Since the dawn of time, human ingenuity has striven to use available resources to the best advantage.

The windmill is one of the first automated mechanical systems.

But the first undoubted example of a rotating windmill appears with Leonardo da Vinci in the 15th century. Use of this type becomes widespread from this era onward.

An illustration from an early Italian treatise clearly displays the inner workings of a post-mill. Resting on a pyramidal base, its entire superstructure rotates to face its sails into the wind, making the most of available energy.

The first example of automatic regulation might well date from the 12th century: the Herrade de Landberg manuscript appears to show a grain feed device in a drawing of a windmill mechanism.

The device is a sort of funnel attached to a part which contacts the square-section millstone drive shaft: the grain funnel is repeatedly jarred, causing the grain to fall, the feed rate increasing as available energy grows.

The combination of the grain feed mechanism and the rotating mill structure is an "intelligent information-processing system", capable of "perceiving" a situation and "reacting" appropriately. Many centuries before the computer, it prefigures man's ability to develop the concept of information engineering.

CAP GEMINI SOGETI

CAP GEMINI SOGETI is a group of some thirty DP service companies primarily engaged in professional services: consulting on the use of DP resources, implementation of software enabling government and corporate users to employ these resources, design and implementation of complex DP systems, development and marketing of software packages, assistance to computer operations, training, consulting in office automation and corporate organization.

Active throughout Europe, the United States and Africa, CAP GEMINI SOGETI is one of the world's foremost DP service firms.

| Summary of CAP GEMINI SOGETI consolidated results US $, in millions | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|
| CONSOLIDATED REVENUES | 55.0 | 67.6 | 86.2 | 122.2 | 152.6 |
| Gross CASH FLOW | 6.4 | 9.7 | 12.3 | 15.6 | 20.0 |
| NET INCOME after taxes | 2.2 | 3.3 | 4.3 | 6.4 | 7.7 |
| SHARE HOLDERS'EQUITY | 8.8 | 9.7 | 12.2 | 15.0 | 21.5 |
| TOTAL OF BALANCE SHEET | 34.9 | 43.7 | 51.7 | 74.2 | 95.7 |
| TOTAL NUMBER OF EMPLOYEES as at 31 December | 2317 | 2725 | 3104 | 3577 | 3995 |
| NUMBER OF PROFESSIONAL STAFF | 2003 | 2332 | 2638 | 3003 | 3345 |

There are some years which, although relatively unpromising or even somewhat somber to start off with, end up by affording as much satisfaction or as many happy surprises as any other.

The greatest satisfaction of 1982 was in having finally achieved our projected results, which had assumed difficult proportions very soon after they had been targeted. Revenues went slightly over the billion-franc mark – representing an increase of nearly 25% over the preceding year* – while net balance-sheet earnings stood at a bit above 5%.

Cooperative ties established with two of our major French counterparts and competitors were another source of satisfaction: first STERIA, which joined forces with us in Vidéographie Systèmes, whose American subsidiary VSA is marketing French videotex products and software in the United States; next, SESA (following CAP GEMINI SOGETI's acquisition of a 35% shareholding in that company), with whom we specifically plan to develop and export Electronic Directory systems.

And added to the roster of satisfying events was the sight of over a thousand of the Group's customers and friends who joined us one magnificent evening last June to celebrate SOGETI's fifteenth birthday, and CAP's twentieth.

The happy surprise was the entry of a new partner into CAP GEMINI SOGETI's capital structure. CGIP (Compagnie Générale d'Industrie et de Participations) is at once a powerful industrial group (1982 revenues in excess of FF 10 billion, with a workforce of 25,000) and an investment company holding a large portfolio of interests in Europe and the USA: an associate whose resources and ambitions harmonize so well with our own that it isn't really necessary to point out that our alliance was the outcome of a case of love at first sight, insofar as the managers of both groups were concerned. We extend our thanks to those who agreed to divest themselves of their investments, acquired from CISI in October 1979, in order to smooth the way for CGIP's entry. There are still bankers aware that their highest function is to help their corporate customers clear the hurdles standing in the way of their growth. And this is precisely what was done by the managers, former and present, of Crédit Lyonnais and Lyonnaise de Banque: they may rest assured that our long-standing friendship emerged strengthened from the episode.

A regular reader will note that CAP GEMINI SOGETI is publishing its Annual Report for the eighth consecutive year, and might be inquisitive enough to compare 1982's key figures with those issued for 1975 in the first Annual Report for the Group as it evolved from the merger of CAP, GEMINI and little SOGETI. This reader will observe that, in seven years, the CAP GEMINI SOGETI Group has multiplied :
— its workforce by a factor of 2        Annual average: + 10%
— its revenues by a factor of 4.5    Annual average: + 24%
— its net balance-sheet earnings    Annual average: + 30%
   by a factor of 6.5

In view of an average inflation rate of 8% (calculated over this period on the basis of annual revenues in each country where the Group was active), the total increase in revenues represents an *annual growth in* **volume** *of 15%*, about two-thirds of which obtained by increases in workforce numbers (hiring and acquisitions) and one-third by increased productivity (training, changes in the job qualification pyramid, more systematic use of methodological tools, fabrication of increasingly-sophisticated systems, etc.).

If projected at their present levels over the next seven years, these growth rates would lead CAP GEMINI SOGETI to issue a 1989 Annual Report announcing:
— a year's-end workforce of 8,000
— revenues approaching FF 5 billion
— net balance-sheet earnings exceeding FF 300 million

2

Curiously enough, these figures are quite close to those obtained by a two-year extension of CAP GEMINI SOGETI's latest version of its "Five Year Plan", which covers the 1983-1987 period (but which, of course, was not constructed by means of a simple extrapolation of the preceding period's results).

Does this mean that everything will proceed at the same pace during the upcoming seven years as during the past? At the same pace, perhaps; but certainly not under the same conditions, for the CAP GEMINI SOGETI Group exercises a profession in which nothing can be taken for granted:

• every business in the world – and ours, whose health is so dependent on that of its customers, is no exception – has been smitten with doubt since the rug was pulled from under the credos which have guided us since the beginning of the '70s: the belief in continuous, quasi-automatic growth has given place to uncertainty, the drive to invest is no longer what it was, cash flow has been throttled;

• if – viewed from the outside – the DP industry seems to be an island of prosperity in a threatening sea, it is nonetheless shaken by unbelievable earthquakes which, from week to week, topple its structures, shift its centers of gravity, disrupt its lines of force: irrepressible eruptions of technological innovation, each making its predecessors obsolete; invention of new marketing and distribution schemes; alliances which seemed out of the question only yesterday and which transform the landscape to such a degree as to make it unrecognizable to anyone who imprudently absents himself for a year or two;

• "software services" – the market slot occupied by CAP GEMINI SOGETI – are the most intangible, the most abstract and the least familiar products in the DP field. It still comes as a surprise to many that a bit of grey matter has to be added to those little electronic marvels that seem to be able to do just about everything themselves. Again and again, to sell its services, the information engineering company has to justify not only their prices, but their usefulness as well. "Selling services? It's like riding a tiger", the CEO of a company in this sector has remarked, and tellingly. And it would be useless to deny that this feeling of uncertainty is fueled by the increasingly-unmasked competition being waged against DP service firms – with varying degrees of success – by computer and component manufacturers.

Reasons for uncertainty, then; but also reasons to act, to seize the initiative. Firstly, because a certain sense of insecurity is actually a necessity to business: it forces managers to be inventive and efficient; it counters the risk of entanglement in frozen internal structures; it leads people to trust their instincts as much as their analyses, and keeps them from burying action under a mountain of preparations; it upraises those who get in there and fight to win contracts. Secondly, because – in spite of what everyone had predicted – CAP GEMINI SOGETI has managed to safeguard its independence, its cohesiveness, its ethical standards, and these additional weapons afford certain advantages to the Group. And lastly, because there is something fabulous about this market's foreseeable growth rate. Speaking of the "software services and program products" sector alone, the consensus is that the market's global volume, estimated at $14.5 billion (service companies + computer manufacturers) for the USA/Western Europe/Japan complex in 1981, will be about $30 billion *in constant dollars* by 1986, for a growth in volume exceeding 15% annually! The CAP GEMINI SOGETI Group – present in all of these countries except Japan – holds only a tiny share of this overall market today (1% of the total, even though this proportion is 7% for France, and 10% if computer manufacturers are left out of the picture), and even the largest American service companies individually hold extremely small percentages**. And, as everyone knows, the possession of a small share in a strong growth market is normally a handsome opportunity for development. It is true, of course, that activity on a buoyant market is not itself a guarantee of success, and there are some well-known companies whose DP misadventures have cost their shareholders – or the taxpayer – dearly. But if mere activity on a growth market is no assurance of prosperity, it is also not forbidden to take advantage of this presence to consolidate an existing taste for enterprise.

So will there be 8,000 of us seven years from now? I simply don't know and – considering the fact that such growth could put us at the level, in 1989, of our main American competitors today – I wonder whether we shouldn't aim for an even higher growth rate, work to create even larger amalgamations? But is this really the most important thing? I don't think so: for CAP GEMINI SOGETI, the important thing is to keep its soul, to hang on to its past sources of strength, to resist the temptation of high-flying digressions, to foster its ambition to perform high-quality work for its customers and to provide its employees with rewarding careers in one of the most exciting occupations that today's world has to offer. If this is done, the rest – that is, size, profitability, expansion – might then surely bestow itself upon the Group as a surplus benefit, as a matter of course.



Serge KAMPF
Grenoble, 9 April 1983

* *A sign of the times: in this English-language version of the Annual Report, with accounts stated in dollars, prevailing exchange rates reduce this growth to 7% in a comparison of 1982 revenues ($153 million, with the dollar at FF 6.73) to the 1981 figure ($143 million, but with the dollar at FF 5.75) !*

** *Computer Services Corporation (CSC), the world's largest DP service company, had 1981 revenues of about $600 million, an estimated half of which was derived from software services. CSC's share of the world market was thus 2%.*

3

## SCOPE OF ACTIVITY

Major features of the information engineering services offered by CAP GEMINI SOGETI include:

• consulting on the selection and use of data processing resources (master plans, feasibility studies, systems analyses, guidance in the use of advanced techniques, etc.), together with associated training and recruiting services,

• design and implementation of software for user requirements (management, scientific, industrial applications, etc.) or for computer operation (basic software),

• systems engineering, i.e., prime contracting for systems of every type and dimension, whether as "industrial architect" tasked with system design and supervision of its implementation, or as "coordinating prime contractor" responsible for turnkey delivery of a complete system.

Besides these services, which represent the bulk of its activity, the Group develops and markets program products, videographic systems and software engineering workshops.

It should also be noted that Groupe BOSSARD S.A. (in which CAP GEMINI SOGETI holds a 49% interest) carries out consulting (organization, human relations and communication), marketing and advertising services.
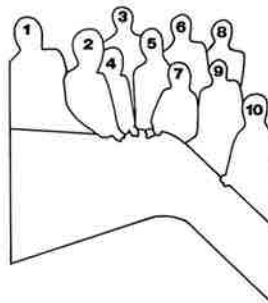


The Executive Committee
of CAP GEMINI SOGETI
consists of 10 members:

1 - Jean-Paul FIGER
2 - Michel JALABERT
3 - José BOURBOULON
4 - Jean-François DUBOURG
5 - Serge KAMPF
6 - Christer UGANDER
7 - Daniel SETBON
8 - Jean-Baptiste RENONDIN
9 - Alain LEMAIRE
10 - Michel BERTY

## OVERALL STRUCTURE

CAP GEMINI SOGETI's overall structure is a conventional one: an executive staff and operational groups. This organization, meeting a straightforward concern for efficiency, has been inspired by four guiding principles:
● ensure substantial operational decentralization by means of highly autonomous "branches". The branch is the Group's basic operational unit. It is at once sufficiently small (an average of 40 employees) to enable the branch manager to be personally acquainted with each of his customers and each of his subordinates, and sufficiently large to let him assume responsibility for his resources and his results. Branches are brought together to form divisions or regions; these in turn are grouped into companies;
● maintain overall cohesion and ensure the Group's efficiency through a shared technical, commercial and financial policy, taking care that its structures are continuously adapted to this policy and to the prevailing situation, and staffing the Group's holding companies with small executive teams, thoroughly familiar with operational realities;
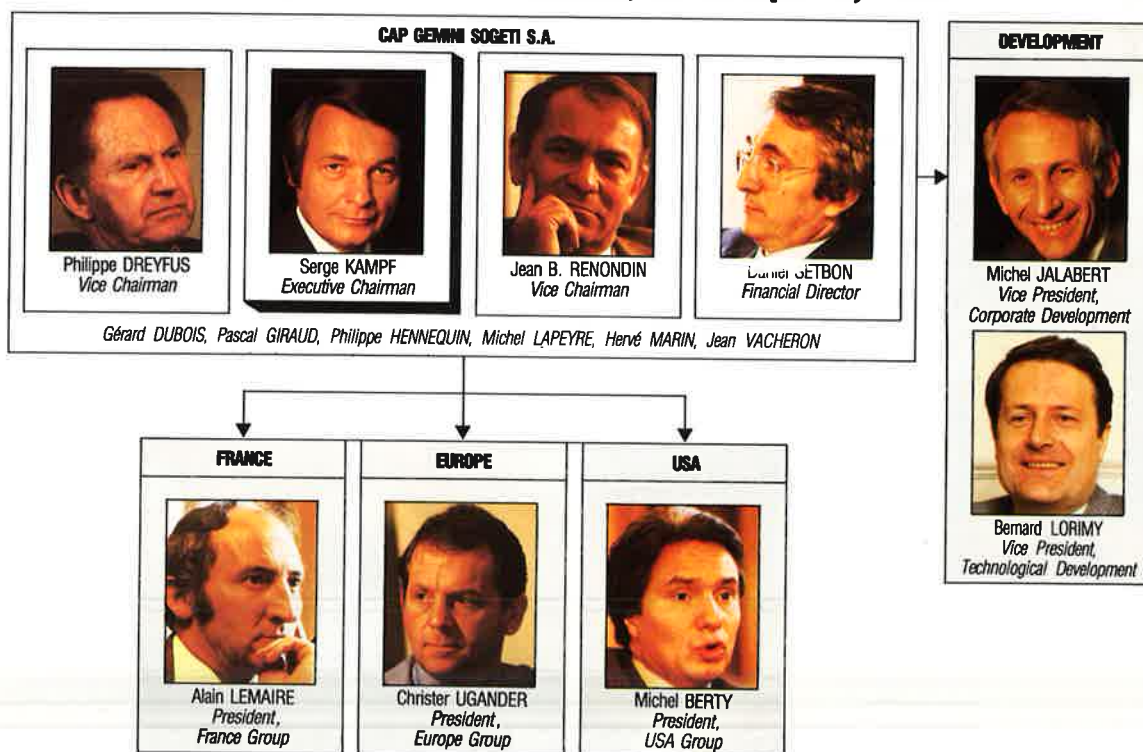● ensure matching of the Group's services and products to market demand, by analyzing information on market trends and by setting up structures capable of meeting new customer requirements, as well as through substantial R&D investment in all areas which promise to encourage the short and medium-term growth of computer service activities;
● prepare for CAP GEMINI SOGETI's development on the major international markets, both through reinforcement of its European and North American presence in the form of wholly-owned subsidiaries and through direct exports and the systematic establishment of cooperative ties with a number of countries.

Overall coordination is provided by two steering bodies:
● *the Executive Committee,* which brings together the Group's leading executives under the chairmanship of Serge Kampf, Executive Chairman of CAP GEMINI SOGETI S.A., at bimonthly intervals to prepare decisions of major importance to the Group and lay down its broad strategic guidelines.
● *the General Management Committee,* made up of the Managers of major operational units, which advises on general guidelines and on technical or commercial matters involving the Group as a whole. As a rule, the General Management Committee meets three times yearly.

## CAP GEMINI SOGETI GROUP
## ORGANIZATIONAL CHART, as of April 1, 1983



**CAP GEMINI SOGETI S.A.**

Philippe DREYFUS — *Vice Chairman*

Serge KAMPF — *Executive Chairman*

Jean B. RENONDIN — *Vice Chairman*

Daniel SETBON — *Financial Director*

**DEVELOPMENT**

Michel JALABERT — *Vice President, Corporate Development*

Bernard LORIMY — *Vice President, Technological Development*

Gérard DUBOIS, Pascal GIRAUD, Philippe HENNEQUIN, Michel LAPEYRE, Hervé MARIN, Jean VACHERON

**FRANCE**

Alain LEMAIRE — *President, France Group*

**EUROPE**

Christer UGANDER — *President, Europe Group*

**USA**

Michel BERTY — *President, USA Group*

The organization and activity of each of the four operational Groups (FRANCE, EUROPE, USA, DEVELOPMENT) is presented more fully in pages 46 to 55

5

# Information Engineering
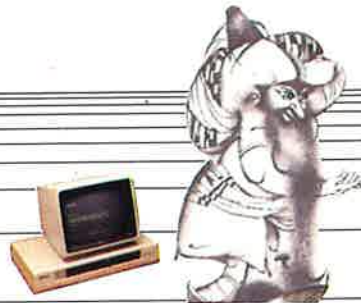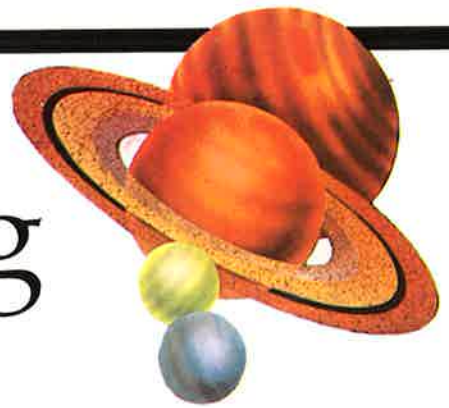
In ancient times, the Latin word "*genius*" designated the divine spirit who presided over each mortal's birth or, in a broader sense, supernatural beings endowed

with magical powers. The term later came to be applied to a person's natural aptitude, his innate penchant for some human endeavour; and, finally, through a derivative "*ingenium*", to creative ability itself.

In times when the applied arts and crafts were essentially based on experience (as well as on esoteric tradition), builders, who carried out both the design and actual construction of their works, were universally imagined to possess near-supernatural powers. Hence the extension of the word "genius" to encompass their activity: the embodiment of *ingenium* was the engineer; his craft, *engineering*.
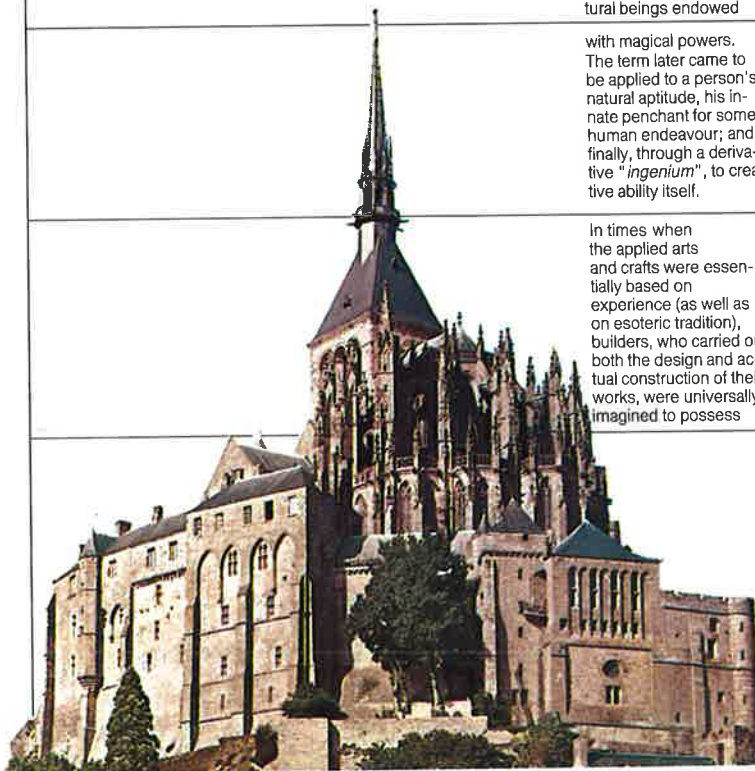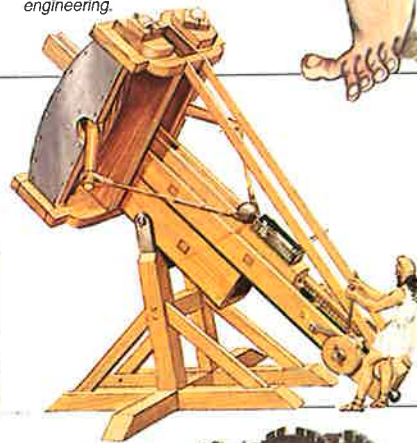
A distinction was very quickly made between two types of activity meeting quite different needs: civil works (housing, palaces, administrative buildings, churches) and military works (fortifications, shelters, defensive works, temporary bridges, garrisons and related facilities, training grounds). Design, rules, methods and details of construction for the former group were designated "civil engineering", while all aspects of the latter category fell under "military engineering"

The many forms of engineering – military, civil, marine and chemical – came gradually into being with the development of science and technology, bringing solutions to increasingly complex problems as they moved beyond the grasp of the ordinary craftsman. Following the same pattern, the extraordinary development of data processing technology and the countless applications that it makes possible have led to the advent of *"INFORMATION ENGINEERING"*. We might define this as *the complex of expertise, methods and end products of the engineers and technicians responsible for the successive steps in the development of information systems.*

In this Report, our aim is to delve into the wealth of meaning underlying the broad theme of "information engineering", in order to describe as clearly as possible the job performed by CAP GEMINI SOGETI.

Suppliers to the DP industry are customarily categorized into two main groups: hardware manufacturers and service companies. The services provided by the latter may also be divided into two major categories: "machine-based" services and "software" services. There is a very clear distinction between these two types of service: in the first, the resource provided is a "slice" of computer power (assuming many forms: rental of a computer room, access via terminal to a computer network, production of accounting documents such as paysheets, etc.); in the second, the commodity is a product of creative intelligence (also in many forms: consulting in the selection of hardware, program development, systems design, etc.).

In real life, however, things are not so clear-cut: machine-based services sometimes include a "software" component, and vice-versa. Examples might include, on the one hand, a machine service company which produces billing on its own computers, using internally-developed programs; on the other, a software service firm which delivers a turnkey system of its own design, controlled by software which it has fabricated and integrated into host hardware before delivery.

"Information engineering" would thus seem to be a faithful definition of the activity of a service firm such as CAP GEMINI SOGETI, particularly in light of this activity's probable future growth and development.

The increasing importance of "software" services is evident at three levels:
● at the individual or "personal" level where, with the advent of the microcomputer and the multifunction terminal, data processing is penetrating both the corporate and personal environments at an ever-accelerating rate;
● at the level of business and government, which possess a massive inventory of applications to be maintained, while new generations of applications made possible by technological advances are waiting to be developed;
● at the level of society as a whole, as DP is slated to take charge of the storage, transmission, duplication and distribution of mass information, extending beyond mere "data" to encompass text, sound and image.

It is simply impossible to imagine the volume of systems and software which will have to be designed, developed and installed, and the resulting volume of new methods and approaches that will have to be assimilated and applied. Obviously, this situation faces society – and computer engineering firms, specifically – with quantitative problems expressable in terms of "workload". But it also raises other, even more complex questions. Two very typical examples:
● design and use of large electronic information systems, whose diversity requires both the ability to devise novel solutions and mastery over many brand-new techniques;
● dissemination of microprocessor software in packages produced by the tens of thousands, a procedure which presupposes the existence of heretofore-unknown methods for software development, marketing, maintenance and copyright protection.

The variety, complexity and volume of software services necessitated by this explosion in the development of applications explains the very rapid growth of the information engineering industry: worldwide sales by information engineering companies totalled $ 10.2 billion in 1981, and should show an average annual growth rate – in constant dollars – of something like 15% over the next five years (source: Pierre Audoin Conseil).

# INFORMATION ENGINEERING: ART, METHODS AND WORKS

"Information engineering" at once designates the **art** of employing DP hardware and associated equipment, the complement of **methods and tools** required to execute DP "works", and the **works** themselves, generally termed "systems".

First and foremost, information engineering is an art, that is - in contrast to science conceived as pure, application-independent knowledge - an expression of human activity directed toward a concrete goal: the design and implementation of DP systems.

As with all other arts, information engineering calls upon intelligence to perceive and comprehend situations, upon creative power to conceive solutions, and upon knowhow to hammer them into concrete shape. These qualities find fertile soil for growth in service companies (or information engineering firms), thanks to their prevalent will to excel, the variety of situations encountered and problems to be solved, and the high degree of communication between professionals.

Information engineering is also made up of an inventory of methods and tools which implementors use for fabrication of their DP products.

