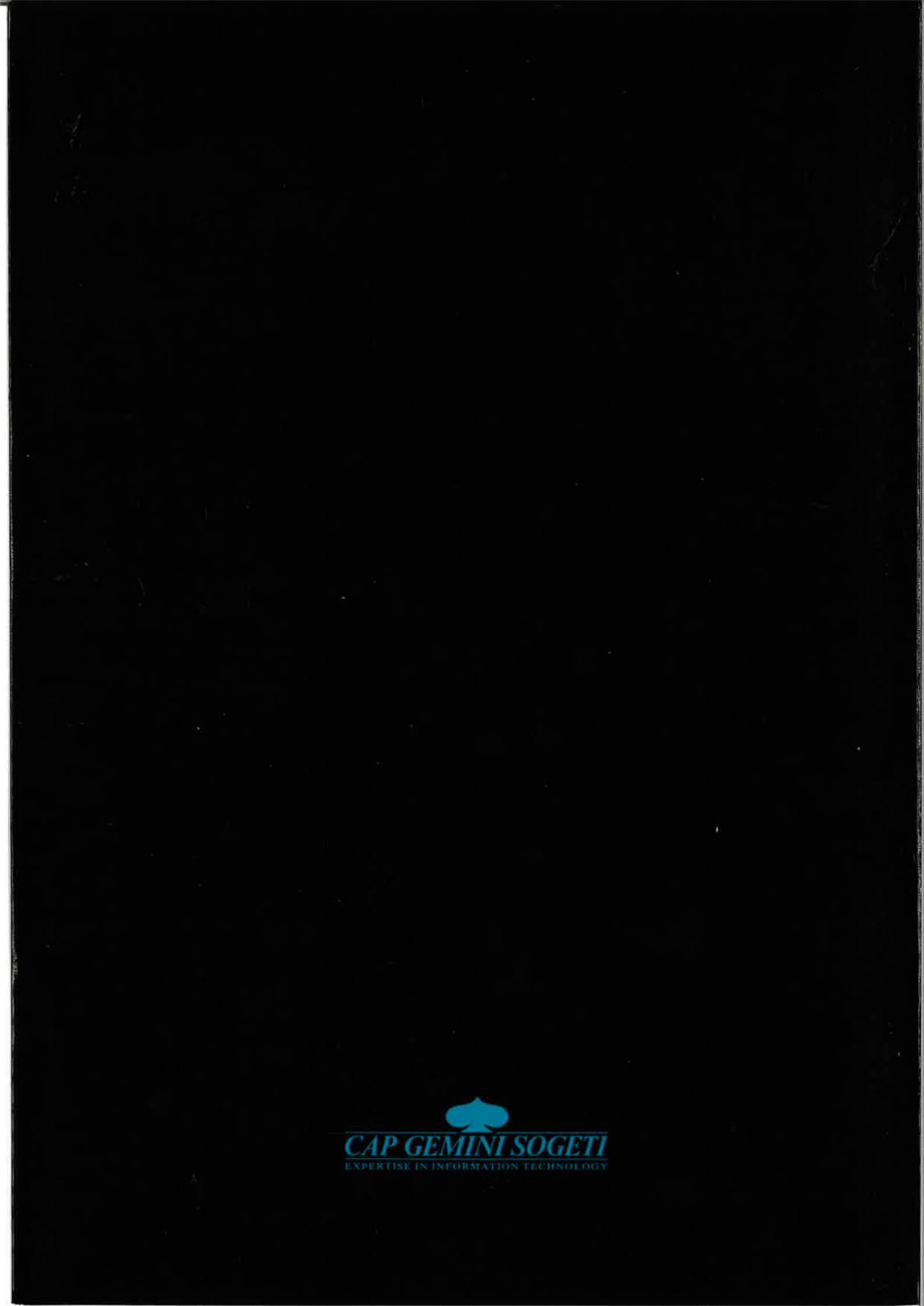
By fitting together, selecting and positioning, Pierre Courtois is extending the boundaries of artistic creation. After all, choosing, arranging and proportioning are as much a means of expression as painting, drawing or sculpting.

In Courtois' hands, objects take on new light. Through a series of subtle, even artificial, arrangements, the artist takes us on a "stroll" which leads beyond reality to a reordered, visually unsettling landscape.

A native and resident of Belgium, Pierre Courtois' original artistic approach bears the stamp of both the Conceptual and Environmental (Landart) movements, two dominant forces in the contemporary art world.

Reproductions of his work have been kindly placed at our disposal by the Galerie Lacourière Frélaut (23, rue Sainte-Croix-de-la-Bretonnerie, Paris). The selection appearing in this volume was made by Cap Gemini Sogeti.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