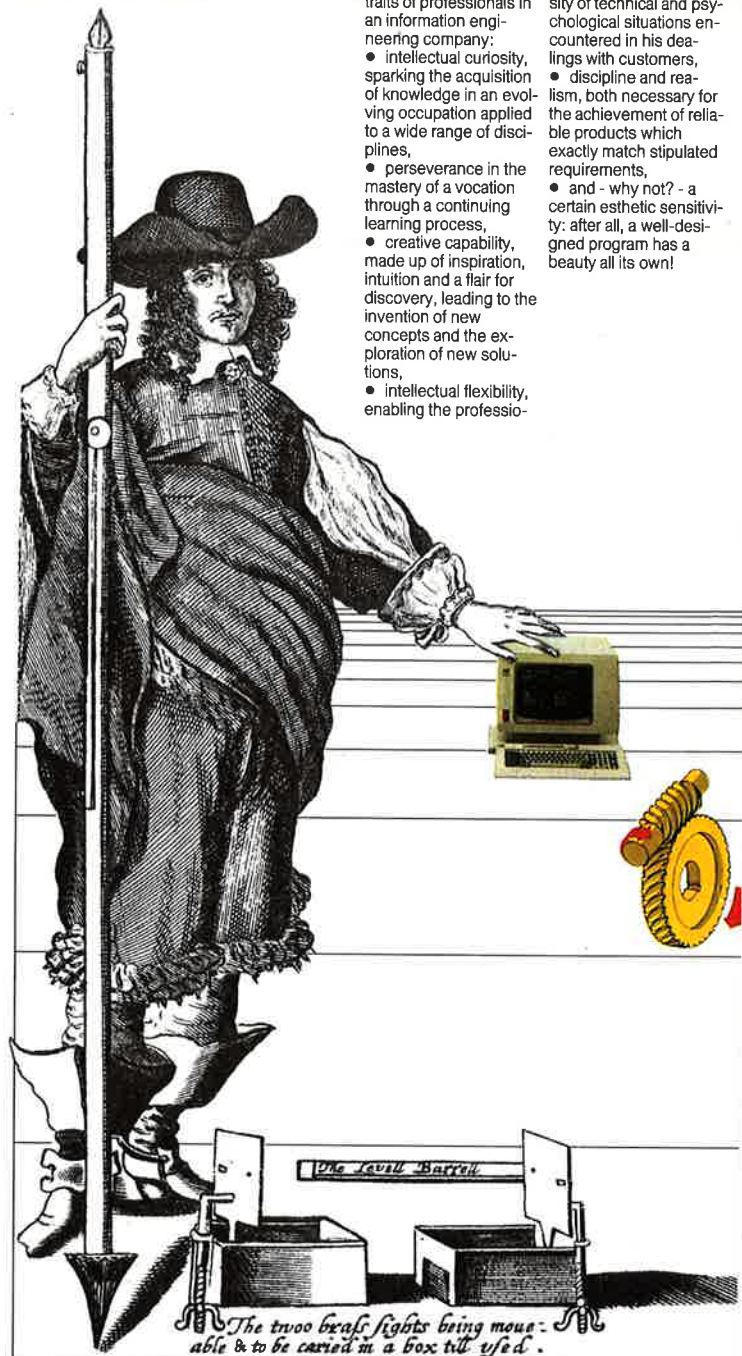Specific to each phase of product fabrication, these methods and tools include:
- at the design level: methods for system or application specification, analysis and design, for performance measurement and comparison in hardware selection, etc.;
- at the implementation level: languages, compilers, interpreters, automatic program generators, syntax analyzers, text editors, program checking aids;
- throughout the design and fabrication cycle: project management and control methods;
- in the startup phase: test and acceptance tools such as static and dynamic analyzers, test data generators, etc.

Finally, the concept of information engineering also embraces the works themselves, that is, the data processing systems designed and implemented by service firm professionals.

The following section of this Report will take a look at these works, which vary greatly in nature, structure, scope and complexity.

The most important traits of professionals in an information engineering company:
- intellectual curiosity, sparking the acquisition of knowledge in an evolving occupation applied to a wide range of disciplines,
- perseverance in the mastery of a vocation through a continuing learning process,
- creative capability, made up of inspiration, intuition and a flair for discovery, leading to the invention of new concepts and the exploration of new solutions,
- intellectual flexibility, enabling the professional to adapt to the diversity of technical and psychological situations encountered in his dealings with customers,
- discipline and realism, both necessary for the achievement of reliable products which exactly match stipulated requirements,
- and - why not? - a certain esthetic sensitivity: after all, a well-designed program has a beauty all its own!

*The twoo brass sights being moveable & to be carried in a box till used.*

**The levell Barrell**

**Chemical Engineering** Chemical engineering covers the field of knowledge required for the development of any new chemical manufacturing process: research, lab and pilot shop experimentation, and finally, plant construction.
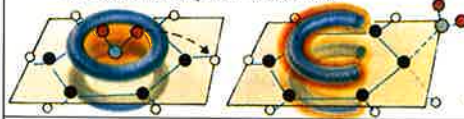
**Marine Engineering** Sea and wind are elusive elements which, if they are to be harnessed for navigation, require skills extending far beyond technical knowlegde alone. The art and technology required for shipbuilding form what we know as "marine engineering".
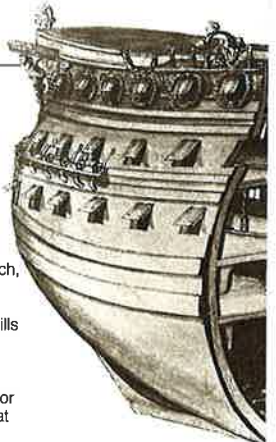
# INFORMATION ENGINEERING: THREE ACTIVITIES

Information engineering basically consists of three main service types: consulting, software implementation and systems engineering.

## Consulting

The massive proliferation of DP resources is leading users - who obviously wish to get the best deal out of all the options available - to make increasingly complex choices. As a result, the user's first need is for advice in the drafting of master plans, performance of feasibility studies, drawing up of specifications, selection of equipment and methodologies, definition of DP security procedures, application of technically-sophisticated procedures, etc.

In ancient Greece, production was designated by three interrelated terms:
**sophon:** art, skill under human mastery and governed by wisdom.
**techné:** the material expression of skill.
**poïesis:** the intimate link between producer and product.
Why shouldn't information engineering professionals also strive to attain this **poïesis?**

## Software implementation

This involves the most cost-effective design and implementation of high-performance, reliable and easily-updated software, whether basic or application-oriented.

Software professionals have to confront a substantial growth in their activity: on the one hand, they have to keep alive - i.e., maintain and update - existing applications running on the installed computer pool, which has doubled in value during the past five years; on the other, they must design and fabricate the software for new systems.

In order to meet this hefty demand, the large service companies have developed a wide range of methods and aids, sometimes integrated into a "software engineering workshop" of the MULTIPRO type (described page 40).

## Systems engineering

Like the architectures developed for the implementation of large systems, where virtually every component must be planned, calculated and measured, systems engineering meets two fundamental demands:
● design of DP "works", i.e., definition of project architecture from overall organization to the detailed features of individual components and their interrelationships,
● full control over fabrication methods to yield products matching the customer's expressed needs within set deadlines and budgets.

The volume of systems engineering services is also growing at a rapid clip: quantitatively, as a result of the number of developments made possible by the new technologies described in pages 14 to 23 of this Report; and qualitatively, due to system complexity, itself a consequence of the potential offered by new equipment and the need to assemble hardware into heterogeneous entities meeting economic or performance targets.
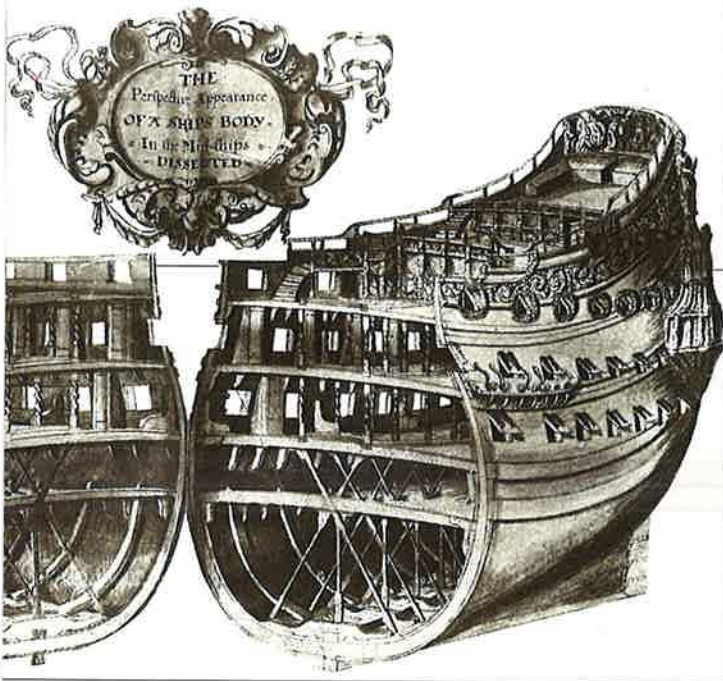
**We have given a brief definition of information engineering and situated its important role in the gigantic task of creation and implementation of new products, and maintenance of existing ones. But how, and under what conditions?**

**Answers to these questions will be attempted in the following sections, whose purpose is:**
● **to define and describe computer engineering works,**
● **to summarize the major trends in technological change, and their effects on information engineering,**
● **to describe the life of a DP system, from inception to maturity,**
● **to specify the functions and responsibilities of the main agents in execution of the work: owner, prime contractor and supplier,**
● **and to introduce the activities of information engineering companies.**

THE Perspective Appearance OF A SHIPS BODY. In the Mid-ships DISSECTED
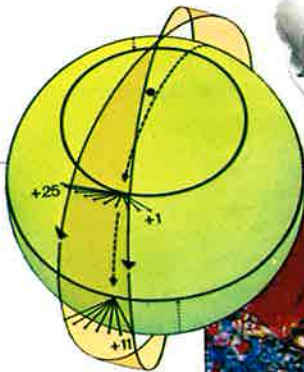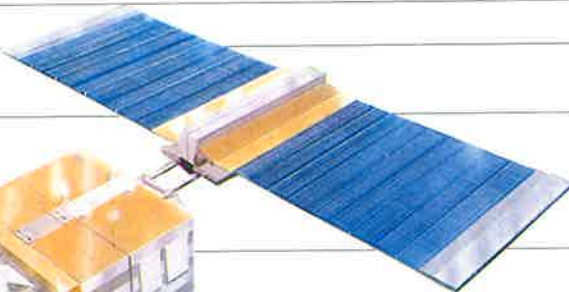
# Data Processing systems
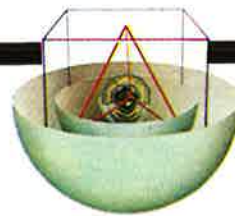
## INFORMATION ENGINEERING WORKS

A system may be defined as "an ensemble of components in dynamic interaction and organized with reference to a goal".

*(Joel de Rosnay)*

BOIS DE BOULOGNE    TOUR EIFFEL

This SPOT simulation photograph illustrates the future system's performance in large city observation. Shown here: western Paris.

Main arteries are easily distinguished thanks to the excellent contrast created by building sha-

dows. Also evident is the difference between the built-up environment of Paris and Boulogne and the single-family dwellings of Meudon, in yellow (tile roofs) and red (lawns and gardens).

We have always treated systems like objects; now, however, we are going to have to conceive of objects as systems.

*(Edgar Morin)*

### An earth observation satellite: SPOT

Space applications embrace three major fields: telecommunications, location and rescue, and earth observation.

The SPOT earth observation satellite, designed by the French National Space Research Center, is being built in association with Belgian and Swedish partners. It includes the observation satellite itself and a network of data-receiving earth stations.

The first satellite will be launched in 1984, and will permit observation in three color bands of the visible spectrum, with a surface resolution on the order of 20 meters (see photo opposite) while yielding black-and-white images with a 10-meter resolution.

Some major possibilities offered by SPOT:
● studies on land use and environmental change,
● evaluation of renewable natural resources (arable land, forests, etc.),
● exploration of mineral resources,
● cartography.

The CAP GEMINI SOGETI Group, which is involved in the development of many software products for SPOT, is also the engineer for the mission center, which decides upon satellite imaging operations to best meet user needs, in light of constraints imposed by orbital path, energy consumption, receiving-station visibility, weather conditions, etc.

Like civil engineering firms, information engineering companies execute "works": *data processing systems*, ever growing in quantity, variety and complexity.

While scientific and technical research (summarized in the inset, opposite) have set the stage for the emergence of systems and the "systemic" approach, the existence of the computer, a tool superbly adapted to systems implementation, has permitted their extraordinary growth in the majority of human activities: control and monitoring of large industrial complexes, operation of gigantic administrative organizations, comprehension (still only partial, it must be added) of the workings of the human mind, design of yet more advanced computers and their software, and even artistic creation.

Among the primary explanations for this massive growth of DP works, we might note their contribution to:
- increased productivity and competitiveness – prerequisites of industrial survival – underlying the spectacular development of computer-aided manufacture and production,
- control over huge masses of data, without which banks, insurance companies or government agencies would be unable to do their jobs,
- enhancement of the quality of service obtained by the installation of extensive technical and managerial infrastructures (reservation systems, Social Security, telecommunications networks, etc.),
- solution of problems lying beyond the scope of human capabilities, such as rocket guidance or computerized astrophysical experiments,
- assistance to planning and decisionmaking, employing mathematical, economic and sociological models.

## THE "TYPICAL DP SYSTEM" CONCEPT

The concept of the DP system is a very broad one, as it is equally applicable to a large technical system (such as a data transmission network), a corporate marketing management system or an industrial process control system. Nonetheless, a DP "work" is always made up of a hardware/software combination, as described in the following.

As a rule, hardware includes:
- one or more computers (general-purpose, minicomputers, microcomputers), usually interconnected,
- high-capacity data storage devices permitting rapid access to memorized information,
- transmission facilities, ranging from low-speed, dial-up telephone lines to packet-switching networks or satellite links,
- information input/output devices enabling computers to communicate with the outside world (man or machine). Examples:
– terminals for communication with users: conventional terminals (keyboards, alphanumeric or graphic displays) or dedicated units (banking terminals, "smart"-card terminals, badge readers or voice-response terminals),
– devices directly connected to processors, such as detectors and sensors, analog/digital converters, contact readers, programmable controllers, or even more sophisticated systems such as radars and infrared tracking equipment for spacecraft guidance.

In most cases, software – the veritable "consciousness" of the work-includes:
- basic software: operating systems, transactional monitors, database management systems, etc.,
- dedicated software, supplementing basic software: infrastructural software permitting interconnection of different hardware types, "custom" basic software for specific systems,
- application software proper, with its central role: as the software is tasked with implementing the detailed logic of each system function in accordance with a clearly-defined architecture, it accounts for the bulk of analysis, design, development and debugging work.

The "systems" concept has gradually taken shape within many areas of science and technology.

Ludwig von Bertalanffy had already published his *General System Theory* before WWII. Norbert Wiener, in turn, made his contribution to the development of artillery pointing devices. He observed a similarity between operational anomalies occurring in these "computers" and the behavior of humans suffering from brain lesions. This observation led him to draw comparisons between neurology on the one hand and mathematics and engineering on the other. In 1948, he published his celebrated *Cybernetics;* during the same year, Claude Shannon brought out an essential work in the systems field: his *Mathematical Theory of Communication.*

As the digital computer was being developed, Warren McCulloch extended his neuropsychiatric research to embrace mathematics and engineering, allowing him to carry out significant research on artificial intelligence.

Finally, J.W. Forrester - whose work served as a basis for the celebrated *Club de Rome* report - applied the "systemic" approach to industrial dynamics, and posited a "general systems dynamics".

## DP SYSTEMS: STRUCTURES AND FIELDS OF APPLICATION

Any DP system may be characterized by its structure and its field of application.

DP system structure is determined by its environment: conditions of operation and use, geographic distribution, performance, security level, etc.

These specific features and constraints have led systems architects to categorize their works into three main types:

• standalone systems, which interact with users only, and not with other systems. Since the development of microprocessors, these centralized systems – heretofore best known as large computer centers – may also be small in size, e.g., small business management systems, personal computers,

• systems integrated into larger ensembles. Varying in size and complexity, integrated systems range from the small, real-time data capture system to the large system handling a full set of functions to disburden a very large mainframe,

• distributed networks and systems which, thanks to recent technological advances (and associated software developments), have solved communications problems and have patterned system structure after corporate organization.

Genuine aids to decentralization, distributed systems have carried out the true revolution in data processing: they have brought the power of the computer tool into the grasp of the user, while also returning full responsibility for its use into his hands.

If DP systems are viewed from the standpoint of their fields of application – although any exhaustive classification is prevented by the existing variety and the fresh possibilities offered daily by technology – they may be "macroscopically" divided into three major groupings:

**Management systems:** these make up the bulk of existing applications within business and other organizations of all sizes and activities, from the giant government agency to the lawyer's or dentist's office. They are increasingly "integrated", i.e., they are providing unified, coherent processing of an ever-increasing number of functions specific to their user activities.

**Industrial systems:** as was previously the case with management, data processing in the form of computer-aided production applications is now overrunning the entire industrial sector, boosting the productivity of all of its processes. These applications are lumped under the catch-all "computer-aided design and manufacture" (CADM). Data processing is also used in monitoring and safety functions not falling specifically within this category.

**Very large systems,** primarily including major telecommunications systems (nationwide packet-switching or satellite transmission networks, electronic telephone directory service, electronic information networks, etc.), systems handling major government applications (public finance, censusing, etc.), or military and aerospace systems.

The systems implemented by CAP GEMINI SOGETI include some of these "typical" entities.

Finally, as seen by the "owner" and the "prime contractor", all of these systems have one or more of the following characteristics:

**Complexity:** either functional, due to the number or sophistication of functions to be specified, organized and harnessed; or technical, due to the variety of procedures and hardware types to be used or developed (interconnected computers, telecommunications networks, database systems, special hardware items) so that the system will meet the user's needs at expected performance levels.

**Size:** characterized by the volume of information to be handled, the number and geographic spread of system users, the quantities of hardware to be ordered, installed and maintained, the size and diversity of teams working together for system implementation.
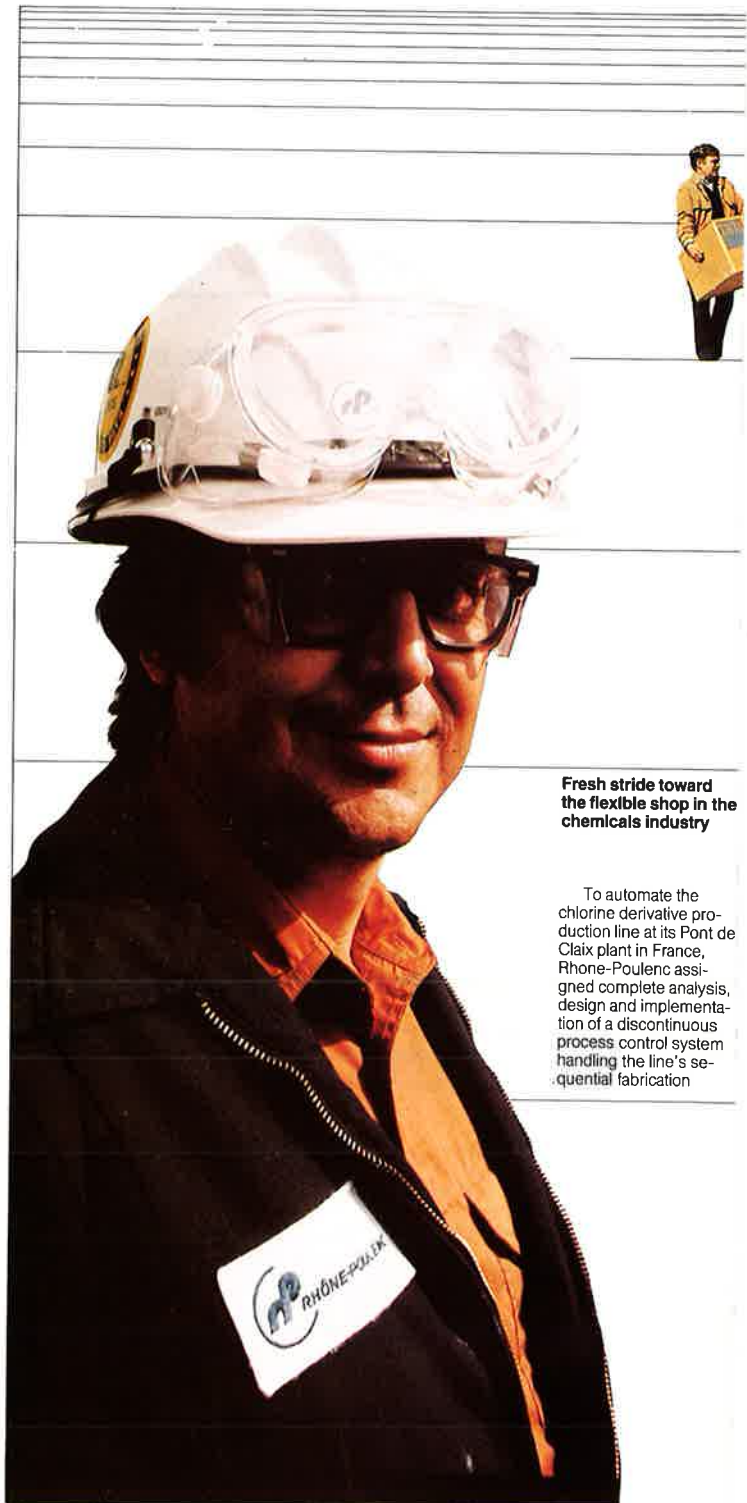


**Fresh stride toward the flexible shop in the chemicals industry**

To automate the chlorine derivative production line at its Pont de Claix plant in France, Rhone-Poulenc assigned complete analysis, design and implementation of a discontinuous process control system handling the line's sequential fabrication

**Specialization:** every one of these systems – even if it becomes a mass-marketed product – leads to the development of "custom" software whose sophistication grows in step with increasing simplicity of use. Systems developers must therefore have the expertise required to make the right choices from the spectrum of possible solutions. And this task is all the more delicate as (in view of the variety of functions and their dynamic interactions) a system's operational optimum practically never coincides with the sum of component optima.

**"Stakes" involved:** financial stakes bound up with investment volumes (systems of some size run into the millions of dollars, and implementation is sometimes spread over a number of years); technical stakes related to the complexity of system component selection and assembly, conditioned by a ceaselessly-changing technology; human stakes tied to the hazards of

disrupting the user company's or agency's operation, and to the possible consequences of resulting disorganization, even if only fleeting.

Still, technological evolution is going to cause the structure, scope and complexity of systems to undergo even more change, and radically so.

The following section explains why, and how.
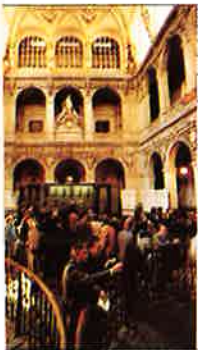


**real-time stock-exchange operations processing network**

CAP GEMINI SOGE- has been tasked by anque Cantonale Vaudoise to automate the bank's real-time stock-exchange operations. Exchanges covered are in Switzerland (Zurich, Basel, Berne, Lausanne) as well as the world's major trading centers (New York, Frankfurt, London, Paris) with continuously updated quotations received over a dedicated network.

The system handles full management and processing of orders, with an automatic brokerage function covering the major international marketplaces for both customers and correspondents.

erating cycles to CAP EMINI SOGETI.

The harshness of the vironment (heat, oisture, corrosion) led the choice of a programmable controller, ore trouble-resistant an an industrial minimputer.

A programmable ntroller is a processor n by a software product known as a "scheler", and automatically ads input data, executes output commands (e.g. level-switch reading, motor startup) and insures sequential execution of the elementary tasks making up the fabrication phases.

Incorporating work by CAP GEMINI SOGETI's Grenoble research center, system design enables the production line to function as a *flexible shop*, i.e., adapting to differing fabrication models by simple change of process data.
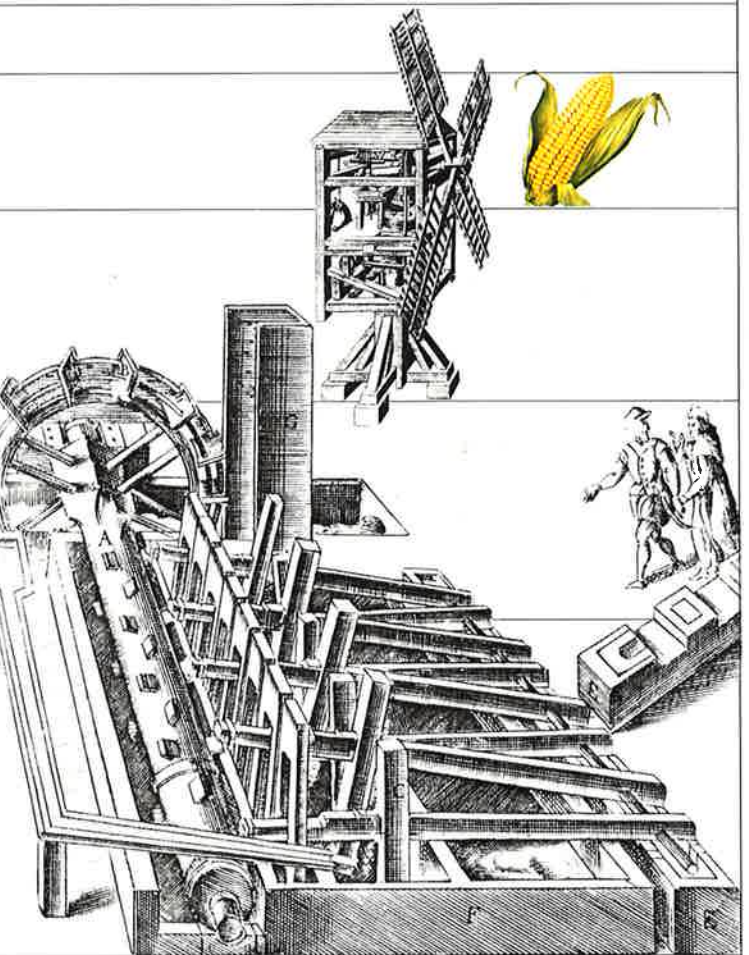
In particular, this required the development of a standard execution program controlling concurrent operation of different processes, together with their "plain-language" monitoring at a control console, and permitting manual intervention on main process parameters (temperature setpoints, pressure alarm thresholds, time delays of operations, etc.).

The system also permits color-screen monitoring of fabrication progress and environment states (temperature, flowrates, levels, etc.).

**An integrated management system**

The Swedish paper industry has no lack of order management or production control systems, but they are generally independent and isolated from one another. This is why several Swedish paper producers have asked BRA – CAP GEMINI SOGETI's Swedish subsidiary – to advise them in the development of integrated systems. One of these companies, producing 550,000 tons of paper annually, has started up a project for implementation of an integrated system based on three hardware and functional levels:
● Level 1 will handle shared activities, such as accounting, cash and payroll management and real-time production scheduling;
● Level 2 will take care of order management, administrative applications, reel handling (800,000 per year) and delivery management;
● Level 3 includes monitoring and measurement terminals for winding stations, wrapping machines and microcomputers for miscellaneous functions.

BRA's capabilities in both the paper industry's varied applications and the triple level of hardware technology (mainframes, minicomputers and microcomputers) were key factors in the construction of this system.

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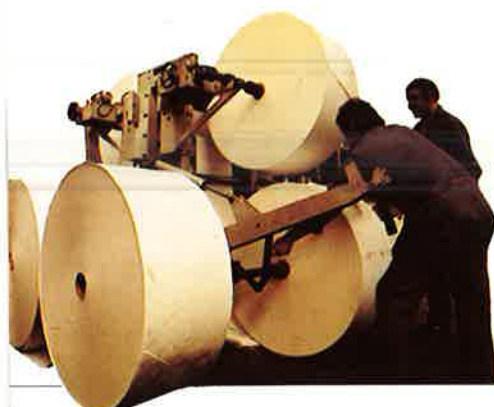
# Technical advances and Information Engineering
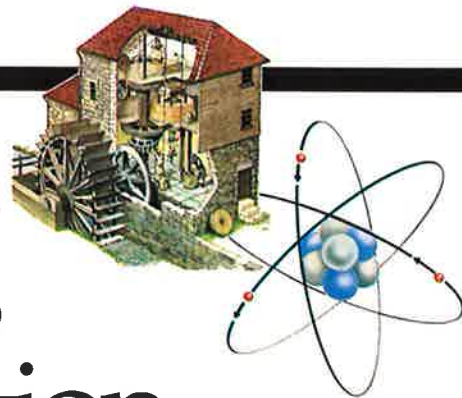
Today's world is one of messages, code, information.

*(François Jacob)*

**Construction of the TELECOM 1 management center**

TELECOM 1, soon to be launched by the French General Telecommunications Directorate, is a satellite primarily designed for intercorporate and – especially – intracorporate communications. It will support transmission of sound (telephone), image (videoconferencing), text (facsimile, electronic mail) and digital data. In this regard, TELECOM 1 prefigures a possible ISDN of the nineties, slated to handle the bulk of digital traffic (including telephone, by that time).

CAP GEMINI SOGETI is implementing the software for the TELECOM 1 management center. This software includes three subassemblies: *switching,* for overall satellite management; *operation,* for overall network management; and *reservations,* as TELECOM 1 is the first network to offer a circuit reservation service.

Optical fibers are manufactured from a material which the Earth possesses in abundance: sand. These fibers have very high transmission capacity.

**Computer-aided design of integrated circuits**

The growing miniaturization of integrated circuits necessitates the handling of increasingly dense and complex circuit layouts, involving expanding masses of data. Extremely lengthy simulation calculations and the use of dedicated tools (graphic communications, operating simulation, manufacturing design aids) have become indispensable.

Under these circumstances, an integrated design system built around a dedicated, rapid-access database permitting graphic representation and assimilation of circuits would enable designers to draw maximum profit from miniaturization (large-scale integration) under acceptable design cost conditions.

In this area, CAP GEMINI SOGETI is participating in work being conducted by IMAG (Grenoble Applied Mathematics Institute) on CASCADE, an integrated circuit design system endowed with a unique language for circuit description at the functional, logical and physical levels.

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Technology is the driving force behind the evolution in the uses of data processing. Although the information engineering activity is equally sensitive to changes in user behavior, technological evolution – portrayed here in six major traits – strongly influences the nature and dimensions of service activities.

## THE INTEGRATED CIRCUIT EXPLOSION

The exponential growth in the processing and memory capacities of integrated circuits, together with a steady drop in price, explains the extraordinary proliferation of microprocessors and microcomputers. This expansion should continue unchecked in all sectors of activity, following four major channels:
- improved performance of existing products, particularly in the areas of telecommunications (telephone, videophone, wideband networks), data processing (for computer and peripherals manufacture, naturally) and office automation (local area networks, electronic messaging, high-speed facsimile.),
- introduction of new software functions in conventional products, made possible by packaging density and low circuit cost: areas of application are countless, but examples might include instrumentation, automobiles, and the home, where "household DP" is starting to take off (heating control, security, appliances, etc.),
- creation of new, microprocessor-based systems and products, particularly embracing robot technology, numerical control and video games,
- development of microcomputers, now swarming over new markets, the most important of which over the next five years will be management applications for small business, trades and professions, merchants, etc.

Without a considerable effort toward designing and implementing these new products and systems, however, the integrated circuit alone will not live up to expectations. Moreover, the quantity of microprocessors sold introduces a new parameter into the service activity: mass information processing. In point of fact, the number of systems or software packages that a single supplier might be selling and delivering could amount to hundreds of thousands of units annually, which raises serious problems of distribution (whence the advent of the "computer shop"), promotion and software security.

## THE NEW TELECOMMUNICATIONS BREAKTHROUGH

Two basic factors – the spread of digitization and the development of wideband transmission media – are harbingers of the arrival of Integrated Services Digital Networks (ISDN) which, tying the knot between data processing and audiovisual techniques, will soon permit the concurrent storage, processing and transmission of pictures, text, data and sound on a single carrier.

Thanks to the shift from analog to digital procedures, all of this information can now be "homogenized" for memorization, mixing and routing to the "consumer" over networks which have themselves become as "integrated" as, say, our highway systems.

In parallel, the development of fiber optics and satellite links furnishes the answer to the problem of transmission capacity required by digitized images.

**Optical fibers,** made of a material which Nature provides in abundance – sand – have an enormous transmission capacity (an optical fiber less than a tenth of a millimeter in cross-section can carry several million bits per second, generously adequate for a TV signal); moreover, they have very low attenuation rates, and they are insensitive to spurious signals (whence their use in military applications and in "noisy" industrial environments).

The development of **satellite links** is based on their ability to handle large volumes of information (a feature required by new services such as file transfer, high-speed facsimile, etc.), their ability to simultaneously cover large geographic areas without leaving microwave "shadow zones", the speed with which they can be set up and their ease of access.

Integrated Services Digital Networks thus permit a spectacular diversification of electronic information services, as shown in a handful of examples:
- person-to-person and group communications (telemeetings, teleconferencing, visiophone, etc.), which will become widespread with the advent of combined picture and high-fidelity audio transmission,
- distribution of audiovisual productions: radio, TV and – tomorrow – à la carte distribution of high-definition TV programs with accompanying hi-fi sound (a single TV channel can simultaneously transmit over 100 high fidelity programs!),
- interactive services, such as: image bank inquiry and retrieval, message transmission, transactions of all kinds (mail-order purchasing, banking operations, etc.), access to educational programs with "live" instructors.

Every subscriber, linked to a transmitting station by fiber-optic cable, will thus have access to a wealth of services; the list opposite gives some idea of their diversity.

Even more than during the past, "telecommunicators" and professionals are going to have to work together: to conceive, promote and try out new services, to fabricate the software needed to convert analog networks to digital ones, to handle the end-to-end implementation of new networks, to assist corporate and other users in starting up their new services, etc.

## THE DEVELOPMENT OF PERIPHERALS

The evolution of terminals is being marked by an integration of functions and ever-growing power, linked to a ceaselessly-increasing level of intelligence, degree of automation and ease of use.

Among the most striking developments, we note:

### The multifunction terminal

With the integration of microprocessors, terminals can now become general-purpose (or multifunction) devices.

Their memories contain both application software (file management, text editing, word processing, electronic mail, archiving, database management, graphics editing, etc.) and overall control software. Some units also support hand-held "mouse" controllers which substantially cut down on keyboard manipulation requirements.

The accessibility of this application software will – insofar as it is accompanied by extreme ease of use and availability of dedicated aids which are genuinely within the grasp of non-professional users – throw open the general-purpose terminal market to the consumer public. And here, too, we run into a software problem, in which a human-engineering component has assumed decisive importance.

### The speech-recognition terminal

For us humans, speech is the speediest and most natural means of communication; this is why voice input/output systems, which give the operator back his mobility by freeing his hands and his eyes, should pave the way for a number of new applications:
● for NC programming of machine tools in the industrial realm, for man-robot dialogue in robot technology; in computer-aided design, where graphic information entry will be accompanied by related verbal input.
● in the office, for internal and external corporate communications, by bringing electronic messaging and appointment-calendar management into widespread use, by permitting voice-input telephone dialling or mail ordering, remote inventory control, telegram and phone message forwarding… and, in a slightly more distant future, the automatic typewriter.
● in the home, where entrances will be guarded by an electronic "Sesame", which opens only to those voices it has been instructed to obey.
● in electronic information systems, with the possibility of using the telephone as a terminal, in the automobile, games, video equipment, home appliances, etc.

To summarize, speech-recognition terminals meet two of the basic goals before systems designers:
– get the greatest possible number of users communicating with one another,
– introduce new technological developments into consumer products.

We note that continuous speech-recognition systems are still only in the prototype stage, but there are already integrated circuits which can synthesize speech on the basis of an initial scan, and which can be integrated into DP systems. The cost of these devices will have dropped by a hundredfold ten years from now!

### The "smart" card

The smart card, which looks just like an ordinary magnetic-stripe credit card, functions – thanks to its built-in microprocessor – as an active, indelible, inviolable and non-duplicatable memory. It brings fresh solutions to problems of information network security, particularly with regard to the confidentiality of stored and transmitted information, and to user authentification (by acting as an "electronic signature").

In association with a telematics terminal, it opens the way to a large number of applications, such as:
● information bank inquiry and retrieval (government information, price lists, etc.), mail ordering, seat reservations,
● remote payment operations, funds transfers, clearing operations, etc.,
● prepayment for fee-charging information access (catalogues, timetables, advertising),
● in France, the "electronic health record", in the SESAM project under development by the Social Security administration,
● pay TV, as operational in France as part of the Antiope Magazine, with a specialized professional target audience (doctors, teachers, truckers, etc.),
● electronic cash for gasoline-pump and pay-phone transactions.

## INCREASE IN STORAGE CAPACITIES

An increase in information storage capacities is obviously a precondition for the development of applications involving high-speed processing of very large masses of data, as required — for example —in the generation of animated graphics. Developments in this field should come from bubble memory devices and digital optical disks (capable of storing thousands of pictures on a disk the size of an ordinary 33 1/3 rpm record). Such disks permit the creation of easily and inexpensively-accessible image banks, but bank management and access will require the development of software adapted to these new volume levels: database management systems, inquiry languages, videodisk connection software, etc.



**A talking terminal in an industrial environment**

CAP GEMINI SOGE-TI has implemented a monitoring and surveillance system including a warning announcement system broadcasting spoken messages, for a major Rhone-Poulenc chemical complex.

In case of gas leakage, for example, the gas would be detected in the shops and a warning is transmitted by "alert" consoles to the central computer. Depending on local weather conditions (wind force and direction), type of gas and leakage volume, this computer would determine the possible spread and damage of the agent and automatically warn all sectors likely to be affected with a voice message: "Gas alert, ammonia, origin shop 14, wind from northeast, force 5, warning sectors 6, 7 and 8" — a sample message that would be heard by persons in the threatened sectors.



**A remote monitoring and control system**

CIT-Alcatel, one of the firms equipping Paris' new Gare de Lyon railway station, has requested CAP GEMINI SOGETI to define the specifications and help implement software for the remote monitoring system equipping the underground station's low-voltage installation.

This system, with "intelligence" distributed among 15 interconnected microprocessors, can continuously scan 480 remote monitoring points and actuate 240 remote-control devices. Along with management of all escalators and elevators, the system handles closed-circuit camera switching for 13 display screens and manages light signals, the interface with Metro and fire department emergency services, and remote surveillance of automatic ticketvending machines.
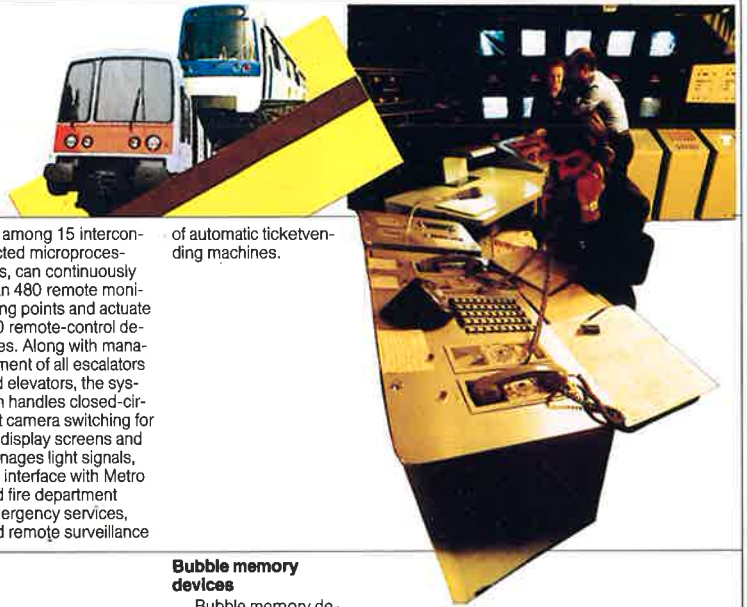
**Automated banking terminals**

Reduced cost of checking transactions, improved quality of service, redeployment of banks' human resources: these are some of the objectives of future investments by banks in new DP technologies.

In this context, automated banking terminals are finding increasingly widespread use:
• automatic cash dispensers,
• automated teller machines,
• retail point-of-sale terminals, combining a financial terminal with a cash register.

POS terminal operation may be "standalone" (in which case the device is a multifunction terminal) or integrated into a DP network linking banks and retailers, or equipped to handle smart cards.
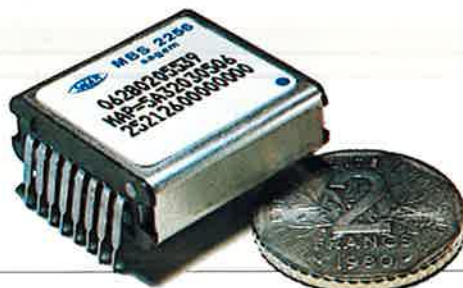
**Bubble memory devices**

Bubble memory devices are characterized by high integration density (1 megabit/cm$^2$), non-volatility (magnetic property of components), operating reliability (no moving parts), portability, low access times (on the order of 10 ms). These features yield highly desirable mass memory devices for telecommunications and industrial systems operating in harsh environments or presenting stringent dimensional requirements.

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## FURTHER DEVELOPMENTS IN AUTOMATION

The possibilities offered by integrated circuits are in the process of revolutionizing automated process control equipment which, in the long run, will possess the features of full-fledged DP systems. The shift from the bulky, hardwired single-function processor to the programmable controller allows us to envisage applications touching upon all industrial activities, and taking all of their functions in hand.

Hence the emergence of computer-aided design and manufacture (CADM), which aims to integrate design, simulation, production management and manufacture. Why?

Design offices which develop and manage parts nomenclatures must wage a continuing battle against overdimensioning, adjust safety factors, enhance quality; methods departments must optimize product ranges; sales departments must adapt to market requirements.

In order to achieve increasingly high performance standards, it has been necessary to develop production processes in which automation is not applied to individual, isolated functions but instead to a continuum of tasks, forming a cascade from design to output.

In design, the interconnection of tasks will come to be viewed as a harmonious series of successive approximations converging toward final project definition. Next, after model creation and optimization, shop drawings and parts nomenclatures will be obtained by CAD, the geometry database will be drawn upon to generate NC tapes for machine programming. The methods department, in turn, will develop global and detailed manufacturing ranges, and information generated upstream will be used by production management and sales for procurements and manufacturing orders.

But this stage has yet to be reached. In point of fact, the diversity of hardware, the lack of standardization, the multiplicity of information originating from various sources, all work against the process of unified management. An organization which typically includes mainframes for scientific calculation, other large computers for data management, minicomputers for interactive applications, microcomputers for manufacturing control and monitoring makes the problem of data exchange a thorny one indeed.

Software capable of administering the system and managing the compatibility of information originating in disparate databases must therefore be designed on a case-by-case basis. CADM utility routines and interactive graphic communications facilities connected to this software must be adapted. And preliminary studies, following appropriate methodologies, must also be carried out: either internally, or by calling in a competent information engineering firm .

## INNOVATIONS IN SOFTWARE

In parallel with other technologies, software is also marked by innovation arising from work by public and private laboratories — and particularly those belonging to the large information engineering companies. As these companies are, by the very exercise of their profession, the organizations closest to both user needs and new offerings of technology, they have become the natural partners of universities and industry in the majority of applied research operations in the software field. We might illustrate four areas where significant innovation is taking place:

### Programming languages

Developments in this field have always been marked by the design of portable high-level languages yielding "machine-independence". A number of familiar names such as PL1, ALGOL, COBOL, APL and, recently, PASCAL, are milestones along this highway. ADA,
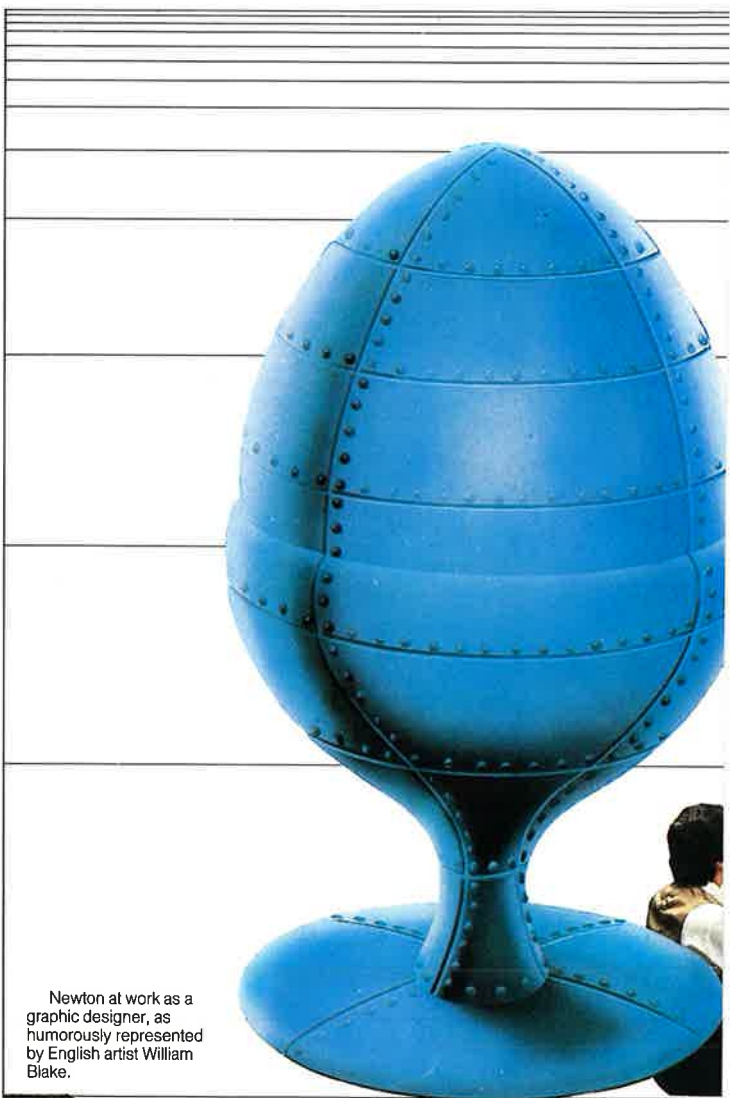


Newton at work as a graphic designer, as humorously represented by English artist William Blake.
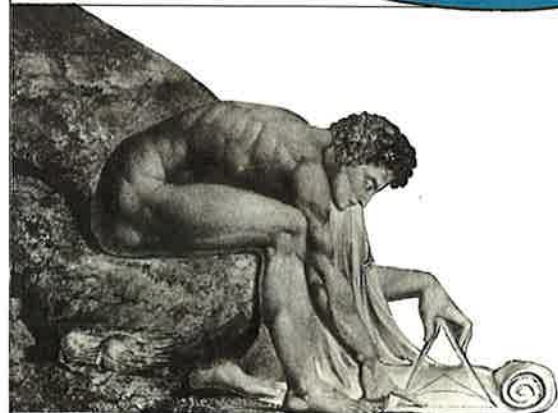
In using CAD to design a mechanical part, is first necessary to create a geometric model which, in a first analysis, takes project constraints, standards and company knowhov into account. This mode is not considered to be geometric database un external limitations of a sembly, dimension, flov and kinetic behavior have been observed. If the part belongs to a more complex assembly, the mechanism's dynamic behavior mus be simulated and initial

however, developed at the request of the US Department of Defense, is thought to bring together the most desirable qualities of a modern language. Supporting very-high-level manipulation (thanks especially to its very powerful instruction set), ADA includes a veritable methodology and makes use of an entire environment, the concept of which has led to the creation of "software engineering workshops".

## Software engineering workshops

These "workshops" consolidate a set of methods and tools within a coherent software development environment (languages, analysis methods, program generators, project management methods, etc.).

The very rare software engineering systems currently being marketed include MULTIPRO, described on page 40, designed and implemented by CAP GEMINI SOGETI. MULTIPRO is the product of fifteen years' experience in the creation and use of software

development aids. The heart of the MULTIPRO system is a computer dedicated to software development, connected to which are workstations for individual programmers and analysts. A full complement of methods and software tools has been built into MULTIPRO; as a result, tests can be carried out in interactive mode, all necessary documentation is within arm's reach, and an entire project can be managed in real time from a single workstation.

The chief advantages offered by MULTIPRO are a reduction in response times in the software development process, enhanced quality of software products and substantially-increased efficiency in program maintenance.



| STUDY GROUP | · identification of CAD project · introductory training in CAD |
| SUITABILITY STUDY | · analysis of existing facilities · definition of goals · survey of solutions |
| FEASIBILITY STUDY | · requirements and goals, by individual application · technical difficulties · resources to be employed |
| FEASIBLE | |
| PROFITABILITY STUDY | · productivity ratios · installation costs, by individual solution |
| PROFITABLE | · I (productivity ratio) · f (solution type) |
| CONCLUSION | |
| SYSTEM ANALYSIS | · conception of solution · integration study · theoretical model of functions to be implemented |
| SPECIFICATIONS | |
| CAD PLAN | · definition of configuration |
| INVITATION FOR BIDS | |
| SYSTEM DESIGN | |
| BENCHMARKS | SELECTION CRITERIA |
| FINAL COMPARATIVE TABLE | SELECTION |

CAP GEMINI SOGETI has developed methodologies to match every major type of problem: shown here is a selection of CAD applications and a definition of resources required.
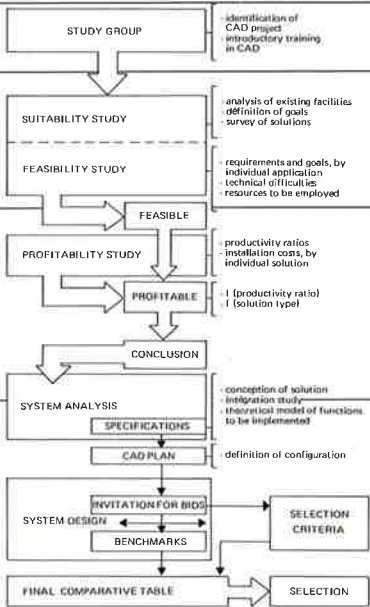
"The evaluation phase, which should precede any selection of a CAD system, is still the victim of neglect. Many designers, filled with the best of intentions, continue to cling to a first impression which tells them that CAD is doubtless the best and only way to improve the operation of their design office. Charged with enthusiasm, they begin the process of system specification in direct dealings with equipment manufacturers. The main result of this approach is a significant failure rate, one which a recent survey has attempted to analyze. In particular, the investigation points out that potential users postpone or abandon their acquisition of CAD for three chief reasons: "inadequate familiarity" is cited in 63% of cases surveyed, along with "excessive investment cost" (56%) and "profitability not demonstrated" (53%). This goes to show the importance of the evaluation phase, and the methodology used during this procedure, for deciding whether CAD is justified and, if so, to what extent and for what processes."
(Extract from Le Monde Informatique)
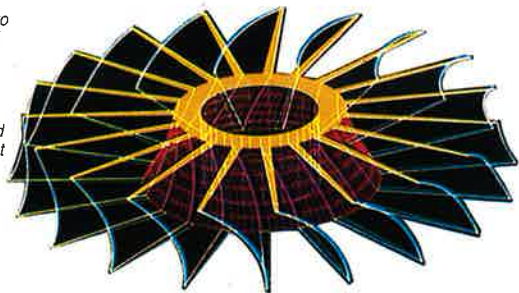
corrections applied before going on to fine analysis. A 3-dimensional mesh preprocessor reads the database for finite-element analysis. Results of complex calculation of stress effects are displayed on the graphic terminal and, after optimization of the model, shop drawings and nomenclatures are obtained by computer-aided drafting.
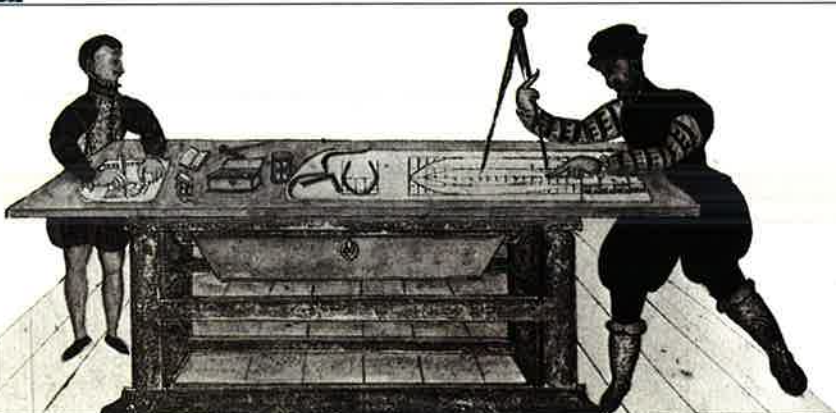
## Artificial intelligence

Current work in this field has led to the inception of "expert systems" aimed at reproducing human behavior in the areas of perception, comprehension and decisionmaking, all of which should lend itself to automation of applications program implementation. Design of these systems has resulted from the observation that, in contrast to software (which requires at once a full algorithmic description and rigorously-complete information), the human mind generally functions with only a partial description of situations, and then deduces a solution or constructs fresh hypotheses in a progression toward solving of a problem at hand.

An expert system is an information system which, on the basis of general inferential★ rules and a knowledge base specific to a given field, solves problems arising in this field. Systems of this type may be designed for medical diagnosis, shop-floor scheduling, structural engineering, etc.

Before these systems can become operational, however, major research activities must be undertaken in the fields of man-machine dialog, analysis and definition of inferential rules specific to each area of application, and in the design of information systems capable of "self-enrichment".

## Software for end users

The easier a system is to use, the more complex its development must be. This is precisely the case with software installed in general-purpose microcomputers and terminals intended for use by non-DP professionals. The most salient characteristics of such software: it is complex, high-performance and user-friendly, i.e., it makes all communications easy.

Two novel features have marked the field of software for end users:
● portable operating systems for microcomputers
These products have become indispensable, as they eliminate the need to bother with organization of information stored on diskettes, screen management, etc. Two of these systems, both portable (i.e., able to run on a variety of machine types without modification), have become "standard": CP/M and UNIX, adopted by over 600 microcomputer manufacturers and thus enabling a given application program to run on a large number of machines.
● "integrated software products", some of which (VisiCalc, LISA) are already widely known to the public at large, characterized by extremely fast user familiarization and manipulation shorn of specifically "DP" features. These packages generate screen displays which virtually duplicate an office, including files, documents and other conventional objects, user-accessed by means of a "mouse" controller which replaces the traditional DP commands for instructing the system to fetch information from a file, perform calculations, print out graphic statistical tables or simply... write a letter.



**Expert system-based text generator**
Within the context of its work, CAP GEMINI SOGETI's Grenoble Research Center is developing a natural language processing system based on the "expert system" principle.
In response to the input of a simple outline, the system will itself draw from a set of elementary knowledge bases to draft texts which are semantically and syntactically correct.

★ *Inference is "the act of passing from one or more propositions... considered as true to another, the truth of which is believed to follow from that of the former" (Webster's); deduction is thus a form of inference.*

An analysis of major technological changes reveals the trends which will affect the qualitative and quantitative developments in future information engineering activities. These trends are:

## The breakdown of boundaries of possible applications

From the household application to the worldwide network, one has the impression that any activity, any function will soon be fair game to digital processing. To this multiplicity and diversity of possible uses are added an equally impressive multiplicity and diversity of possible solutions.

All of these solutions have one point in common: they function in accordance with programmed instructions. Software, moreover, which is already present in computers, in network nodes, in system meshes, is henceforth to be found at the level of the component itself.

To me, a "convivial" society is one in which the modern tool is at the service of the individual integrated into his community, and not the implement of a phalanx of specialists. Convivial is the society in which man controls the tool!
*(Ivan Illich)*

**The biological computer**

IBM Scientific Director Lewis Branscomb pointed out in a recent conference that "the 2708 computer will store a volume of information equivalent to the contents of sixteen thousand human brains.... We will have to invent something new..... something which will have to possess a complex, 3-dimensional memory cell with a self-replica-ting capability. Do we have a model for this? Of course: the ADN chain, which has a genetic memory holding 10 billion bits and is programmed to replicate itself.... Within the next century, we will probably have to build a *biological computer,* using something like ADN; in short, we might have to reinvent the brain".

The task of consulting, of creation and implementation assigned to information engineering companies by users will thus deal with increasingly-varied situations. These companies will therefore bear a growing responsibility for disseminating new techniques among private corporations and public agencies which might otherwise have to wait before learning of — and profiting from — these approaches. This "seeding" role will require an increased effort of creativity, mobility and communication from service-company professionals confronted by the widest range of problems.

## The dovetailing of skills

In order to carry out his job, the DP professional — and particularly the information engineer — has always had to comprehend the field of activity within which he must automate specified functions. But today's technological change is greatly expanding this requirement. In point of fact, the number of "devices" operating under program control is growing exponentially, and information engineering companies are now implementing software destined to reside in automata, telephone exchanges, television sets, prosthetic devices, etc. These companies' specialists must therefore be able to assimilate the operating techniques governing all of these devices. Moreover, "distributed intelligence" systems (which, paradoxically, are often highly "integrated" systems), combine to join multiple levels of computer use and multiple application types: for example, a single system will perform the information transmission functions and accounting for all of a group's subsidiaries, manage the inventory in every one of its warehouses and carry out its global financial analyses. Information engineering companies will thus be increasingly capable of grasping specific types of requirement -- down to the smallest detail, as is required by the analysis task — and integrate answers to all of these needs within a single system.

Finally, "comprehension" alone is not enough when dealing with techniques forming components of new DP hardware: as a result, large information engineering companies must now hold genuine skills in telecommunications, videography, mechanical engineering, electronics.
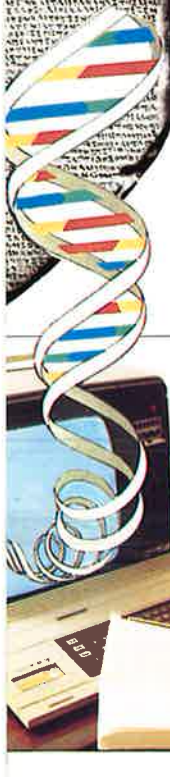
## System complexity

System complexity is increasing in scope and intensity. In point of fact, a number of "dimensions" are factors of complexity: distribution of system intelligence (between conventional computers, minicomputers, microcomputers, concentrators, multiplexers, etc.), diversification of terminals (purpose, functions and modes of operation), the inevitable incompatibility between hardware types, the dispersal of end users, performance requirements (low response times; simple, "natural" man–machine communication; high reliability).

Consequences of this increasing complexity: the systems architecture task is growing more important, technical choices are more difficult (and often of fundamental importance), technical risks are increasingly high… and users are being increasingly led to subcontract full systems implementation!

Information engineering companies thus find themselves in a growth market. It is absolutely indispensable to them, if they are to work in it successfully, to acquire a solid financial base, develop trustworthy methods and bring together large teams of systems engineering specialists at both the technical and management levels.

## The accelerating pace of innovation

Innovation, reflected in the proliferation of techniques, hardware types, applications and software products, is influencing behavior and gradually altering working methods. At the currently-foreseeable pace of innovation, then, the number of situations in which a DP professional can find himself is growing at an exponential rate. This situation, theoretically favorable to users, will really be to their advantage only insofar as they are in

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### Over one hundred home applications of information technology

(after James Martin, *Telematic Society*)



**● Passive entertainment**
Radio
Many television channels
Pay television
Dial-up music/sound library

**● Telephone voice answerback**
Stock market information
Weather reports
Sports information
Banking
Medical diagnosis
Electronic voting

**● Monitoring**
Fire alarms on line to fire service
Burglar alarms on line to police
Remote control of heating and air conditioning
Remote control of cooker
Water, gas, and electricity meter reading
Television audience counting

**● Home printer**
Electronic delivery of newspaper/magazines
Customized news service
Stock market ticker
Electronic mail
Message delivery
Text editing; report preparation
Secretarial assistance

Customized advertising
Consumer guidance
Information retrieval
Obtaining transportation schedules
Obtaining travel advice/maps

**● People-to-people communications**
Telephone
Telephone-answering service
Voicegram service
Message-sending service
Telemedical services
Psychiatric consultation
Local ombudsman

**● Computer terminals (including the viewdata television set)**
Income tax preparation
Recording tax information
Banking
Domestic accounting
Entertainment/sports reservations
Restaurant reservations
Travel planning and reservations
Computer-assisted instruction
Computation
Investment comparison

and analysis
Investment monitoring
Work at home
Access to company files
Information retrieval
Library/literature/document searches
Searching for goods to buy
Shopping information; price lists and comparisons
Real estate searching
Job searching
Vocational counseling
Obtaining insurance
Obtaining licenses

Medicare claims
Medical diagnosis
Emergency medical information
Yellow pages
Communications directory assistance
Dictionary/glossary/thesaurus
Address records
Diary, appointments, reminders
Message sending
Dialogues with other homes
Christmas card/invitation lists

**A Teletext Production System for NBC (National Broadcasting Company).**
The American market offers very large prospects in the field of broadcast teletext, due to both the diversity of its giant TV networks – some 2,000 stations broadcasting local news and information – and the very extensive development of cable TV networks.
CAP GEMINI SOGETI is one of the major affiliates of VSA, Videographic Systems of America, the company that has been created to market videotex and teletext systems in the United States. CAP GEMINI SOGETI brings to VSA its expertise in such systems and the support of its USA group.
NBC has recently awarded VSA a contract to provide a complete teletext production system for its network teletext service. The facility is equipped with a head end computerized system, called the "page mill" which, through screen composition terminals using the NABTS protocol (North American Broadcast Teletext Specification), a database, and dedicated computer programs, automatically fabricates information magazines in the form of teletext page displays. The system uses information from sports, weather, political, economic and other sources. Its unique feature is the ability to automatically insert advertising content in the information pages. Advertising will be the main revenue source for teletext service in the US.

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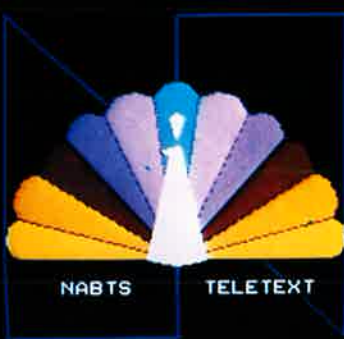
information for technical decisionmaking and resources required to implement solutions adopted. As this is becoming increasingly difficult, however, corporate users are seeking all necessary assistance from large information engineering firms, dropping the problem into their laps... which is only right, since information engineers have voluntarily chosen their profession!

Service companies are therefore responsible for maintaining a continuous survey over their potential and making sure that it is kept at a high technical level. But companies which -- like CAP GEMINI SOGETI -- are determined to remain at the forefront of information engineering service providers, will have to make an additional, triple investment effort: themselves participate in basic research, organize necessary in-house transfers of technology, and develop creativity and independence of judgement among their employees.

## The immensity of the task to be accomplished

By now, the reader should be aware that all technological developments are accompanied by software research and development requirements.

Whether for converting mechanical operations, for installing the infrastructures of future networks or for transmitting electronic images, operation of the new machines must be ordered by means of program instructions. Without overlooking, of course, those smaller organizations now tending to become users of DP resources thanks to the drop in hardware cost, or the substantial volume of work generated by incompatibility between differing computer and peripheral models... which are nonetheless dying to communicate with one another!

The tree should not hide the forest, however, and recent changes should not relegate existing DP centers to oblivion. The pool of installed systems -- which has doubled in five years -- is matched by a substantial "applications pool", which must be operated, maintained, updated and, if necessary, converted. An absence of these operations would rapidly bring the economy to a standstill. To give an idea of the workload involved, we might point out that the maintenance of existing software is keeping over half of the world's software technicians busy at the present time!

In view of this twin demand -- from existing DP centers and from an evolving technology -- the supply of information engineering resources is inadequate. This reality faces service companies with two problems. The first is quantitative in nature: the selection, training, motivation and supervision of increasing numbers of professionals each year. The second has qualitative features: to increase technicians' productivity by creating or adopting efficient software development and information engineering methods, by participating in appropriate research programs and, finally, by implementing veritable tools (software engineering workshops) and ensuring their promotion and use.



- **Interactive television**
Interactive educational programs
Interactive television games
Quiz shows
Advertising and sales
Television ratings
Public opinion polls

Audience-response television
Public reaction to political speeches and issues
Television interviewers soliciting audience opinion
Debates on local issues
Telemedical applications
Bidding for merchandise

on televised auctions
Betting on horse races
Gambling on other sports

- **Still-picture interaction**
Computer-assisted instruction
Shopping
Catalogue displays
Advertising and ordering
Consumer reports
Entertainment guide
City information
Obtaining travel advice

and directions
Tour information
Boating/fishing information
Sports reports
Weather forecasts
Hobby information
Book/literature reviews
Book library service
Encyclopedia
Politics

Computer dating
Real estate sales
Games for children's entertainment
Gambling games (such as Bingo)

Housing, health, welfare, and social information
Games (e.g., chess)
Computer dating
Obtaining sports partners





(*) Videography: techniques and systems for transmission of "pages" of text or graphics to a user display screen identical to that of an ordinary TV receiver. A distinction is made between interactive videography, or videotex, and broadcast videography, or teletext.

# The life of a system

Like any other construction, a DP system has a life: it is designed, it is built, it is used, it is remodelled, its patches are plastered over and, one day, it is abandoned for construction of a newer, more welcoming facility.

Its creation and fabrication is a complex task, rife with technical risks, in which the information engineering company is very frequently the key participant, whether by assuming full project responsibility, by carrying out a portion of the work, or as a consultant at critical junctures.
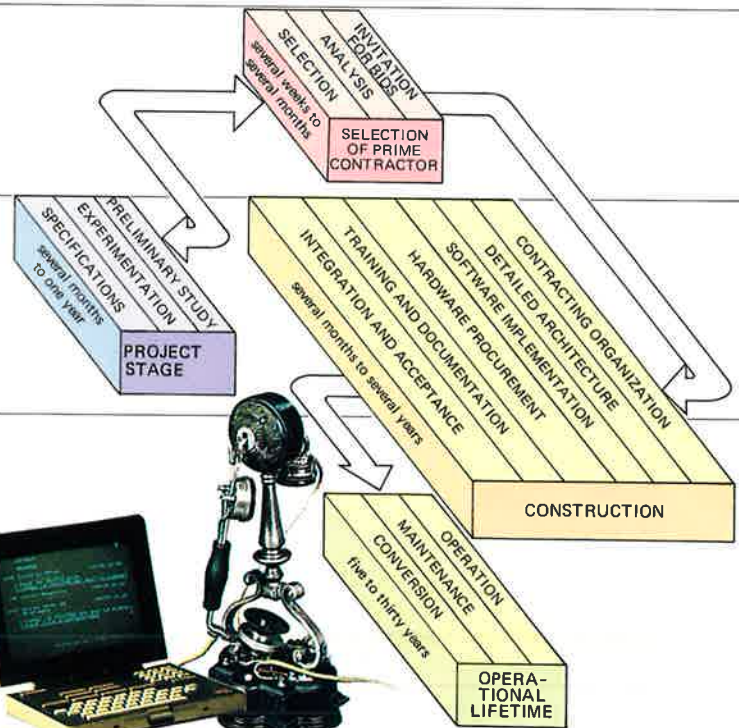


**Electronic Directory system dialog trials**

Before deciding to start up its Electronic Directory project, the French General Telecommunications Directorate wanted to test consumer reaction to the use of IT terminals.

The Directorate therefore called in CAP GEMINI SOGETI to implement a mock-up — dubbed "Mae West" — which was tested in the Atlantic coast city of St.-Malo. As of summer 1980, 55 voluntary users were accessing the telephone information service for St. Malo and 20 neighboring townships via this experimental system. The system's human engineering was enhanced on the basis of their reactions, remarks and suggestions. Conclusions were drawn and system specifications improved thanks to this observation of the behavior of a representative user sampling.

User reaction made it possible to select a keyboard with a simple alphabetic layout, and to observe — for example — that certain keys among the complement of "Next", "Return", "Send", "Correct", "Simulate" and "Menu" were more "user-friendly" than others. The user's guide could thus be drawn up in a logical, step-by-step manner.

# SYSTEM PROJECT:

## Preliminary study

The birth of a DP system is the terminal point of a progression which began with a user's awareness of a need (to improve manual procedures, to automate processing of masses of information, to create new services, to install decisionmaking aids) or of the possibility of solving a clearly-identified problem, under advantageous cost conditions, by means of a new technological approach.

At this stage, the need is often perceived from a qualitative and global standpoint, and the feasibility of a new system must be established on both the technical and economic levels. This is the purpose of a preliminary study, which acts:
● to stipulate the object of the system – i.e., its target functions, together with its environment and specific constraints – with the greatest possible accuracy;
● to sketch out possible solutions and conceivable developmental scenarios, as a function of organizational, technical or economic parameters (quality of service, system performances, operating constraints, admissable development and operating budgets, etc.);
● to prepare a report presenting the system projects, solution(s) adopted and an estimate of resources (budgets, deadlines, etc.) required for its implementation.

The promoter (or "owner") will decide between abandoning or starting up the project on the basis of this report: this gives some idea of its importance. Success is assured only by tapping a source of many-faceted knowledgeability and broad experience. In point of fact, it requires the capability of understanding and analyzing requirements, the art of communicating with users and in-depth familiarity with new products and technologies; it demands the ability to conceive solutions, sureness of judgement, and the experience required for choosing the most appropriate architecture from a range of possible solutions and of implementation costs and time requirements. This is why customers very often turn to the knowhow held by information engineering companies for the implementation of preliminary studies.

## Experimentation

In the case of ambitious and complex projects harboring profound social implications or surrounded by high technical risks, however, the promoter might not happen to have all of the information needed for an immediate decision to plunge into full-scale system implementation, and will therefore wish to carry out trials on a reduced-scale or limited-application system. The purpose of such experiments will thus be to test a particularly sensitive aspect of the project (ergonomic, technical or economic).

The French PTT's "Electronic Directory" system is a particularly eloquent example of this optional experimental phase. In getting this project off the ground, the General Telecommunications Directorate was committing itself to a major program of operations aimed at overall enhancement of its telephone information service (improved quality of service to users and bettered working conditions for operators), while giving a boost to videotex. But the Directorate did not want to make this commitment until thorough trials had been carried out (test of a sampling of fifty-five voluntary subscribers using a mock-up, followed by development of two full-scale prototypes for 300,000 subscribers).

## Specification

When construction of the system is given the go-ahead in light of the feasibility study and any initial trials, the customer must draw up a system specification expressed in terms of his needs, but abstaining from any definition of solutions: he must describe only what the system has to do, and not how it should do it, in order to avoid the a priori imposition of penalizing or expensive technical requirements and to derive the greatest benefit from the creative imagination of systems designers.

This specification should indicate, as accurately as possible :
● the system's objectives, its required functions and the quality of service demanded (e.g., around-the-clock operation);
● the system's environment, its relations with other systems (if applicable), its users (indicating, for example, user familiarity with DP techniques, ease of use required probable system utilization rate, frequency of transactions, etc.);
● specific constraints to be taken into account (required system growth capabilities, conditions surrounding maintenance operations, degree of freedom in selection of hardware, etc.).

In drawing up his specification, the owner – who must in any case retain responsibility for his project – regularly turns to an information engineering company for assistance in defining and expressing his needs.

The owner next either issues an open invitation for bids or consults with a selected group of potential contractors.

The companies approached may be hardware manufacturers, but are increasingly including information engineering firms. Acting alone or – in the case of large projects – as members of consortiums, they form the pluridisciplinary teams which will come up with solutions, design architectures and seek out the most appropriate equipment. Then, by successive iterations, they will isolate the solution which best matches – in terms of technical, human engineering, financial, etc., criteria – the specifications of the system to be implemented.

# SYSTEM CONSTRUCTION

## Contractor organization

After analysis and comparison of bids, the owner selects a prime contractor – assisted by subcontractors or co-contractors, as required – tasked with building his new system.

To meet his commitments to the owner (and to make sure that his subcontractors honor their own pledges, in turn), the prime contractor must organize and install a stringent project management structure, exercising three basic functions:
– a planning function,
– a technical function,
– a financial function.

To begin with, the prime contractor must set up project management methods and structures, ultimately including (for a large project):
● *a single project manager,* exercising all necessary operational authority and acting as sole spokesman in dealings with the owner;
● *a project steering committee;* made up of the project manager and spokesmen for the prime contractor and other project implementors, which makes essential decisions and monitors project progress;
● *the prime contractor's working departments,* tasked with project scheduling and review, quality control, documentation, training and maintenance policy. The planning team, assigned to keep tabs on overall scheduling and to monitor project progress, requires at least:
– a PERT-type scheduling system,
– a production control system to track project execution vis-a-vis the budget;
● *a project administration organization,* tasked with concluding contracts, billing, receipts, payments to suppliers, etc.;
● *a technical coordination branch,* tasked with technical supervision of implementing teams and subcontractors. This agency will define the languages, methods and tools to be used during contract execution, develop a detailed system architecture, centralize requests for modifications and check their consistency and compatibility with supplies or requirements of other participants.

## System architecture

The system architect – increasingly a large information engineering company holding the prime contract for a project – must next confer with his subcontractors to:
● define the system's main components, their relative ranking, and the interfaces between components and the system environment (insofar as possible isolating portions likely to evolve in time, in order to achieve the most stable possible interfaces).

In particular, the prime contractor must define operating conditions in case of component failure (automatic switchover, load sharing, etc.) compatible with the minimum required quality of service.
● define system operating procedures and conditions by seeking out solutions yielding the greatest ease and safety of use compatible with budgets and deadlines (simplicity of dialog with system, operational control, automation of the maximum number of service fonctions, etc.).
● select equipment (computers, terminals, telecommunications equipment, etc.) and dimension them (computing, storage, transmission capacities, etc.) as a function of anticipated performance levels.

Just as the must strive to build the simplest and most easily-used solution possible, the system architect will place priority choice on standard hardware and software in order to minimize costs and deadlines (which will in no way hinder him from building a heterogeneous system – i.e., one associating hardware from different vendors – if economic reasons justify this approach).

If no standard hardware product is capable of satisfactorily solving a given problem, the prime contractor and his subcontractors will jointly define dedicated equipment. An example of this approach was the Electronic Directory, which necessitated implementation of a concentrator and a database management system yielding higher performances than vendor offerings available at the time.

An intermediate solution would, in most cases, involve the writing of dedicated software for standard hardware.

Throughout this delicate process, the architect builds his system so as to provide maximum support for tests and integration, failure detection, maintenance, user and operator training and – insofar as possible – future system evolution.

Finally, the architect checks out his system, specifically making sure that the equipment "dovetails" correctly for achievement of desired performance levels.

At this stage (i.e., without waiting for the acceptance phase), the system architect might wish to apply a number of tools (load or traffic simulators, behavior simulators) to make sure that performance levels expected of critical items of equipment will actually be attained.

The design of a system architecture requires competence of the highest level comprised of experience and familiarity with the economic sector in which the system will be used, hardware, basic software and applicable leading-edge technology. But it also demands qualities more closely related to the art of information engineering: the ability to think of solutions and the sureness of judgement leading to and effective, harmonious and economical solution.

At this stage, the project is broken down into a number of operations, themselves divided into elementary tasks, and the schedule stipulating the relative rankings and chronological relationships between these operations or tasks is drawn up in detail. Human and material resources required for accomplishment of each task, as well as its forecast duration, are stipulated in the schedule.

Before commencement of implementation, it must be ascertained that this schedule complies with contractual delivery deadline and cost commitments and, if not, the prime contractor must make necessary adjustments to live up to requirements imposed by his bid.

The implementing teams will then progressively install themselves for handling the various project phases.

**Management system for luxury products**

LACONTRE is an exporter of French luxury products (wines and spirits, cigarettes) and publicizes its activities with an all-women parachute team shown here at the outset of a spectacular jump. With both feet on the ground, the company has entrusted complete implementation of its business management system to CAP GEMINI SOGETI.
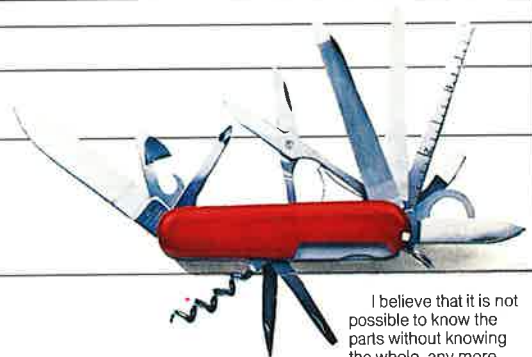
I believe that it is not possible to know the parts without knowing the whole, any more than it is possible to know the whole without knowing the parts.
*(Blaise Pascal)*

**The operational audit**

CAP GEMINI SOGETI has been making use of operational audits for many years: both for its in-house requirements and for its customers' projects, when required.

The operational audit, carried out by a team of two or three experts who are as independent as possible from the project management team, is aimed to ensure implementation quality and review technical risks vis-a-vis project targets (content, deadlines, budgets and performance levels) and quality standards applied (e.g., for documentation, programming, etc.).

Audits are triggered as systematically as possible in preventive (rather than remedial) mode, with a natural priority assigned to high-risk projects.
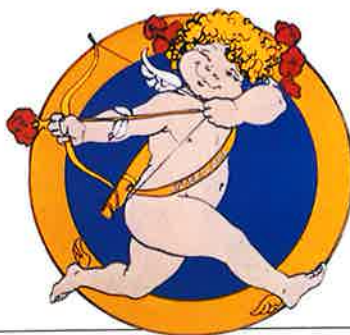
**Interflora clearing system**

The INTERFLORA network provides a well-known service for domestic and international flower deliveries in practically every country of the world.

This company called upon CAP GEMINI SOGETI to implement the specifications for its new system for management of payment clearing operations between participating florists, and project management using the Group's SUPER method: training of the project manager of BFII (common subsidiary of Banque Française and Interflora) and project staffing, with validation of progress schedules and supervision of project progress.

**Preliminary study for an electronic mail system**

Each year, post offices face an increasing volume of letters, printed matter and parcels. In order to reduce workloads and handling costs, the French General Directorate of Posts is considering use of the high-speed transmission facilities offered by the TELECOM 1 satellite. With this in mind, the Directorate has requested CAP GEMINI SOGETI to perform a preliminary definition study for an electronic mail system which would transport documents, bills, bank statements, etc., issued by large companies, banks and certain government agencies, with printout in local post offices.

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## Software development and debugging

Software to be implemented primarily consists of application programs, system initialization programs (taken from existing data and program file), programs for tests and integration (which from be viewed as applications in themselves) and, if applicable, supplementary infrastructural software (connection to special peripherals, protocol for communication between equipments, etc.) added to the vendor's basic software.

The following tasks – which themselves constitute a project – must be carried out: organization and followup of the project schedule, team formation, detailed system analysis, system design, program writing and testing, documentation writing, sequencing tests, user training, etc. The majority of large information engineering companies are capable of applying highly sophisticated methods and tools for each of these jobs (pages 38 to 44) present a selection from CAP GEMINI SOGETI's inventory of methods and aids.

## Procurement of hardware and equipment

In parallel with software development, the prime contractor oversees procurement of system hardware and equipment, falling within three categories:
- "catalog" hardware, ordered directly from the manufacturer, or furnished by him if he is a member of the consortium (computers, conventional peripherals, detectors, actuators, controllers),
- "special" hardware, requiring design and fabrication operations,
- "supplementary" equipment – not included as part of the system supply – required for tests and integration, such as environment simulators, software performance measuring units, etc.

To this end, the prime contractor must set up an organization for technical, administrative and financial management of subcontractors. This function is entrusted to the technical coordination team, which draws up schedules for standard hardware ordering and delivery and for design and fabrication of special equipment. In case of difficulty, this team is responsible for working out solutions with suppliers aimed at preventing overall project delay.

**Integrated real-estate management**

The integrated management system developed by CAP GEMINI SOGETI's Grenoble Branch for HOMING – a company formed by two real-estate firms specializing in the winter sports resort market – handles all administrative and marketing operations related to seasonal apartment rentals and sales.

Making use of a telecommunications network, this system permits the selection and immediate reservation of an apartment i one of 20-odd resort integrated managem of owner-tenant relations, and complete i ternal management f the associated real-e
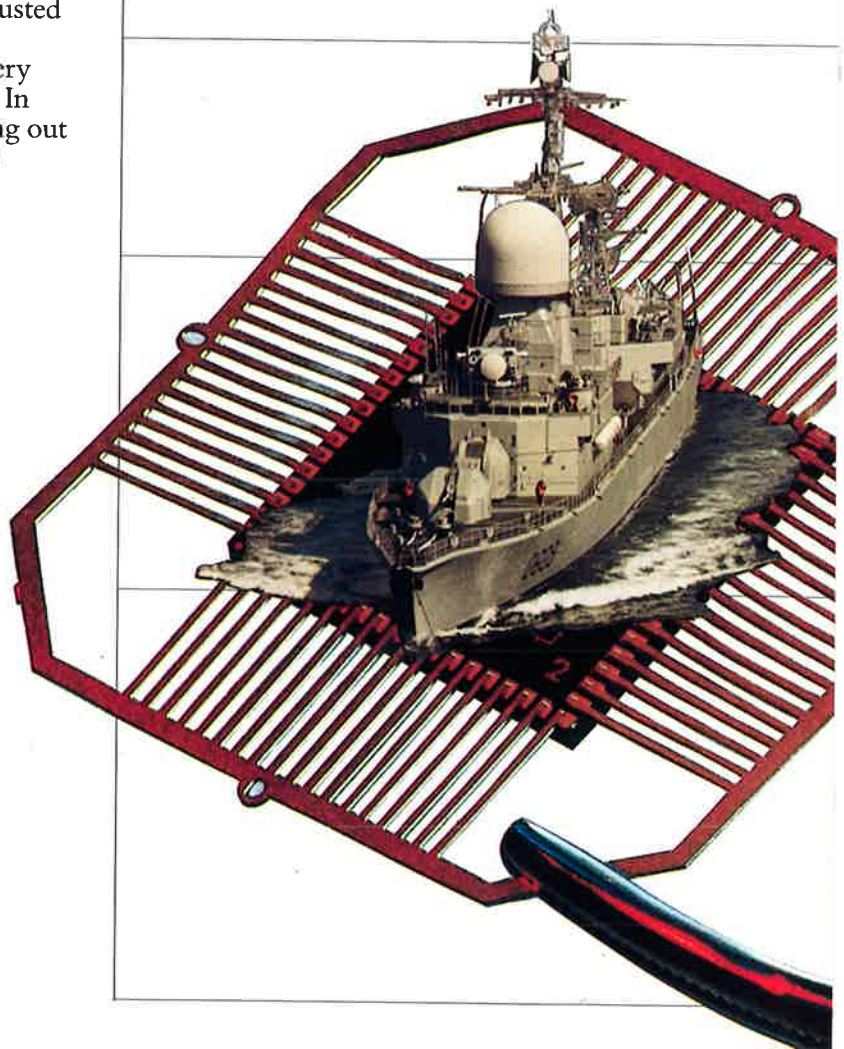
## Training and documentation

Customer takeover and operation of the system are obviously highly dependent on the quality of documentation and training which he receives.

System documentation is extensive and varied: user's manuals, operating manuals, technical documentation on software (general specifications, module documentation, system design, program documentation, etc.), general documentation on hardware and accessory equipment (general description, drawings, nomenclatures, operating and maintenance manuals, etc.). Moreover, documentation for non-standard system components (application software, special equipment, etc.) undergoes continuous modification and adjustment during the entire design and implementation phase, and its updating is a time-consuming, meticulous and painstaking job.

To mitigate this problem, information engineering companies have made an effort toward maximum automation of the documentation of their systems, and have developed automatic documentation tools for this purpose. ADOC, developed by CAP GEMINI SOGETI, is a software product which automatically generates, formats and updates documentation from the very outset of a project.

Following this procedure, system documentation is available at a very early stage, and training of users, operators, DP and maintenance personnel may begin with the integration phase (described below), permitting their thorough familiarization with the system as of the provisional acceptance phase. In the CAP GEMINI SOGETI approach, these training tasks are performed by the system designers and implementors themselves, under the supervision of specialists.
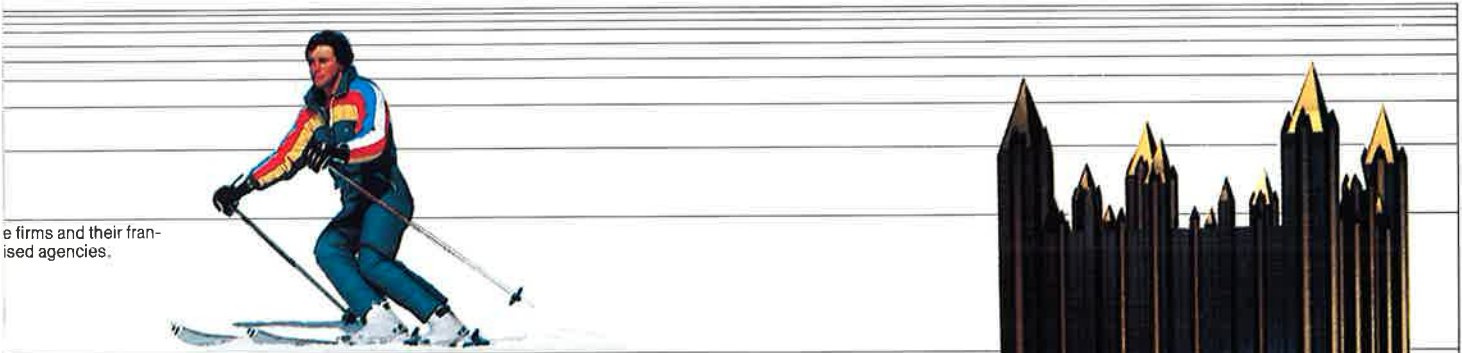
e firms and their franised agencies.

**A major conversion for PPG Industries, Inc.**

When PPG Industries, Inc., a major manufacturer of glass, chemicals and paints, decided to change its computer environment within the Coatings and Resin Division, DASD Corporation was called on to plan and implement this conversion.

Initially, the business and manufacturing applications are being converted for the corporate offices and once completed will be moved to each of the 12 outlying plant locations.

The project will involve a DASD team of 17 people, a COBOL language translator, file translator and file compare utility programs.

**Evolution of a large system during its operational life**

An Automatic Digital Information Relay Center (CRAID), the first automated link in the French Navy's telegraph network, has been operational in Paris since December 1970. At that time, the Navy had requested Compagnie des Compteurs and CAP GEMINI SOGETI to implement three message switching centers, nodes of this network.

As maintenance of the computers controlling these centers is growing increasingly problematic and the volume of messages exchanged is increasing each year, the Navy has decided to modernize its equipment and has assigned CAP GEMINI SOGETI and TIT to implement a new hierarchized network employing packet switching but making renewed use of enhanced functions from the existing system, particularly with regard to message switching procedures. This system will be replaced during (1983) by the ARTIMON network, now being implemented by CAP GEMINI SOGETI and TIT.

**Growth and Computerization**

MAPEM is a small, family-operated manufacturing firm whose "Expresso" household coffee-makers currently hold 20% of the French market. In order to cope with its rapid growth (on the order of 30% annually) and with past problems in computerization, MAPEM requested CAP GEMINI SOGETI to provide it with a five-year DP plan, involving an appraisal of the existing system, analysis of information systems, recommendation of an organizational structure and selection of a medium-term developmental scenario

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## Hardware and software integration: system acceptance

After procurement or fabrication of hardware, and development of software, the prime contractor moves into the painstaking phase of integration, aimed at testing and debugging overall system operation and terminating in final acceptance by the customer.

Integration must follow a strict plan; each test must move verification of system operation a step forward without allowing corrections made during this process to have repercussions on portions already tested.

Integration thus requires a maximum degree of method, stringency and discipline, particularly in the case of large integrating teams. Integration must be planned from the very design phase, with the drafting of acceptance documents stipulating test content, modalities and results for the three main phases described below. Integration must therefore be viewed as a sub-project in itself and must be automated to the greatest possible extent, requiring – besides the use of a number of tools – the writing of dedicated programs.

### ● "Test-platform" technical acceptance

In order to permit system integration at the earliest possible date, the prime contractor installs a "test-platform", made up of actual (or identical) system equipment. At the outset, this platform – at the disposal of implementing teams – includes only a computer and a handful of peripheral devices; it is gradually supplemented by other items to be integrated, which have already undergone in-plant acceptance. As total system testing cannot be performed until the system is connected to its final environment, simulators and performance measurement tools must be used. Platform acceptance should be as complete as possible, with testing of as many components as are available at this stage.

### ● Onsite provisional acceptance

When the system has been installed at the final site, platform acceptance tests are first repeated, followed by a "suitability check" aimed at testing "real-life" system operation and ensuring that it complies with the operational criteria defined in the specification. This phase marks the transfer of the right to system use to the customer, operational startup and commencement of the guarantee period.

### ● Final acceptance

Final acceptance takes place at the end of an interval ranging between several weeks to several months of normal service, during which the customer assures himself of satisfactory system behavior – particularly from the standpoint of performance levels – under normal operating conditions.

**Computerized management for regional food products**

To develop its management information system, LA-FOREST-, a company which manufac-tures and distributes traditional fine food products from France's Périgord region (such as goose-liver pâté) – turned to CAP GEMINI SOGETI's Bordeaux Branch,

**Performance enhancement tools**

In order to achieve the PTT's stipulated response time of one second for 100 simultaneous calls for Electronic Directory service, the system designers had to make use of two dedicated hardware units: a traffic generator and a status monitor.

With the traffic generator, predefined scenarios can be simultaneously established on up to 190 lines. The status monitor, deriving data from a probe in the computer, gives an instantaneous screen display of global central-unit loading and interrupt level activities.

In parallel, a statistical logical extractor allows observation of the time dis-

**Command assistance systems**

Implemented for the French General Staff under the aegis of DTAT/SEFT, the Controlled Message Distribution System (SDCM) and Command Information System (SYSIC) – operational in 1977 and 1979 respectively – provide continuous information to the General Staff concerning the situations in France and abroad and feature switchover between systems to adapt resources to changing situations.

As prime contractor for one of these systems and responsible for the bulk of the other's software, CAP GEMINI SOGETI worked with its associates CIMSA and La Signalisation to set up a particularly effective technical structure for maintenance and expansion of these systems throughout their lifetimes. In particular, this system provides for reconfiguration requests, user prompting, situation analysis, solution seeking and evaluation, task execution and documentation and history file updating.

## OPERATIONAL LIFETIME OF SYSTEM

### System guarantee and maintenance

The guarantee, generally included in the implementation contract, stipulates that, for a period of several weeks to several months, the prime contractor undertakes to correct operating defects (correction of software errors, replacement of defective parts, etc.).

Beyond this period, and throughout the system's lifetime – lasting for an average five to ten years, but sometimes extending to some thirty years – many maintenance operations will be required: corrective maintenance (correction of hidden errors which may not become evident except under exceptional operating conditions, replacement of defective parts); preventive maintenance, performed systematically and at regular intervals on equipment; software updating as a result of hardware replacement or modification; and, above all, changes desired by the user, as a system is a living thing, an entity in constant evolution.

Special attention must therefore be devoted to system maintenance from the very design stage (priority selection of standard hardware and software, definition of interfaces which will remain as stable as possible in time, systematic use of methods and tools for maximum automation of system fabrication and documentation, etc.). Maintenance must also be organized with the greatest of care, because:

● it represents a substantial cost factor, as – according to a number of surveys – it takes up some 50% to 90% of user DP professional's attention over the system's lifetime, regardless of their company's activity,

● fault location poses difficult problems, particularly in large and heterogeneous systems,

● system shutdowns must obviously be reduced to a minimum (disruption of service, economic and human consequences of failures, etc.).

In order to reduce shutdown durations and repair costs, the prime contractor must therefore enable the system operators to handle as many maintenance echelons as possible, providing them with manuals, documentation, measurement, diagnostic and locating procedures and tools, as well as training resources. He must also plan on an adequate number of spare parts and sub-assemblies, enabling the operator to replace failed equipment, to be repaired onsite by the manufacturer – or, in the case of more serious failures – returned to the plant. It should be noted that, for certain components, some manufacturers have already adopted the concept of "throwaway" hardware when – thanks to lowered manufacturing costs – straightforward replacement of defective equipment proves less expensive than repair.

### System conversion

It is rare for a system to escape the need for conversion during its lifetime, as the speed of technological change often necessitates replacement of hardware, software or both at once, for reasons of efficiency or economy; conversion may also result from a wish to achieve a uniform hardware base.

A conversion is a special type of project, quite different from implementation of an application, whose basic difficulty is an organizational – and not a technical – problem.

Conversion of a large system might take 12 to 18 months and requires several months' more parallel operation of both the old and new systems. Moreover, the system continues to live and change during the conversion process itself. Successful conversion requires genuine experience and the application of a tested project management method, a methodology, and dedicated tools permitting maximum automation of operations.

CAP GEMINI SOGETI has made a full-fledged activity of the conversion process. The Group's knowhow, methods and tools enable it to guarantee the full success of conversions requested by its customers.



which implemented the following applications: ordering and invoicing, payroll, personnel, inventory, accounts receivable and payable, and general and cost accounting management, among others.

tribution of program execution and operator action on system nerve centers.

Thanks to these tools, the saturation level was raised from 10 to 60 callers with nominal response times achieved in a second stage.

**A maintenance assigment for CAP GEMINI BELGIUM**

The information processing requirements of Esso's Antwerp refinery have increased ceaselessly during the past 15 years, and over 100 users today regularly forward application update and enhancement requests to the refinery's computer center.

CAP GEMINI BELGIUM, which has been providing assistance to Esso-Antwerp's internal DP department for a number of years, is currently implementing the bulk of the refinery's maintenance and a portion of its system programming.

Each of CAP GEMINI BELGIUM's professionals, assigned responsibility for one or more subsystems, is in direct contact with users, attends their meetings and carries out all requested maintenance operations.

Thanks to the application of CAP GEMINI SOGETI software development and documentation standards, maintenance execution times have been reduced by about 30% in two years.

# "Owner" and "Prime Contractor"

## SHARING OF TASKS AND RESPONSABILITIES BETWEEN OWNER AND PRIME CONTRACTOR

| STAGES OF SYSTEM LIFE | OWNER | PRIME CONTRACTOR | Information engineering company | | |
|---|---|---|---|---|---|
| | | | Industrial architect | Ind architect and software | Turnkey supplier |
| PROJECT | - preliminary studies<br>- specification writing<br>- selection of prime contracting type,<br>- establishment of credits<br>- invitation to tender<br>- selection of prime contractor<br>- contract negotiation | - creation of consortium<br>- drafting of bid<br><br>- contract negotiation<br>- installation of prime contracting organization<br>- installation of procedures with owner and co-contractors<br>- consulting to owner and co-contractors/subcontractors<br>- technical, administrative and financial project supervision<br>- integration and submittal for acceptance | | | |
| CONSTRUCTION OF THE WORK | - installation of procedures with prime contractor<br>- overall project supervision<br>- partial and final acceptance<br>- financing of work | - system guarantee | | | |
| OPERATIONAL LIFE | - operation and maintenance | - system definition to the operational phase (audits, organization, etc.). | | | |

Comment: Obviously, information engineering firms are in a position to offer consulting services in each phase of a system's life, from preliminary studies for

A bank wishes to install an automatic teller machine network. Its DP manager will begin by defining his needs as though he were a user of the future system. He will stipulate inquiry frequency, admissable response times, etc. In point of fact, he will draw up a specification, which he will turn over either to an "architect" tasked with translating these needs into a detailed plan, or directly to the future prime contractor, who will propose a number of possible solutions and implement those ultimately adopted.

Our scenario thus involves two chief agents: on the one hand, the banker-owner; on the other, the prime contractor, who might be an information engineering company.

## OWNER

The owner is the person – in most cases, a legal entity – for whom the system is produced ; by extension, the "owner" is the department, organization or public or private agency assigned to conduct the investment operation.

His task may be described as follows: define the work in the form of a detailed program providing data on the site, operational requirements, legal or environmental constraints, deadline, quality and (exceptionally) price requirements; negotiate study and execution contracts; and carry out acceptance of completed studies and works.

This definition, originally applied to construction and engineering contracts, is also valid for DP systems, as the customer – obtaining assistance from an information engineering company, if required – must perform preliminary studies, draw up a specification (which must leave room for widely-diversified responses and, consequently, must abstain from the definition of solutions, a task to be performed by the system architect), issue an open invitation for bids or engage in limited consultation; then, after having made his selection from among the bids submitted, he concludes one or more contracts for implementation of the system, supervises project progress and carries out acceptance of the work.

## PRIME CONTRACTOR

This term, common in the construction field, designates the party tasked with "designing the work, directing its execution and submitting it for acceptance and payment".

The process of contract execution may follow two paths. On the one hand, responsibility for design and supervision of system construction may be assumed by a single prime contractor. On the other, this responsibility may be shared between a general prime contractor and special prime contractors who, under the supervision of the former, are tasked with design and monitoring of execution of portions of the work.

In the DP field, prime contracting may – if analysis of possible variants is carried to an extreme – assume one of the following two practical forms:

### Prime Contractor as "Industrial Architect"

In this case, the prime contractor and the system architect have very similar assignments. These may start far upstream from actual execution of the work, beginning with the drafting of a master plan, preliminary studies and specifications (hardware and software). They continue logically with the analysis of bids, development of a detailed system architecture, specification of hardware, basic software and application software.

The prime contractor then negotiates contracts with subcontractors; in this task, he is assisted by the "industrial architect", the contractor tasked with starting up the work, coordinating it and monitoring its progress (in particular, by ensuring that subcontractors comply with deadlines and prices) and, finally, carrying out acceptance operations. The industrial architect also acts as permanent consultant to the prime contractor.

When the industrial architect is an information engineering firm, the prime contractor also tends to task him with the fabrication of dedicated basic and application software. As the industrial architect has defined the system specifications, architecture and environment, he is thoroughly familiar with them; moreover, he possesses the necessary development resources and methods. He is therefore in the best position for rapid, efficient design and fabrication of this software.

## Prime Contractor as Turnkey Supplier

In this case, the prime contractor undertakes to perform full design and implementation of the system, which he delivers to the owner in turnkey form. He must entrust a portion of his services and supplies to subcontractors or co-contractors, and his role consists in assembling the target system on the basis of all of its parts.

If the system is a relatively simple one, the prime contractor purchases hardware (computers, transmission equipment, etc.) directly from its manufacturers, who are subcontractors having no direct dealings with the owner (unless the owner requires otherwise, in which case he designates them – and possibly pays them – directly).

This approach may also result in a triangular agreement between the owner, the prime contractor and the hardware manufacturers. While maintaining responsibility for turnkey system delivery, the prime contractor is not involved in the supply and installation of hardware, which is purchased directly by the owner.

In most cases, however, contractors dealing with an owner are led to form consortiums, in which they are either (or both) "joint", if all are jointly responsible for the entirety of the contract, one of them being designated as spokesman vis-a-vis the owner, and "several", if each is responsible only for a specified portion of the work, with one contractor designated as spokesman and coordinator usually acting jointly with each of the others. In the absence of such an arrangement, a number of separate contracts are prepared for separate contract divisions.

The task of the coordinating prime contractor (see general table) is to prepare, submit and defend the consortium's bid, negotiate the contract with the owner (and his own contracts with his partners), provide technical, administrative and financial project supervision, move information between participants, validate his partners' services and supplies, monitor all phases of integration and submit the system for acceptance. The coordinating contractor also issues the system guarantee.

Co-contracting partners are, obviously, associated in each of these tasks as a function of their respective responsibilities.

## CRITERIA FOR SELECTION OF PRIME CONTRACTORS

In view of these two very different contractual forms, what criteria will guide selection of a prime contractor?

At first sight – and if we hold to the schematic definitions of the preceding paragraphs – the owner should always prefer to deal with a prime contractor assuming overall responsibility for delivery, within stipulated deadlines and budgets, of the specified system (rather than supplying system architecture and, possibly, software implementation as well). In practice, however, this is not always the case, as this formula offers four major disadvantages :

*disadvantage 1:* the project will necessarily be more expensive; in view of the substantial risks he must take, the prime contractor will – quite naturally – require a higher margin on equipment and services provided.

*disadvantage 2:* to hedge his risks, the prime contractor



**Forms of payment for prime contracting**
*(after Metzger, Managing a Programming Contract)*

● **Firm Fixed Price (FFP)**
The price is set and not subject to change even if you have estimated badly. This is the most risky type of contract to use on a programming job. It should never be used without at least a very clear statement of work, no fuzzy areas, no dangling definitions. Many a project has experienced severe losses operating under such a contract.

● **Fixed Price with Escalation (FP-E)**
The price is set, but some allowance is made for both upward and downward adjustments in case certain things happen, for example, labor rates or material costs change.

● **Fixed Price Incentive (FPI)**
A target price is set, but formulas are established that allow the contractor a higher percentage of profit if he exceeds selected targets, such as cost, and a lower percentage of profit if he misses the targets.

will tend to multiply precautions, stretch out preliminary studies and add safety margins on to deadlines, with a resulting prolongation of completion time.

*disadvantage 3:* this contract form has a tendency to "rigidify" a project: the prime contractor will cling to the specification, and refuse any request for modification made by the owner; even in the absence of such requests, relations between the two parties will be much more formal, to the detriment of overall efficiency and possibly even leading to a conflictual atmosphere.

*disadvantage 4:* a major one, indeed. In case of serious difficulty, the only solution open to the prime contractor is to take advantage of inevitable ambiguities in the specification and negotiate additional contract clauses.

Under these conditions, the guarantee of a fixed price may become a mirage.

## PRIME CONTRACTING: MODES AND CONDITIONS OF PAYMENT

Reality does not allow itself to be reduced to such clear-cut definitions of responsibility as those summarized above. This is why – as the inset below indicates – remuneration actually assumes many forms.

In a very rough outline, however, the prime contractor might find himself in one of the following three situations:

### As industrial architect

His payment may be in the form of fees calculated in terms of the time spend by his personnel in its consulting tasks, system design, supervision of execution and acceptance. A portion of his fee may also be tied to the results of the operation (compliance with deadlines, budgets, system quality): this "cost plus fee" formula originated in the USA and its use is tending to spread. The "cost" (direct and indirect) portion is supplemented by a fee, a variable which is negotiated with the owner.

### As industrial architect and software implementor

The "cost plus" formula is supplemented by payment for software design and implementation, which may be calculated either in terms of time spent or on a fixed-price basis.

### As coordinating prime contractor

The prime contractor is remunerated as in the preceding cases, both for the portion of the work that he has himself implemented and for his management and coordinating duties. This payment is also accompanied by a risk coefficient related to his undertaking to deliver a turnkey system. The relative weight of his managing and coordinating tasks may vary between 10% and 20% of the contract price.

In each of these three cases, the prime contractor is paid as a function of project progress – monthly, upon submittal of progress reports – and of completion of planned phases.

If he is the coordinating contractor, he must also pay his co-contractors as stipulated in his contracts with them.

Finally, the owner does not turn over the balance of payment due to the prime contractor and his associates (which might amount to 5-10% of system cost) until final acceptance of the system.



**ll Implementation of new system**

Charles of the Ritz Group chose to implement an entire data processing installation. Spidirellis & Associates, Inc., was called upon to provide an on-line sales, marketing and distribution system.

Spidirellis & Associates, Inc., operating in an environment where the client had no hardware of its own, took responsibility for project management of the applications projects, designed all aspects of the system, and provided advanced technical trai-

ning for the client's staff. The system, operating in an IBM 4341 environment, went operational exactly as scheduled.



**Cost Plus Incentive e (CPIF)**

This provides that the ntractor will be paid all costs plus a fee ich varies depending how close the ntractor comes to eeting the established get costs, or how well does in other areas elled out in the ntract. In the case of IF, the criteria which termine the fee are all jective and easureable.

**Cost Plus Fixed Fee PFF)**

The contractor is paid owable costs and a set .

● **Time & materials (T&M)**

Here the contractor is paid for labor hours actually worked and the cost of materials used.

## SELECTION OF A PRIME CONTRACTOR

Prime contracting for a large project is a profession in itself. A profession with its own "rules of the art", its own methods and tools, a profession involving continuing learning and self-improvement, in which experience and references are acquired over the years. This is why owners are increasingly turning to outside prime contractors, a very rare event only a decade ago.

But to whom should the job be entrusted? To a computer manufacturer, a general engineering firm... or to an information engineering company? If this question arose during the past, it is now tending to become a dead issue.

First, let us take a look at the general engineering/ information engineering alternative.

With the increasing complexity of DP systems of a given size, the proportion of specifically computer-related technical sophistication is such that no one would seriously consider entrusting design and implementation to anyone other than a DP professional. An analysis of the majority of large DP projects with prime contracting handled by a general engineering firm indicates that this company either included a very large, integrated or subsidiary DP department or – the most frequent case – it in turn called in an actual information engineering company as subcontractor or co-contractor, the lastmentioned acting as prime contractor for the project's DP development proper.

It is on this basis that CAP GEMINI SOGETI is regularly requested to carry out assignments of this type.

As for the second alternative, between the two major families of DP experts, with computer manufacturers on the one hand and information engineering companies on the other: which is today best placed to perform prime contracting for large DP projects?



**A land management system for the Dutch Ministry of Agriculture**
In order to accelerate the process of agricultural land consolidation and redistribution required for use of modern farming techniques, the Dutch Ministry of Agriculture decided, in 1982, to computerize management of parcels held temporarily in its custody. The Limburg DP center, one of two operated by the Dutch government, entrusted the preliminary studies for this very large project, followed by prime contracting for system design and implementation, to PANDATA, a CAP GEMINI SOGETI subsidiary.

Thanks to use of the SDM (System Development Methodology) method, developed by CAP GEMINI SOGETI some years ago, the project – started up in April 1982 and requiring some 11,000 man-hours of work – was delivered to the customer on schedule, just before Christmas of that year.

**A turnkey computerized command and monitoring system for a Scottish fire department**
The Strathclyde Fire Department provides protection for a population numbering 2.5 million and handles 40,000 fire calls yearly. It recently decided to carry out an ambitious program for enhancement of its service through reduced call response times and increased safety for firemen and the public.
In this context, it contracted with

Until the beginning of the '70s, the answer was obvious: systems were primarily constituted by computers and their peripherals, and the cost of this equipment represented by far the lion's share of project cost.

In the space of just a few years, however, the spectacular fall in the cost of components and a parallel progression in equipment price/performance ratios has shifted the large project's center of gravity away from hardware toward software. But this purely quantitative factor is overshadowed by at least two even more important considerations:

● the increasing heterogeneity of equipment making up DP systems (computers, peripherals, telecommunications equipment, dedicated hardware such as detectors, programmable controllers, etc.) places growing importance on the role of an *independent* prime contractor in the selection and coordination of multiple hardware suppliers. And, assuming that a manufacturer demonstrates as much impartiality as an information engineering firm (which is hardly likely, as the manufacturer would frequently have to act against his own interests), the manufacturer does not – as does the information engineer – have the everyday experience of handling specifications for hardware of many origins and functions, nor the experience of implementation on a wide range of hardware types: the only experience which can yield an in-depth familiarity with necessary hardware.

● the variety of capabilities which must be brought together and efficiently harnessed for system design and fabrication: specialists in the sector of activity concerned, experts in state-of-the-art techniques, software engineering professionals, systems architects, etc. Now, the computer manufacturer's raison d'être is to produce and sell hardware ranges and their basic software, whereas the prime goal of the information engineer is to design and implement systems and software, regardless of whether this involves a large distributed system linking the branch offices of a major bank to its head office, a real-time process control system in a refinery, or a telecommunications satellite program module... And to do this, the information engineering firm must unite a spectrum of capabilities which a manufacturer probably could not or would not make available to his customers, simply because it is not his job to do so.

These are all traits – wealth of experience, variety of capabilities, creative power, arsenal of methods – making information engineering companies the best prime contractors for DP systems.



**A computerized project management system**

Tasked with electrical installation work on the giant Statfjord-C offshore oil platform, National Electro – a Norwegian company specializing in electrical equipment and cable – decided that a computerized system was needed to manage this contract.

The Bergen branch of DATA LOGIC (CAP GEMINI SOGETI's Norwegian subsidiary) was given full responsibility for the project, including procurement of hardware on the customer's behalf.

The system , running on a Norsk Data Nord 100 computer, handles the following interactive applications: scheduling and supervision of operations, personnel assignment, completion time monitoring and cost control.

IAL GEMINI, a British subsidiary of CAP GEMINI SOGETI, for turnkey implementation of a major command and monitoring system capable of handling operational problems and generating necessary management information.

The system performs the following main operational functions:
● message exchange with mobile units by means of 60 on-line terminals,
● generation of a street index for exact fire locating, using a phonetic inquiry technique,
● continuous indication of the status and location of firefighting equipment and personnel.

# Information engineering companies

## Qualities sought during recruiting of professionals

- aptitude for logical thinking: reliability and flexibility of reasoning,
- intellectual aptitude: faculty for adaptation and assimilation,
- personality: dynamism, emotional stability, drive, self-sufficiency, cooperative spirit, imagination,
- technical knowhow.

In France alone, to meet its own needs and satisfy a small portion of its customers' requirements, CAP GEMINI SOGETI:

- examined 8,000 employment applications in 1982
- hired (or was responsible for the hiring of) over 700 professionals during that year.

## A successful project... thanks to SDM!

When Union Carbide Benelux decided to install a DP system in Antwerp at the beginning of 1982, it turned over full responsibility for system development to the local Branch of CAP GEMINI BELGIUM. CAP GEMINI BELGIUM's use of SDM (System Development Methodology), a decisive factor in the customer's decision on contract award, enabled the company to deliver the system – within the stipulated deadline and budget – in February 1983.

We recall that SDM, developed in 1970 by a team of CAP GEMINI SOGETI's Dutch and American consultants, is a DP project management method providing a full definition of each of the seven stages of a project's life (from preliminary studies to maintenance operations), together with tasks to be implemented and methods and tools to be used.

## An "Expert system" application

An expert system using a CAP GEMINI SOGETI "thinker" is now undergoing automated development. It will provide construction contractors with decisionmaking information on excavation and foundation test drillings required by soil characteristics.

"Inferential rules" are fed into the system to enable it to solve problems posed by this specific situation. Sample rules:

- if the building is constructed of contiguous blocks, settling must be calculated,
- if the terrain is on a sharp incline or is very broken, a stability calculation must be performed,
- if the terrain has no water table or circulating groundwater, its hydrogeology need not be investigated,
- if the terrain might conceal cavities, they must be detected by microgravimetry.

"The modification of the species, the creation of new living types could only be a matter of molecular biology."
(after Jean ROSTAND)

The information engineering industry – which, we recall, primarily includes the three activities of consulting, software implementation and systems engineering – is still in its youth.

An "engineering" activity may acquire its title and content almost overnight, or through a millenial process of change and development. The former case is exemplified by the newborn field of *genetic engineering;* the latter, by military engineering, originally limited to the art of fortification, then expanding to encompass field work during military campaigns, then management of matériel and, finally, combat training for engineer units... to ultimately retain this lastmentioned function alone.

A function which evolves with changing industrial techniques and organization, *engineering* may now be clearly and accurately applied to characterize the activities of software service firms. A variety of caricatured or incomplete designations for these companies has been proposed over the years, ranging from the humble "temporary personnel contracting" to (in France) the dignified "data processing services and consulting" tag. In our opinion, today's realities and tomorrow's needs would seem to merit – at least insofar as larger firms are concerned – use of the term *information engineering,* uniting the concepts of our profession's ART, its METHODS and its WORKS.

## ART

The information engineering professional is characterized by his ability to create. This faculty is a combination of creative power, knowledgeability in a number of techniques, a liking for innovation and a job well done, and an aptitude for listening to others.

It is expressed in the ability to *offer counsel* after having fully analyzed and understood a customer's need or problem, to *construct a solution* on the basis of existing technical materials and comparable situations from the past, to conceive and apply *fresh ideas* (which might derive from application of a new theoretical concept to a concrete situation, transfer of techniques used in one domain to another, or creation of new functions).

It is not by chance that the leading information engineering companies hold and maintain a high level of creative potential. In fact, a major segment of their organization is focussed on this target; CAP GEMINI SOGETI's own activities take the following approach:
- at the recruiting level, the Group seeks out candidates whose personalities, inclinations and attitudes are attuned to exercise of the information engineering professional's trade (see inset, below);
- besides his hands-on training (marked by diversity of experience, emphasis on teamwork), the professional participates in training courses given by Group companies to match the needs of a project or within the framework of a training plan providing complete coverage of new technologies;
- the environment created both by the company (and, within the company, the Branch, the basic cell of CAP GEMINI SOGETI's organization) and by the profession itself is rich in incentive, encouraging creativity and open-mindedness. Not only do CAP GEMINI SOGETI's professionals enjoy a wealth of opportunity for enriching contact with other Group engineers and experts: they must also – within the framework of the projects to which they are assigned – fit themselves into a ceaselessly-renewed working context, adapt themselves quickly to highly diverse technical and human environments, and be able to react unhesitatingly to customers' demands.
- finally, CAP GEMINI SOGETI has its own research centers and development departments which go beyond the implementation of new products to disseminate the results of their work throughout the Group, thereby contributing to the maintenance of a high technological level. The Group has three research centers: the Grenoble Research Center is specialized in software engineering, database systems and machine translation; the Rennes Information Technology Center specializes in networks and videography; and, as its name indicates, the Toulouse Space Technology Center devotes its activity to space systems. Three other units create software products: CAP SOGETI INSTRUMENTS' Development Department in Paris (software engineering products), CAP SOGETI FRANCE's Directorate of New Techniques, also in Paris (videotex products) ; and DASD's Conversion Products Development Unit in Milwaukee.

## METHODS

Methods form the most valuable set of tools held by the most experienced information engineering companies for software development and systems implementation.

In the case of CAP GEMINI SOGETI, this arsenal is the\product of over fifteen years' experience and contract projects numbering in the thousands. It may be broken down into three major families:

**Software engineering tools and methods,** aimed at enhancing the productivity of each of the successive stages in the life of a program, specifically including:

● methodologies for master plan drafting and systems development, generally based on the principle of segmenting development operations into short phases, from initial scheduling to preparation for startup and maintenance;

● project management and systems engineering management methods and software primarily intended for supervision of large projects whose PERT scheduling cannot be established or updated manually, given the large number of constituent elementary tasks;

● integration of assemblies of elementary tools into a coherent environment, the most concrete and advanced example of which is MULTIPRO, developed and marketed by CAP SOGETI INSTRUMENTS (see inset, below).

## MULTIPRO, CAP GEMINI SOGETI's range of software

A modern means of rationalization of program production, MULTIPRO – one of the few software engineering systems currently on the market – offers all functions required for implementation and monitoring of all stages of a software product's life:
● project scheduling and progress supervision, using methods such as SUPER, developed by CAP GEMINI SOGETI,
● design, specification and analysis aids such as diagram and form generators, which guide



**MULTIPRO's Contribution to DP Centers:**
● speedier development times,
● reduction of user mainframe workloads,
● enhanced software quality and possibility of reuse,
● increased maintenance efficiency.

**Aids to applications development,** spanning the range from the analysis guide to the ready-made program.

Standard application programs, quite common in mathematical and technical applications (structural, statistical calculations) and in simple management applications (general accounting, accounts receivable) unquestionably meet the needs and wishes of microcomputer users, but cover only a minor portion of the requirements of users of other hardware categories.

Obviously, it would be desirable to offer off-the-shelf solutions whenever acceptable to the user, if only to economize on DP professionals' time. But the ready-made program is not the only aid available, and CAP GEMINI SOGETI has developed a set of programs and documents which its professionals use in determining and proposing the most effective and appropriate resolution to the customer company's application problem. In increasing order of generality, this series of aids includes:
- standard application modules (SAM), covering the major realms of routine management: general and cost accounting, inventory control, etc.;
- management applications analysis guides by field of activity: hotels, local governments, hospitals, banks, etc.;
- detailed systems descriptions meeting highly specialized requirements, including reusable program modules: public service communications, weapons systems, etc.;
- application descriptions embracing both functional and actual operational specifications.

## engineering workshops.

the designer and facilitate document output,
- programming and debugging aids, such as the syntax analyzer,
- library management, easing the storage and

updating of all project information,
- processing of documentation, including texts, codes and diagrams, thanks to "GraphiXstructuré" (R),

- aids to communication between implementors, such as selective or general message distribution,
- metrological tools, permitting – for example

– generation of statistics on use of the software engineering machine.

**The Lyons Regional Telecommunications Directorate chooses the DIALOG method**

Wishing to get a firm grip on development of its DP projects, the Lyons Regional Telecommunications Directorate has adopted the project organization and management methods offered by CAP GEMINI SOGETI's DIALOG methodology. DIALOG is made up of three modules: SCOP, SUPER and MAD.
- SCOP: an organizational method for project definition, identification of associates, operatio-

nal task assignment, overall task scheduling and assistance to project management decision-making.
- SUPER: project management for unification of progress measurement and project acceptance, providing, if necessary, supervisory in-

formation to project managers.
- MAD: a systems analysis method for exact definition of applications and their real validation prior to fabrication, generating unique reference documentation for all implementors.
CAP GEMINI

SOGETI provided training for project managers and their direct subordinates, guided method installation on test projects prior to definitive startup of the methodology, and furnished assistance and consulting on integration of DIALOG.
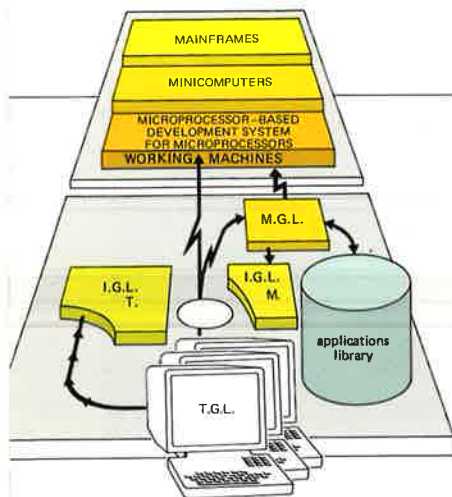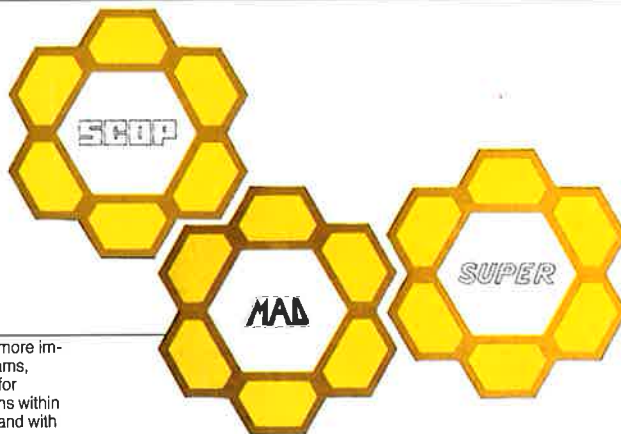
As the diagram of system architecture shows, MULTIPRO consists of:
- individual workstations or software engineering terminals (TGL). These microcomputer-based workstations are integrated into a human-engineered environment including printers (IGL) and attractive furniture, as shown in the photo opposite,
- a dedicated development machine or software engineering machine (MGL), for interactive production and updating of programs and associated documenta-

tion by one or more implementing teams,
- equipment for communications within the workshop and with user mainframes for which applications are intended.

MAINFRAMES

MINICOMPUTERS

MICROPROCESSOR-BASED DEVELOPMENT SYSTEM FOR MICROPROCESSORS

WORKING MACHINES

M.G.L.

I.G.L. T.

I.G.L. M

applications library

T.G.L.

## Basic tools for new technologies

Some new technologies are rapidly and economically accessible to users only insofar as basic tools have been developed and implemented by specialized suppliers. The large information engineering firms, generally participants in development work involving these technologies and generating user requests, are sometimes led to develop such tools. In videography, for example, CAP GEMINI SOGETI has created the MULTITEL range of videotex systems, currently in use by many banks, distribution companies, newspapers, local governments, etc. Without the availability of systems like MULTITEL, these organizations would not have been able to install their experimental videotex services or schedule startup of definitive services.

# MULTITEL,

## CAP GEMINI SOGETI 's vidéotex systems range.

The MULTITEL system range is made up of four models:

MULTITEL 10: Standalone videotex processor, without direct link with the user company's existing DP systems.



Videotex is a new mode of communication, information and dialog, making use of the techniques – combined, at last – of data processing, television and the telephone. It provides users in their home environment ("consumer" videotex) or their working surroundings (professional videotex) with access to information ("pages") managed by a computer and organized into "magazines" by means of a "structure".

CAP GEMINI SOGETI has developed a complete range of videotex systems, called "MULTITEL", to enable users to make the most of this new media. MULTITEL systems are available on a range of computer types and makes, and permit implementation of videotex applications without altering existing DP applications.

MULTITEL 20: Dedicated front-end processor, for videotex terminal connection and access to the company's DP applications.
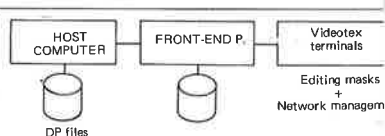


MULTITEL 30: Preprocessor permitting retrieval from videotex databases on a dedicated minicomputer and access to the files and programs installed on the company's DP system.
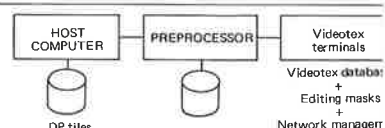


MULTITEL 40: Multiprocessor, for videotex service distribution in a network of distributed videotex processors.



"To facilitate the installation of videotex services by the Banques Populaires banking network, its governing board – after having examined a range of software products with the aid of CAP GEMINI SOGETI banking representatives – decided to acquire the Group's MULTITEL videotex monitors for development of planned applications. Among the reasons behind their choice:
● MULTITEL's functional richness, the generality of its basic concepts and its ease of use. This monitor performs the following functions: prestructured database management, message creation, operation and surveillance, dedicated applications (electronic messaging and mail, etc.),
● the portability of MULTITEL software on differing computer makes and powers, permitting its installation on the range of mainframes used by the Banques Populaires,
● the MULTITEL monitor's adaptability to varied architectures, offering optimized solutions for the Banques Populaires' individual DP centers. In point of fact, CAP GEMINI SOGETI's videotex monitor is a set of standard programs tasked with videotex data management and suitable for installation on a standalone processor (MULTITEL 10) or on a preprocessor (MULTITEL 30). This enables each regional bank to retain full independence in the choice of its DP resources, while retaining coherence on a groupwide level."

(From an article by Jean-Pierre Gervais, **Banque**, December 1982).



PROGRESSONS ENSEMBLE

BANQUE POPULAIRE DU NORD

TAPEZ SUITE

Remaining within the realm of new technologies, we might also point to:

- technological developments surrounding the Electronic Directory project, most of which will be reused. These developments include distributed databases, database machines and a phoneme-analyzing inquiry language;

- "thinkers": basic software representing forms of logical reasoning designed as components of expert systems (see p. 38 of this Report). Knowledge acquisition methodologies are also being developed;

- "LOVE", a computer-aided instruction language enabling teachers to develop course materials and interpret replies.

## SYSTEMS

The most spectacular end-products of information engineering are, of course, the large domestic and international systems such as satellite transmission, rocket launching and airlines reservations systems. Still other systems implemented by information engineering firms – while less striking than the examples given above – are just as vital to their users: conventional management and industrial applications in which the part played by new technology may be great or small, and for which studies, software development, conversions, operation or simply program maintenance are carried out by information engineering firms.

CAP GEMINI SOGETI's ability to implement any or all of such projects is a result of:

### Its Branch-based organization
The Group's typical operational unit, the Branch, covers a clearly-defined economic or geographic territory. Each Branch manager bears full responsibility for his unit's sales and technical activities. He is personally acquainted with every one of his customers and professionals. Customers thus receive his undivided attention, adapted to their specific personalities and situations. No significant industry-related event in his territory escapes his eye. He is known to, and regularly consulted by, computer users.

### The density of its international network of Branches
The CAP GEMINI SOGETI Group numbers over one hundred such units, located in France, the USA and all of the major Western European nations. Users - whose needs often extend beyond national boundaries – appreciate the fact that an information engineering company is familiar with management practices and legal requirements from one country to another, that it can deal smoothly with a customer's subsidiaries abroad and that it offers uniformity of service quality and experience on the major Western markets.

### Its flexibility of action
Characterized by its ability to rapidly mobilize resources whose size and technical sophistication are matched by few others, this flexibility is of essential importance to users, as it enables them to adapt their own workload programs without constraint.
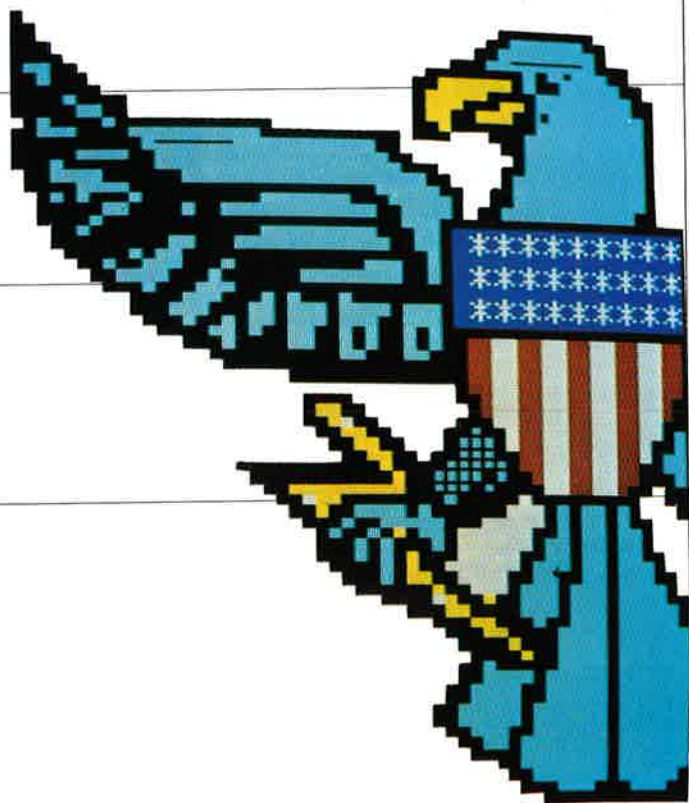
- The MULTITEL range is supported by the following software products: **the Videotex Monitor:** a set of standard programs tasked with videotex data management. Installed on the MULTITEL 10 and 30, it carries out the following functions: videotex database management, message creation thanks to its "Formatter" and "Designer" frame editing software, processor operation and surveillance, and application management (user-provided programs, electronic messaging, etc.).

- **The MULTIMAIL communications system:** installed on a MULTITEL videotex processor, it carries out the following three functions:
  - electronic messaging: rapid, informal message exchange between individuals,
  - electronic mail: formal communication with distribution of messages to multiple addressees.
  - electronic appointment calendar: inquiry of individual appointment calendars and of shared resources, such as meeting rooms.

- **The Electronic Directory:** with this system, businesses can benefit from the main features of the French Electronic Directory system.
- **MULTITRANS:** specifically intended for transactional applications running on IBM hardware, MULTITRANS is a high-performance approach to the development of videotex processor centers by making the system see the videotex terminal as an intelligent full-frame terminal while working in multi-frame mode.

# CAP GEMINI SOGETI: A SPECTRUM OF SERVICES

## Consulting and related services

including all of CAP GEMINI SOGETI's operations for assistance to DP users, enabling them to get the most out of their existing applications and make the best choices in new hardware and systems.
- *consulting and studies*: development of master plans, preliminary studies, specifications, consulting on methodology in hardware selection, DP centers operational audits, organizational procedures for DP centers;
- *training and operational supervision*: specialized in-house training courses, intercompany training courses, data operator supervision, very high level seminars conducted by the Collège Informatique;
- *operational management*: assignments ranging from localized assistance to full management of DP centers;
- *selection and recruiting:* from analysis of job slots to final selection of candidates.

## Software implementation

CAP GEMINI SOGETI implements software for all makes and models of DP hardware. An industrial approach is followed in development of this software (methodologies, tools, MULTIPRO software engineering workshop), which falls under three categories:
- *basic software*: programming languages, analysis languages, high-level language compilers, cross-chains for program generation, transactional monitors, processor status monitoring tools, documentation aids, etc.;
- *application software:* these programs are developed in all types and sizes for applications including management, manufacturing, office automation, information technology, military and aerospace activities, etc. ;
- *software products:* portable software development packages such as CPL1, ADOC, MULTILIB, etc.; videography products in the MULTITEL range;

telecommunications products (ESOPE, RTX25, NTI). CAP GEMINI SOGETI also has a range of standard applications modules.

## Systems engineering

CAP GEMINI SOGETI designs and implements systems of all kinds, whether as an industrial architect (generally also tasked with software implementation) or as coordinating prime contractor delivering a turnkey product. The primary missions carried out as prime contractor are: contract negotiation, project scheduling and supervision, technical and financial management of subcontractors, definition of system architecture, procurement of hardware, software and special equipment, system integration and acceptance, etc.

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### INDEPENDENCE, EFFICIENCY and POWER

*these are the three essential qualities offered to users by the information engineering activity carried out by CAP GEMINI SOGETI. These are the qualities which will be in demand during the eighties.*

**Independence** *of judgment and action vis à vis any outside force - be it industrial, political or financial - is a prerequisite for the most objective selection from a choice of technical options. And this feature is all the more important as these choices can have significant economic and social consequences at both the corporate and social levels.*

**Efficiency** *can be attained only with a complete familiarity with available techniques, their real state of development, and the operational conditions which must be assembled if they are to be genuinely useful.*

**Power** *of individual creation and teamwork, power to implement complete systems, power of a healthy organization: all qualities required to face up to the volume and diversity of tasks, to handle technical risks and to resist any pressures or demands capable of bringing independence into question.*
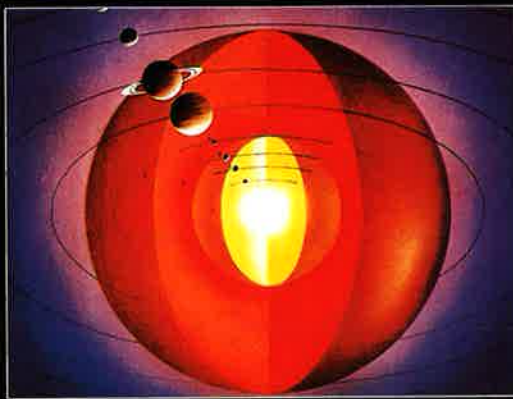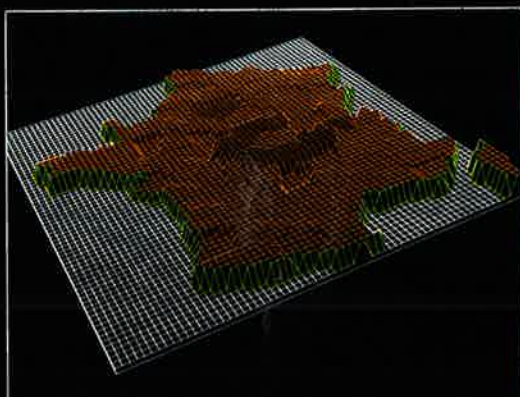
# THE FRANCE GROUP

Keeping step with forecasts, the FRANCE Group showed excellent growth during 1982, with development marked by a noteworthy expansion of its range of services.

With revenues increasing at a rate of nearly 24%, the FRANCE Group maintained its frontrunning position on the French market for DP software services and – with a total workforce which will top the 2,000 mark in 1983 – continues to be placed among the country's groups showing the highest rate of job creation.

Achieved by the combined effort of all the FRANCE Group's employees, this expansion has been facilitated by a structure primarily characterized by its nationwide coverage, thanks to a network of Branches in close contact with our customers, with technical and marketing leadership exercised by the operational and administrative managements described in the following pages.

This growth could not have been consolidated, however, without the CAP GEMINI SOGETI Group's continuing concern for the transformation of services offered to match changes in market demand brought about by new technological advances.

In this regard, 1982 will go down as a crucial period during which the effort and investment of a number of years have given the FRANCE Group the chance to expand and develop its range of services. In particular, we might note:
● Our videography activity, which moved into a phase of very rapid growth with the success of the Electronic Directory project and the MULTITEL product range.
● The field of applications packages, with the design and fabrication of numerous "Standard Application Modules" (SAM).
● Achievements in industrial data processing, where the results of our research on artificial intelligence have played a key role.
● Expansion of training operations to include office automation.
● A wide range of microcomputer-based implementations in all fields of activity.

Naturally, this qualitative development is to be expanded and intensified in 1983. We shall spare neither imagination nor effort to meet our goal of remaining in the forefront of a rapidly-evolving market, thereby providing enhanced career opportunities for the members of our Group.

Alain LEMAIRE
President, FRANCE Group.

The FRANCE Group acts to implement all of CAP GEMINI SOGETI's software services and to market its software engineering and videographic products on the French market. It includes the following operational companies:

● CAP SOGETI LOGICIEL, covering the public and semi-public sector market, which it provides with consulting, software development and systems engineering services,

● CAP SOGETI SYSTEMES, providing identical services for the private sector and for banking institutions and insurance companies in the nationalized sector,

● CAP SOGETI FORMATION, specializing in training, recruiting and the organization of high-level seminars,

● CAP SOGETI EXPLOITATION, which provides consulting and training services in the field of DP system operation and carries out assignments involving the use of these systems.

# 1982 - FOUR STRIKING EVENTS

## MULTITEL TAKES OFF



*CAP GEMINI SOGETI's "MULTITEL" range of videotex processor centers meets the needs of organizations and corporations wishing to offer services based on the new videotex technology to their employees, their customers and the consumer public.*

*These services provide database inquiry and retrieval, electronic messaging, commercial and financial transaction handling, etc., without necessitating modification to existing DP appli-*

cations. Launched in 1981, the MULTITEL range has already proved a striking success, with products up and running at some 40 user sites. Some of 1982's major achievements:

• A significant number of "professional" references, particularly for banking, distribution and the publishing/newspaper industries:
– Banks: Crédit Commercial de France, Banques Populaires, Crédit Mutuel, Banque de Bretagne, Crédit Agricole, Crédit Indus-

triel de l'Ouest.
– Distribution: La Redoute, Les Trois Suisses, Darty, Mazda.
– Newspaper/publishing: Didot-Bottin, La Nouvelle République, La Dépêche du Midi, Le Provençal.

• The creation of MULTITRANS, in cooperation with Renault-Véhicules Industriels and Crédit Agricole de l'Isère. With this MULTITEL derivative, a videotex terminal can simulate a conventional data communications terminal.

• Finally, implementation of a "transport station" for BURROUGHS, now marketed by this manufacturer under the "Burrotel" label.

## LAUNCHING OF A CONCERTED RESEARCH AND DEVELOPMENT EFFORT

The France Group's Directorate of Research and Development (DRD), working through its Grenoble Research Center (GRC), has set up five research groups in cooperation with laboratories belonging to the National Scientific Research Center (CNRS), National Space Research Center (CNES), and National Institute for Data Processing and Automation Research (INRIA) and to the Universities of Chambéry, Grenoble, Toulouse and Paris. An introduction:

### Artificial Intelligence Group

Members of this group develop and experiment "expert systems" technology on real-life test cases. These systems, designed to reproduce human problem-solving behavior, fall within one of the most promising areas of artificial intelli-

gence. Nonetheless, a great deal of research and experimentation is still necessary before true systems, applicable in an industrial environment, will be achieved. Among this Group's projects, we note work on signal analysis, soil analysis and machine-shop scheduling.

### Natural Language Group

The Natural Language Group is developing techniques for natural-language analysis and synthesis, aimed toward applications for comprehension and translation of texts, natural-language database inquiry and resume generation. The GRC is also a participant, together with CNRS' GETA laboratory, in the ESOPE machine translation project.

### Industrial DP Systems Group

After having defined

– with the assistance of manufacturers and specialists in computer-aided production – the general organization desirable for an industrial system, this group has turned its attention to the development of tools – graphic interfaces, database management systems – and dedicated software modules for the general system. A discontinuous process control module and an expert system for shop scheduling assistance have thus been implemented within the framework of the "flexible shop" concept. Other modules – robot control, local area network interconnection of programmable controllers – will gradually supplement the system on its path to becoming a complete, coherent ensemble.

### Software Engineering Group

The GRC is participating, together with the

Grenoble Applied Mathematics Institute (IMAG), in the National Telecommunications Research Center's CONCERTO project for the definition, design and implementation of software engineering systems making use of new techniques for program representation and manipulation. These techniques are based on a tree-structured "internal representation" of programs and on an arsenal of tools working on this internal representation.

Work in progress, initially concentrating on the PASCAL language, should result in acceleration of the programming cycle and software production through the assembly of programs on the basis of tested, validated sub-trees.

### Computer-Aided Instruction Group

Working together with CEREP (a subsi-

diary of the Caisse des Dépôts et Consignations), DRD has developed a microcomputer-aided instruction system based on work by CNRS' IRPEACS laboratory. This product, LOVE, is now in the pre-marketing stage. DRD is also an active participant on TELEMAQUE, an interactive, integrated-media remote teaching system making use of recent advances in data processing and information technology (sound and image processing, interactive operation, natural man-machine interfaces, etc.).

## INTEGRATION OF EXPERIENCE COVERING A TARGET APPLICATION FIELD



*Taking the military field as an example, the France Group has carried out eight distinct implementation types; the following list clearly indicates the scope, diversity and complementary nature of work performed by the Group. The integration of this experience within CAP GEMINI SOGETI's implementing teams assures users of a high level of comprehension of problems and the ability to come up with solutions, regardless of the diversity of situations encountered and the complexity of resources available for their handling.*

• Technical and technological studies, e.g.,

for the Telecommunications Research and Fabrication Section's Automatic Language Translation System or Military Systems Production Method.
• Basic software, such as the production chain for a SNIAS spaceborne computer, the CLX compiler for SINTRA, or librarian monitors.
• Systems for aid to decisionmaking, such as the SDCM (controlled message distribution) system or the SYSIC command assistance system for the French Army's General Staff, implemented together with CIMSA for the SEFT. These command information systems combine networking,

electronic messaging, databases, display techniques, etc.
• Weapons systems such as the ATILA artillery system (target acquisition, automatic pointing and firing for self-propelled guns) and its export-oriented derivatives, or the MASURCA system (medium and high-altitude anti-aircraft defense) for the French Navy.
• Transmission systems and networks, such as the Navy's CRAID telegraph network and ARTIMON telex network.
• Real-time systems for test benches, training simulators (such as the PALMIER training packages for officers),

etc.
• Management systems, ranging from master plans (Roanne Arsenal) to complete personnel, inventory and ordering management systems, etc.
• Conversions, such as the conversion of Army Regional DP Center applications to CII-HB 66 (subcontracted by CII-HB), or the conversion for CIREM (Interservice Electronic Intelligence Center).

Present in all areas of military data processing, CAP GEMINI SOGETI also acts as a permanently-available source of knowhow, particularly useful in view of the rapid rotation of many specialist categories of mili-

tary or civilian armed forces personnel.

## OPERATIONS: GROWTH AND DEVELOPMENT

CAP SOGETI EXPLOITATION expanded its activities on both the geographic and technical levels during 1982. While the share of its activity devoted to the operation of DP centers is continuing to grow, the company is also actively participating in the changes marking DP center management and procedures. In an initial stage, changes in a DP center's production resources and procedures might be reflected in an organizational effort aimed at keeping down workforce numbers and improving the utilization of existing equipment.

In a more or less long-term view, how-

ever, this development must result in genuine industrialization. Automation of production leads to both a standardization of operational tasks and reinforcement of operational logistics.

The purpose of industrialization is to transform the DP center's organization from a "handicraft" or semi-evolved form into a veritable industrial process. Its consequences: a relatively far-reaching change in the operational skills involved. In this development, CAP SOGETI EXPLOITATION is determined to play a pioneering role in the field of automation, in terms of conceptual ap-
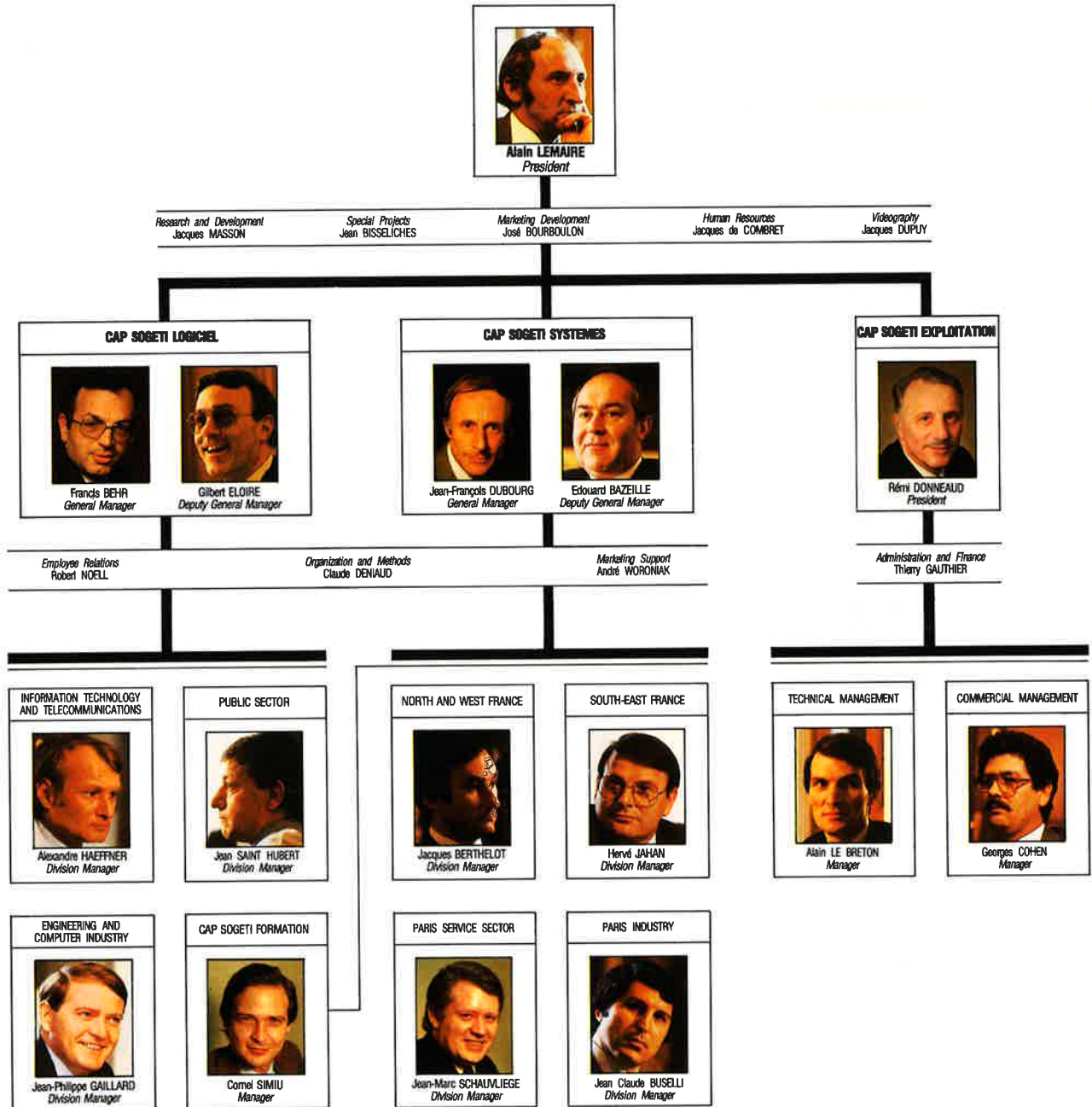
proaches to the problem, the technical profiles of specialists, and the use of dedicated aids such as "automata".

In another field attracting much industry attention, CAP SOGETI EXPLOITATION is also actively present in the implementation of DOS/MVS migrations using the France Group's new conversion technology.

CAP SOGETI EXPLOITATION also expanded on the geographic plane during 1982. A new company, CAP SOGETI EXPLOITATION S.A., was established in Geneva.

# ORGANIZATION OF THE FRANCE GROUP: AT 1 APRIL 1983

## FRANCE GROUP ORGANIZATIONAL CHART

**Alain LEMAIRE**
*President*

Research and Development — Jacques MASSON
Special Projects — Jean BISSELICHES
Marketing Development — José BOURBOULON
Human Resources — Jacques de COMBRET
Videography — Jacques DUPUY

### CAP SOGETI LOGICIEL

**Francis BEHR** — *General Manager*
**Gilbert ELOIRE** — *Deputy General Manager*

Employee Relations — Robert NOELL

### CAP SOGETI SYSTEMES

**Jean-François DUBOURG** — *General Manager*
**Edouard BAZEILLE** — *Deputy General Manager*

Organization and Methods — Claude DENIAUD
Marketing Support — André WORONIAK

### CAP SOGETI EXPLOITATION

**Rémi DONNEAUD** — *President*

Administration and Finance — Thierry GAUTHIER

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**INFORMATION TECHNOLOGY AND TELECOMMUNICATIONS**
Alexandre HAEFFNER — *Division Manager*

**PUBLIC SECTOR**
Jean SAINT HUBERT — *Division Manager*

**NORTH AND WEST FRANCE**
Jacques BERTHELOT — *Division Manager*

**SOUTH-EAST FRANCE**
Hervé JAHAN — *Division Manager*

**TECHNICAL MANAGEMENT**
Alain LE BRETON — *Manager*

**COMMERCIAL MANAGEMENT**
Georges COHEN — *Manager*

**ENGINEERING AND COMPUTER INDUSTRY**
Jean-Philippe GAILLARD — *Division Manager*

**CAP SOGETI FORMATION**
Cornel SIMIU — *Manager*

**PARIS SERVICE SECTOR**
Jean-Marc SCHAUVLIEGE — *Division Manager*

**PARIS INDUSTRY**
Jean Claude BUSELLI — *Division Manager*

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### Main branches and their Managers

#### CAP SOGETI LOGICIEL

**Information Technology and Telecommunications Division**
- Telecommunications
Jacques TIXERANT
- Terminals and Telephone 1
Jean ROCHET
- Terminals and Telephone 2
Jean ROCHET (acting)
- Space
Jean Loup BOUDINEAU
- Rennes Information Technology Center
François RIAS

**Public Sectors Division**
- Military Agencies
Christian GALLIN
Deputy Division Manager
- Army
Jean-Marie BARRE
- Air Force, Navy, Missiles
Michel COFFY
- Civilian Agencies
Jean-Louis BOUR
- Public Corporations
Guy PEUCELLE

**Engineering and Computer Industry**
- DP Manufacturers
Jean TASSON
- Engineering
Denis SERGENT
- Automation
Alexandre LEVY

#### CAP SOGETI SYSTEMES

**Paris - Industry Division**
- Industry 1
Jean-Pierre REY
- Industry 2
Jean-Pierre FOUSSIER
- Industry 3
Théodore KLOCANAS

**Paris - Service Sector Division**
- Banking 1
Bernard SARRAZIN
- Banking 2
Christian CHEVALLIER
- Insurance
Jean-Luc CHATEAU
- Services
Jean-Michel ROY
- Consultants
Alain SARRAZIN

**North/Southwest Regional Division**
- Bordeaux/Toulouse
Paul CHAFFARD
- Lille-Industry
Marcel de TAEVERNIER
- Lille-Service Sector
Bernard LEUBA
- Mulhouse
Raymond PAWLOWSKI
- Nancy
Bornard REGNAULT
- Nantes/Rennes
Bertrand de TROGOFF
- Orleans
Jean-Michel PARMENTIER
- Rouen
Philippe de BEAUCHAMP

**Southeast Regional Division**
- Grenoble
Patrick BARBEROUSSE
- Lyons 1
Christian SOUCHON
- Lyons 2
Jean-Pierre PANDIN
- Marseilles
Jean-Marie LAVASTE
- Montpellier
Francis MORRA
- Nice
Charles-Henri LIMOUSIN

#### CAP SOGETI FORMATION
- Collège Informatique
Cornel SIMIU
- DP Training
Jacques DENIE
- Office Automation Training
Jacques SCHMITTE
- CAP SOGETI SELECTION
Any BOULADE

#### CAP SOGETI EXPLOITATION
- Branch 1
Jacques AUGER
- Branch 2
Jacques MONS
- Branch 3
Luc-François SALVADOR
- Branch 4
Jean-Marc BY
- Branch 5
François NEANT
- French-speaking Switzerland
Claude BUGEY

**STAFF MANAGEMENTS**

The Branches and Divisions of the four France Group companies – see opposite for general organizational chart at 1 April 1983 – are backed by the five administrative managements described in the following paragraphs. Each in its specific field, these managements also provide the coordination required for coherence and cohesion between the Group's operational units.

**RESEARCH AND DEVELOPMENT MANAGEMENT**

This agency defines research policy, orients research activities by the France Group's research centers, itself investigates new software technologies and implements experimental systems. This Management is also responsible for transfers of knowhow within CAP GEMINI SOGETI so that positive, usable research results can be applied to customer projects as speedily as possible.

It should be noted that CAP GEMINI SOGETI's research centers work hand in hand with France's universities, public and private research institutes and major industrial corporations.

**MARKETING DEVELOPMENT MANAGEMENT**

This Management assists France Group companies in gaining a clearer view – and a more thorough penetration – of their markets, and enhancing their own and the Group's images.

Continuously monitoring all marketing operations in France, the Marketing Development Management steps in wherever it sees an inadequacy or a deviation in the sales function: in such cases, its operation is one of simple coordination, together with a bit of statistical analysis.

Finally, this Management is responsible for general marketing operations (image enhancement, advertising campaigns, improvement of existing sales aids, creation of new tools), and it takes part in market studies, development of marketing strategy, and definition and launching of new products and services.

**SPECIAL PROJECTS MANAGEMENT**

When projects require substantial resource volumes or unusual technical capabilities, the Special Projects Management acts to mobilize required resources at the overall Group level, organizing them into task forces targeted on responding to an invitation for bids or implementing a promised system. For certain large projects, associations are also established with companies offering supplies which complement those of the CAP GEMINI SOGETI Group (such as standard or special hardware, in the case of turnkey systems).

**VIDEOGRAPHY MANAGEMENT**

The Videography Management is in charge of CAP GEMINI SOGETI's videographic product line, with the following target functions:
– draft the developmental program for the MULTITEL range and write specifications for new products,
– have new products fabricated by France Group branches, supervise production, accept initial copies and carry out first customer installations,
– define marketing policy and conditions and sales targets,
– aid France Group branches in achieving these targets, primarily by providing necessary training, furnishing direct assistance, constructing promotional tools and organizing industry-oriented or public events,
– with the aid of Group subsidiaries, promote export of MULTITEL technology by furnishing necessary specifications and assistance for adaptation to local operating conditions.

**HUMAN RESOURCES MANAGEMENT**

The Human Resources Management concentrates its efforts on managers who are themselves directly and fully responsible for their subordinates. Its primary task is the selection of future managers: 122 candidacies were examined in 1982. It trains managers to take the human dimension of their profession into account: eight seminars bringing together 85 participants.

It works for acceptance and use of a system for evaluation of high-level executives; it examines and proposes areas of motivation and incentive (opinion surveys, salary policy, etc.); and it turns an attentive ear to one and all, striving to mesh individual wishes with the career opportunities offered by the Group's development.

*Besides consulting in the development of software and systems engineering, the France Group provides recruiting and training services and organizes high-level seminars.*

**COLLEGE INFORMATIQUE**

*The state of the art in data processing: this is the preserve of CAP GEMINI SOGETI's Collège Informatique, which each year organizes a number of high-level seminars designed to bring participants up to date on selected key areas of the DP activity.*

*Condensed and information-packed, these seminars – generally lasting two days – are aimed at DP managers and their direct subordinates.*

*Seminars organized by the Collège Informatique in Paris and other European cities during 1982 brought together some 190 well-known speakers, universally recognized in their respective fields.*

*Among the most successful seminars during 1982, we mention:*
● *Electronic mail: state of the art and prospects*
● *Software engineering: what you can expect from it*
● *Local area network: the next five years*
● *Distributed databases: state of the art*
● *Infocenter: strategic choices and techniques*
● *Computer-aided production: state of the art*
● *How to negotiate the best DP contract*
● *Network administration: methods, tools, techniques*
● *Relational databases: current achievements and prospects*

**RECRUITING**

*Thanks to its twin capabilities – in data processing and psychology – CAP SOGETI SELECTION offers solutions to match the precise requirements of DP users.*

*CAP SOGETI SELECTION carries out either one-shot operations or complete recruiting programs, using the following conventional sequence: analysis of position, definition of recruiting budget and selection of media, resumé-based preselection, graphological analysis and psychotechnical evaluation, psychological interview, technical interview, summary and presentation of selected candidates.*

# THE EUROPE GROUP

With the recent integration of CAP GEMINI ESPAÑA, the EUROPE Group embraces all of CAP GEMINI SOGETI's European subsidiaries outside of France, with a workforce exceeding 850 people: working through 29 local branches, distributed among 9 companies, active in 10 countries.

The Group's substantially-decentralized, multinational network for DP services catering to differing languages, customs and cultural and technical contexts is at once the wealth and the challenge which has nurtured its growth on the basis of a clear set of principles:
- adaptation to local markets through individual, national subsidiaries and branches, staffed with locally-recruited managers and professionals capable of meeting customer needs in harmony with local requirements, rules and practices;
- support from the Group's international resources through the exchange and pooled use of knowhow on techniques, management methods and training programs, in order to make the Group's combined resources available to our customers;
- a policy of independence, guaranteeing that our services take professional considerations only into account, to the exclusion of any other factor;
- a policy of professionalism, through specialization in software development and a continuing search for improvement of our methods and tools, enabling us to offer the highest possible quality and reliability and the best quality-price ratio to our customers;
- unceasing alertness to new techniques and applications, reflected in the establishment of Skill Centers at a number of points in Europe, tasked with adapting to our customers' changing needs in the light of recent technological developments.
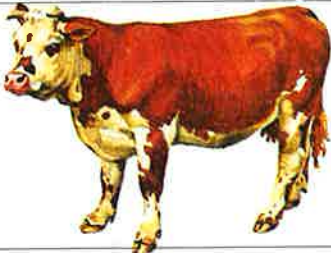
These fundamental principles are unshakable, regardless of any superficial disparaties which might be caused by the variety of cultures and techniques within the EUROPE Group as a whole. We are proud of our past results, borne out by the continuing and growing confidence showed by our customers throughout Europe, and we will continue to do our best to make service characterized by its reliability and extremely high quality available to the European market.

Christer UGANDER
President, EUROPE Group.

| BRA (SWEDEN) | CAP GEMINI BELGIUM | CAP GEMINI DEUTSCHLAND | CAP GEMINI ESPAÑA | CAP GEMINI NEDERLAND | CAP GEMINI SUISSE |
|---|---|---|---|---|---|
| Kaj GREEN *General Manager* | Jean MILAN *General Manager* | Kaj GREEN *General Manager* (acting) | Philippe DANGLADE *General Manager* | Chris Van BREUGEL *General Manager* | Werner ZÜLLIG *General Manager* |

| DATA LOGIC (NORWAY) | IAL GEMINI (U.K.) | PANDATA (HOLLAND) |
|---|---|---|
| Kai MARTHINSEN *General Manager* | Jeff ENGLAND *General Manager* | Aad UIJTTENBROEK *General Manager* |

| Country / Branch | Managers | | | | |
|---|---|---|---|---|---|
| **Germany**<br>**CAP GEMINI DEUTSCHLAND** | • Düsseldorf<br>Werner BONGARTZ<br>• Munich<br>Klaus FEKETE | A recent international study has shown that 16% of all data processing expenditure goes into converting systems to upgraded or different computers. CAP GEMI-NI DEUTSCHLAND is rapidly winning a reputa- | tion as *the* German conversion specialist. The Preussische Elektrizitäts Werke is presently its client for a major conversion covering 482 programs containing 460,000 lines of code. The CAP GEMI- | NI DEUTSCHLAND team is using automatic translators developed by DASD. The German company has also launched an associated conversion product of its own — IN-FOLIB — that automates | most of the essential information-gathering at the study stage of the project. |
| **Belgium**<br>**CAP GEMINI BELGIUM** | • Brussels 1<br>Jean MILAN (acting)<br>• Brussels 2<br>Jan PETERS<br>• Antwerp<br>Robert MALONGRE | The Belgian steel group, Cockerill, has made CAP GEMINI BELGIUM prime contractor for the core of a computerized automatic control system for a new cold-rolling line at its Jemeppe/Liège plant. This new rolling tech- | nique (Howaq process), based on continuous sheet heating and quenching in boiling water, requires absolute accuracy in line control. The system makes use of two minicomputers. The first, in liaison with the computer center, handles information | entered by line foremen. The second supervises the physical sequence of operations by processing information captured by microprocessors installed directly on the rolling line. | |
| **Spain**<br>**CAP GEMINI ESPANA** | • Madrid<br>Philippe DANGLADE |  | LACTARIA ESPA-ÑOLA S.A. is the largest holding company in Spain's dairy food sector. It consolidates six companies and over 20 dairy centers scattered throughout the country; its 1981 consolidated revenues totalled nearly 2 billion dollars l. The group requested | CAP GEMINI ESPAÑA to conduct an audit of its DP department and a study of problems posed by decentralization. As a result of the audit, carried out using CAP GEMINI SOGETI methodologies, called for drafting of a DP plan at the holding company level. This plan | is currently being developed with the assistance of CAP GEMINI ESPAÑA. |
| **United Kingdom**<br>**IAL GEMINI** | • North<br>Gerald PLIMBLEY<br>• Special systems<br>Phil BENTON | The major dedicated computer system implemented by IAL GEMINI on behalf of Sussex Police is in full operation at the Force's Lewes Headquarters. The system is part of a re-equipment program undertaken by the Force enhancing its control- | room operations and generally updating its computer and communications facilities. This full turnkey implementation, to time and to budget, for one of the U.K.'s larger county Forces, further reinforces IAL GEMINI's record of success as lea- | ding supplier in this highly important field of activity. |  |
| **Norway**<br>**DATA LOGIC** | • Oslo<br>Svein WEINHOLDT<br>• Province<br>Per ROSENKILDE<br>• Special systems<br>Viggo TRANGERUD | A relational database allied to new computing equipment has in a few months transformed the work of insurance clerks at NJGB, the company providing risk coverage for 27,000 employees of the Norwegian state railways. It was conceived by NJGB DP managers | Arne Nilsen and Harry Binderø and designed and implemented on the IBM 38 equipment by a Data Logic team of the Oslo branch IBM unit. Five main sub-systems are involved: motor vehicle policies, building policies, accident and fire claims and a wages system. | The new system replaces painstaking and repeated access to card files and old fashioned ledgers with a single entry into an IBM terminal which answers in less than a second. | |
| **The Netherlands**<br>**CAP GEMINI NEDERLAND** | • West<br>Hans BOOM<br>• Center<br>Chris Van BREUGEL (acting)<br>• South/East/Training<br>Vrisou VRISOU VAN ECK |  | The Royal Dutch Navy has assigned the Rotterdam branch of CAP GEMINI NEDERLAND complete responsibility for the implementation of an important logistics system which will cover the reordering, purchasing and distribution of hundreds | of thousands of spare parts and supplies in general, excluding food. The system is based on one central mainframe, some thirty minicomputers and 150 terminals which will give on-line facilities to users at different locations throughout the Netherlands. | Representing a 75 man-years' development effort, this system-for which CAP GEMINI NEDERLAND carried out the preliminary study in 1980 – is expected to be completed by 1986. |
| **PANDATA** | • Rijswijk<br>Piet ADRIAANSSE<br>• Amsterdam<br>Peter BUISMAN<br>• Zwolle<br>Ron LAVALETTE<br>• Eindhoven<br>Ton CASPERS<br>• Training<br>Peter VAN DE RAADT | Apart from the CAD/CAM systems required for aircraft design and production, a company like FOKKER in Holland needs to keep track of millions of maintenance data and configuration data on more than 800 Fokker civil short-haul airliners now flying. | Computer Aided Product Support (CAS) includes commercial, maintenance and technical airframe information and it services major product support activities. PANDATA has been helping FOKKER meet these and other informa- | tion demands for many years. Most recent projects in which PANDATA has been involved include:<br>• A technical system for management of aircraft test data.<br>• The FOKKER central documentation system (FDBS) | • The Computer Aided Product Support, the Commercial System (CS) and the Technical Data Collection (TDC). |
| **Sweden**<br>**BRA** | • System products<br>Christer ABERG<br>• Application products<br>Leif BJORDELL<br>• Stockholm<br>Lars Olof NORELL<br>• South<br>Berndt OSMUND<br>• North<br>Lars SUNDBERG | Among the products manufactured by the SAAB-SCANIA corporation in Southern Sweden are military and civilian aircraft, whose construction demands an ability to calculate inherent characteristics at an early stage of design and manufacture. To achieve | this a mass of data needs to be collected and processed. BRA was commissioned by SAAB-SCANIA Aerospace Division to construct a database containing information on all aspects of the aircraft, reducing manual calculations to a mini- | mum and presenting mass data usefully and quickly. This project, planned and supervised according to BRA methodology, uses the relational database Oracle; it started in June 1982 and was completed recently. |  |
| **Switzerland**<br>**CAP GEMINI SUISSE** | • Basel/Bern<br>Walter WEISS<br>• Geneva<br>Victor GANI<br>• Lausanne<br>Alain MARECHAL<br>• Zurich 1<br>Erwin ESTERMANN<br>• Zurich 2<br>Arthur HOLENWEG | The Shell DP center in Zurich has recently completed a re-design and implementation of its fixed assets accounting systems, covering the whole of its activities in Switzerland. Shell gave the CAP GEMINI SOGETI company a free hand in choosing the methods to | be used in the implementation of this new IBM 38 system, which includes not only normal accountancy procedures but asset administration for such investments as tanks, trucks, etc. The Shell user department, already highly experienced in administrative computing, | worked closely with the CAP GEMINI SOGETI team to produce a system that integrated smoothly with others. CAP GEMINI SWITZERLAND used group project management methods, structured programming techniques and a quality assurance review to | bring to a successful conclusion this major project. |

# THE USA GROUP

After the creation of CAP GEMINI INC. – whose consultants work primarily for the Federal government – in 1978, and DASD's entry into the Group in 1981, the integration of SPIRIDELLIS & ASSOCIATES in 1982 marked the third stage in the growth of CAP GEMINI SOGETI's USA Group.

SPIRIDELLIS & ASSOCIATES supplements DASD's network of branches with a significant presence in New York and New Jersey, together with a degree of specialization in DP applications for large financial and industrial organizations.

1983 will witness completion of the fourth stage of this development – already substantially under way – by meeting the challenge posed in DASD's motto: "People, Products, Results". People: create a community of motivation and professionalism with the USA Group's 800 employees, and guarantee uniform attentiveness to user needs regardless of the type of service rendered, anywhere in the USA.

Products: supplement the three American companies' services and products (conversion tools, large project management and systems audit methods, training courses) with those offered by CAP GEMINI SOGETI's European companies, adapting them to American needs, and participate in developments carried out at the Group level.

Results: maintain a strong growth rate for the USA Group, while providing its customers with "results", thanks to the high quality of services and the value of operations performed.

Michel BERTY
President, USA Group.

## Main branches and their Managers

### DASD

| WESTERN REGION | MIDWESTERN REGION | SOUTHERN REGION |
|---|---|---|
| ● Denver | ● Chicago | ● Atlanta |
| Jerry J. BEATTY | John A. WOLOSCHEK | Robert J. MALPEDE |
| ● Los Angeles | ● Des Moines | ● Dallas |
| David A. MORGAN | Terry L. FRAZIER | R. Tim FLYNN |
| ● Portland | ● Detroit | ● Houston |
| LaVelle DAY | Gerald J. QUARTANA | Steve B. COFFMAN |
| ● San-Francisco | ● Indianapolis | ● Jacksonville |
| David R. CUTLER | David L. DENTON | William S. DIXON |
| Hartley CHELIN | ● Milwaukee | ● Tampa |
| ● Seattle | Gerald J. QUARTANA | John R. HAMON |
| David A. GANTT | ● Minneapolis | |
| | Terry L. FRAZIER | **EASTERN REGION** |
| | ● Saint-Louis | ● Baltimore |
| | Jon E. JENSEN | Robert M. VUOLO |
| | | ● Philadelphia |
| | | Keith E. RUECKEL |
| | | ● Pittsburgh |
| | | Richard E. SMITH |
| | | ● Washington D.C. |
| | | Leonard JACOBY |
| | | (acting) |

### SPIRIDELLIS & ASSOCIATES, INC.

**NORTHEASTERN REGION**
● New York
Ronald C. FOSTER
Mark HENKIN
Kert HERRMANN
James F. McSHANE
Clifford R. RADISCH
Mike SPIRIDELLIS
● Piscataway
Robert A. WARWICK
James J. RYAN

## Main staff functions

● Human Resources Development
Charles M. HARRISON
● Technical Development
Dan A. PARMAN
● International Sales
Roy A. JUDD

The USA Group includes 4 operational companies: DASD and SPIRIDELLIS & ASSOCIATES, whose branches are listed on the opposite page, CAP GEMINI INC. (Washington DC) dedicated to the federal government market, and CAP GEMINI SERVICES, also located in Washington DC, recently formed to serve the unique requirements of the Department of Defense and other government agencies engaged in security programs.

Morever, the USA Group works closely with VIDEOGRAPHIC SYSTEMS OF AMERICA, (a subsidiary of VS, of which CAP GEMINI SOGETI is a shareholder) to market broadcast and interactive videographic systems based on European technology.

## THE STATE OF MARYLAND

The State of Maryland is re-designing and programming its Medicaid Management Information System (MMIS). This system currently processes the medical claims for each Medicaid recipient in the State of Maryland. The re-design is required to meet revised Federal certification standards which, when met, will permit the State to continue receiving 90% Federal matching funds for the operation of the MMIS itself. The Baltimore branch of DASD Corporation is responsible for developing two of the six subsystems – Eligibility and Claims Processing – of this major re-design effort which is expected to take one year.

## CONTINUING SUPPORT



GARRETT AIR RESEARCH AVIATION Company, a leader in the general aviation marketplace, has relied on DASD's Los Angeles branch for general consulting services since 1979.

Major systems have been jointly developed, including OASIS, a cost accumulation and billing system for aircraft service centers; and GOAL, a business forecasting system. DASD is currently assisting this client in a major project to assess company-wide requirements and to evaluate available software packages for a distributed data processing network.

The life cycle of the project (including feasibility studies, cost benefit analysis, hardware evaluation and selection, etc.) was conducted using a structured design methodology.

## METROPOLITAN INSURANCE COMPANIES



METROPOLITAN Insurance Companies is a family of organizations providing a full range of life, health, disability, auto and homeowner's insurance, as well as retirement plans and related services.

With $ 57.5 billion in combined assets, METROPOLITAN is one of the largest insurers in the world.

In order to service its more than 47 million policyholders; and coordinate the work of field offices and sales representatives across the United States and Canada, METROPOLITAN uses an extensive array of hardware and software.

Spiridellis & Associates has assisted METROPOLITAN in several areas, including: business systems analysis, data base design, telecommunication programming/analysis, data base programming/analysis, data processing education etc.

## BOISE CASCADE

The paper group of BOISE CASCADE Corporation is currently engaged in the development of a system to ensure that management receives adequate information to manage the group efficiently. Specific emphasis is to be placed on the completeness, timeliness, accuracy, consistency, format and relevance of the information provided to group management. The project, known as Management Information Improvement Program (MIIP), is made up of five general teams: General Ledger, Budgeting Aids, Standard Costing, Sales Reporting, and Variance Analysis. The Portland branch of DASD has contributed significantly to the functional design and has assumed responsibility for a major portion of the systems design and programming support providing a total of 15 people (including subproject leaders, systems analysts, etc.) working in concert with Boise Cascade personnel. DASD's involvement began in October 1981 during the early phase of this project, expected to be completed during the first quarter of 1984.



## THE DEPARTMENT OF EDUCATION



The Department of Education, considering the interest of automating their administrative tasks, has awarded CAP GEMINI Inc., Washington, a study to assess that agency's need to introduce automated systems into their office environment and to determine if office automation technology can be cost effectively implemented.

The types of systems under consideration for implementation include those which provide professional staff support and word processing as well as those which use specialized technology to augment standard system components. The six specialized technology areas specified for potential use at the Department of Education are: micrographics, optical character recognition equipment, dictation equipment, intelligent printer/copiers, and electronic mail.

## AMERICAN BELL



AMERICAN BELL is one of the newly created subsidiary companies associated with American Telephone and Telegraph. Through the creation of this new subsidiary company, and pending FCC approval, AMERICAN BELL will assume the current leases on all the telephone and telephone-related equipment of the divested BELL system operating companies that currently exist in residences and businesses throughout the United States.

DASD Corporation's Tampa branch is participating in the development of business-related data processing systems to support the addition of these assets, roughly estimated at $ 11 billion, to American Bell.

These will involve a combination of system modification, new development and package installation. DASD Corporation is providing project leadership, system analysis, programming and database administration support.

## TIME INSURANCE

TIME INSURANCE, a major life and health insurer and part of NV AMEV, a Dutch financial services concern, faced a peak of activity in 1982, particularly in the area of new products development, to meet the needs of a three-year business plan designed to make the company more competitive. It was estimated a three-fold increase in staff would be required and DASD provided up to 23 people at one point.

Specifically, DASD has been associated in the systems analysis and the development of a new portfolio of disability insurance as well as that for a new major medical portfolio. In addition DASD carried out the programming for an annuity program associated with TIME's traditional insurance protection, and entirely implemented a new system that will provide salesmen with automated proposals for the new insurance products of the company.

## BENDIX CORPORATION

BENDIX Corporation is a large and diversified American industrial concern with aerospace, automotive and machine tool businesses. One of their automotive-related companies, the Friction Materials Division (FMD), asked the Detroit branch of DASD to help with a major conversion as the company expanded and upgraded its information systems to meet the needs of a long-range business plan.

By using a combination of DASD conversion tools, conversion methodology and personnel with their own staff, the FMD conversion progressed more smoothly than expected, staying within budget and on schedule.

# THE DEVELOPMENT GROUP

Initiation of new activities, opening of new markets, export of the Group's products and services, maintenance of cooperative ties between the Group and associated companies in which it does not have a majority shareholding: these are the tasks and responsibilities of the DEVELOPMENT Group.

Activities in support of this mission during 1982 might be illustrated by a handful of striking events and achievements:

● the software engineering workshop designed by CAP SOGETI INSTRUMENTS was officially inaugurated in France on 2 June 1982, an event widely reported in the press. Over 100 workstations had been installed before year's end, and emphasis should be placed on the fact that the MULTIPRO system is generating a very lively interest among DP users. A major development and marketing program has been launched to prepare for MULTIPRO exports, particularly to the USA;

● the creation of Vidéographie Systèmes and its wholly-owned subsidiary, Videographic Systems of America, a move involving the very substantial participation of CAP GEMINI SOGETI. These two companies, which have taken over the activities of ALPHATEL, are receiving technical and marketing support from our Group in the USA. The Group is also a shareholder in VS and, together with STERIA, is the company's exclusive supplier of videographic systems;

● the Group's acquisition of a 35% interest in the share capital of our competitor, SESA, with whom active cooperation is to be developed in all areas where a combined effort will prove more profitable than separate activity;

● the Group's data entry activities have been sold off to a company specializing in this field, now by far France's largest supplier of data entry services. As CAP GEMINI SOGETI's rapid growth is taking place in a market characterized by continuing technical change and development, this divestiture reflects the Group's wish to devote the entirety of its management resources to its software service activity.

Finally, by creating a Technological Development Management at the overall Group level at the end of 1982, CAP GEMINI SOGETI has materialized its intent to place increased emphasis on advanced technologies, in order to make the most of the Group's internal synergism and seek out opportunities for the creation of new activities.

Michel JALABERT
Vice President, Corporate Development

## MAIN MINORITY INTERESTS MANAGED BY THE DEVELOPMENT GROUP

| | *CAP GEMINI SOGETI Investment* |
|---|---|
| Groupe BOSSARD S.A. | 49 % |
| SESA S.A. (Société d'Études des Systèmes d'Automation) | 35 % |
| Vidéographie Systèmes | 13 % |
| ISMA (Infotecture, Services et Management) | 35 % + 14 % Groupe BOSSARD |

## CAP SOGETI INSTRUMENTS

Chairman:
Jacques Lescault
President and Chief
Executive Officer:
Jean-Paul Figer
Sales Manager:
Jean-Claude Micheau-
Maillou
Technical Manager:
Jean-Marc Ponthus

Since its founding in January 1982, CAP SOGETI INSTRUMENTS has been tasked with the design, development and distribution of the Group's program products and its MULTIPRO software engineering workshop.

Profiting from fifteen years of work by CAP GEMINI SOGETI teams specializing in the industrialization of software fabrication, these products and systems can be classified in three categories:

● Tools for software development centers. Used by DP professionals, these aids are oriented toward increased productivity combined with enhanced software quality. Examples include CPL1, MULTI-LIB, ADOC and MULTIPRO.

● "Infocenter" tools, enabling non-professional users to solve relatively simple problems: SYSIF and MULTISYSIF are typical products.

● Productivity-enhancing program products for DP center operations such as STARTER and SYNCSORT.

The MULTIPRO software engineering workshop is built around the MGL10, 20 and 40 development machine range, acting to support interactive production and updating of programs and associated documentation for one or more implementing teams. This includes: TGL workstations, offering a microprocessor-based local processing capability, and IGL printers with graphic capability, connected to workstation terminals or the development machine.

Thanks to its methods and tools, MULTIPRO can perform all functions required for assistance to development and maintenance of all types of software (management, computer-aided production, office automation, scientific applications, etc.) on many CII-HB (Mini 6, DPS 7, DPS 8), and IBM (43XX, 30XX) target machines and microprocessor development systems.

With its exclusive GraphiXstructuré (R) feature, MULTIPRO can create, manage, update and print out all information generated during a software product's life cycle (text, code, programs, drawings).

Since its official unveiling in June 1982, MULTIPRO has shown an initial market success and is being used increasingly within the CAP GEMINI SOGETI Group for both conventional management applications and large projects such as the Electronic Directory, TELECOM 1 and videographic systems development.

## VSA

President:
Bernard Joseph
Vice President,
Sales and Operations:
Hubert Stijns
Vice President,
Marketing:
Gregory W. Harper

VSA is a subsidiary of Vidéographie Systèmes (VS), in which Thomson-CSF is the majority shareholder (with 51%), while CAP GEMINI SOGETI, with a 13% investment, is one of the main owners. VSA was created specifically for the development, marketing and installation of videographic systems in North America.

These include professional videotex systems of the MULTITEL type; and teletext systems, such as the one now being implemented for the giant TV network, NBC, which will generate information magazines for broadcast by the network's affiliated stations.

CAP GEMINI SOGETI's contribution to VSA's activity includes:

● its capabilities in the videotex and teletext fields, acquired during the course of many operations carried out in cooperation with CCETT (Joint Telecommunications and Television Research Center), in developing its own MULTITEL videotex processor range, and in prime contracting for France's Electronic Directory system,

● its association with Steria within the VIDEONET consortium, assembling and adapting the software products developed by both firms,

● its substantial presence on this market: with its 800 professionals working out of 23 of the country's largest cities, CAP GEMINI SOGETI's USA Group is one of the very few suppliers capable of guaranteeing a solid future availability of its systems consulting, implementing and maintenance services over the entire North American continent.

## SESA

Chairman:
Jacques Arnould
General Manager:
Michel Fievet

Specialized in telecommunications systems, SESA has already developed and sold network switching systems in 26 countries. The company's 1982 revenues totalled FF 470 million, with a workforce of some 1,200 people.

Among its major achievements in the telecommunications and information technology fields, we note:
● turnkey fabrication of packet-switching networks: TRANSPAC, for the French General Telecommunications Directorate; EURONET, which enables users in the nine EEC countries to access some 100 database services; HERMES, for the International Railroad Union, etc.;
● supply of public data transmission networks in a number of countries, including Australia, Brazil, Luxembourg and New Zealand;
● development and marketing of DPS 25, SESA's packet-switching product, forming the basis for the public and private networks that it installs worldwide;
● development of one of the two prototypes for the French Electronic Directory system, and participation in the nationwide expansion of this system as a member of the consortium led by CAP GEMINI SOGETI.

Besides this field of concentrated expertise, SESA's activities also extend to prime contracting for large projects, supply of management products – particularly for small business applications (management systems for warehousing, real-time production, marketing and accounting operations, etc.) – and development of special systems (military and law-enforcement systems, major government applications, etc.).
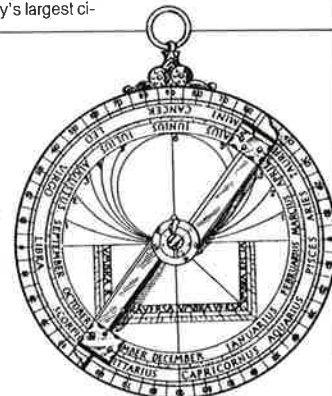


## GROUPE BOSSARD

Chairman:
Jean-René Fourtou
Vice Chairman:
Jean-Pierre Auzimour
Financial Director:
Georges Goury

Groupe BOSSARD is a group of companies specializing in management consulting. With revenues of FF 175 million and a workforce numbering approximately 350, it holds a dominant position in its field in Europe.

Group BOSSARD's 1982 activities were primarily marked by two events:
● establishment, in January, of a consulting subsidiary, BOSSARD PERMAL CONSULTANTS, INC., in New York.

While the initial purpose of this company – led by President John Rich – was to assist French firms wishing to start up activities in the United States, BOSSARD PERMAL CONSULTANTS has already begun to establish an American customer base.

As BOSSARD CONSULTANTS ITALIE has also built up a solid reputation, while the Group's Madrid and Barcelona agencies are continuing to grow, BOSSARD CONSULTANTS' international move is progressing smoothly.
● reinforcement of the Group's "communication" activity, primarily on two fronts:
– creation of CMBA – the Group's second agency, after France 1 – specializing in marketing and advertising in the health field, and confirming BOSSARD CONSULTANTS's front-running position in this sector (further strengthened by the acquisition of FARMED, an agency carrying on a similar activity in Spain).
– establishment of Information & Stratégie, a communications consulting and engineering firm, at the end of 1982. The goal of this new team, led by President Etienne Giudicelli, is to establish a firm foothold in the new field of strategic corporate communications.

Groupe Bossard deals regularly with:
● 6 of Europe's 20 largest groups,
● 10 of France's 20 largest groups, and 30 of the country's "top 100".
Among its customers:
● ENI, ELF AQUITAINE, CDF Chimie, RHONE POULENC, ROUSSEL UCLAF,
● CARREFOUR, GB INNO BM, PRIMISTERES,
● RENAULT, PEUGEOT S.A.,
● GENERAL MILLS, SOPAD, ROWNTREE MACKINTOSH,
● CREDIT LYONNAIS, CREDIT AGRICOLE, BARCLAY'S BANK,
● and of course CAP GEMINI SOGETI.



## CSB BUREAUTIQUE

President:
Jean-François Dubourg
General Manager:
Denis Ettighoffer

Supported by the resources and the strong international organization of CAP GEMINI SOGETI and Bossard Consultants, CSB BUREAUTIQUE's objectives are to advise and assist business and government in the development of their office automation systems, by optimizing available technical, economic and human resources. In each of its assignments, the company makes a special effort to take the psychological and social ramifications of office automation into account.

To achieve these goals, CSB BUREAUTIQUE bases itself on tested methods, permitting:
● preparation for office automation by sensitizing and training operations tailored to each customer's needs,
● identification and analysis of requirements, using an Office Automation Action Plan, designed to define the customer company's strategy, evaluate possible forms of organization, select the most suitable of these, and identify managers capable of preparing for and putting through the operation,
● promotion and implementation of office automation in business and industry, particularly through the installation of office automation systems proper and their appropriate operating procedures, while creating conditions for their optimal exploitation by the various user categories concerned.

## OVERALL WORKFORCE TRENDS

As of 31 December 1982, the Group's workforce numbered 3,995, including some forty people belonging to the holding companies (see graph 1), representing a moderate growth – about 12% – since the preceding 31 December 1981.

The software services and information engineering activities, now the Group's virtually exclusive working domains (see graph 2), have shown significant expansion, with an increase of 447 professionals for a growth exceeding 14% in just one year. This growth showed an uneven distribution:
- moderate for France, with 144 new jobs (+8.1%),
- low for Europe (although the preceding two years were marked by a substantial increase in workforce),
- very high in the USA, with 294 new people (181 of them accompanying the entry of Spiridellis & Associates, Inc. into the Group in May 1982).

The CAP GEMINI SOGETI workforce showed the following geographic distribution at 31 December 1982:
- France    : 2,291
- Europe   :   846
- USA      :   820

The trend toward equilibrium between "French" and "non-French" employee numbers gained momentum (with the "French" proportion of total workforce diminishing from 61.5% to 57.9% in one year) and should continue during upcoming years.

## CAP GEMINI SOGETI: A VECTOR OF SUCCESS FOR PROFESSIONALS

The Group's success is inseparable from that of the men and women of whom it is composed, from the development and enrichment of their individual energies within the context of the cultures, customs and laws of the countries in which the Group is active. This is why CAP GEMINI SOGETI, while allowing substantial independence of action – particularly in the social sphere – to each company, applies a well-defined, ambitious policy of employee growth and development, enabling Group members to satisfy their wishes for personal advancement and to make lucid and effective preparations for their futures.

CAP GEMINI SOGETI has based this policy on:
- **rules for employee recruiting** which, while providing a stringent definition of required technical capabilities for each job opening, favor those candidates best equipped for a career in a large information engineering company, i.e., those showing creative imagination, a taste for effort, ambition, etc. The Group considered 5,300 applications in France alone, and hired 585 new employees for its own needs during the year;

- **a training policy** which – in accordance with modalities which might differ from one country or company to another – guarantees continuing, individualized instruction to each employee, as a function of his or her experience and probable career development. In the France Group companies, for example, the Individual Training Plan includes a segment common to all employees, personalized segments and (also personalized) combined training, all scheduled over a number of years. The cost of this training represents from 3.2% to 5% of the total wage bill, depending on company;

- **technical quality requirements** satisfied by the systematic use of working methods and aids which ensure the level of professionalism now indispensable to information engineering activities. But the quality of the Group's services is not due solely to its methodological inventory (DIALOG, SDM, MULTIPRO software engineering workshops, etc.): it is also achieved thanks to the experience of project managers, to the supervision and assistance granted by Branch and Division technical officers, to the systematic auditing of large projects and complex systems. The significance attached by CAP GEMINI SOGETI to technical quality is illustrated by the fact that – in contrast to the customary situation in service companies – over one-fourth of the Group's highest-salaried positions are technical ones.

- **promotion principles** the unceasing expansion of the information engineering activity is offering exceptional career opportunities to all those engaged in this profession. Whenever there is a new position to be filled, however, CAP GEMINI SOGETI does not turn to outside recruiting until it has made sure that an existing employee cannot be appointed to the opening.

The results of this policy?
- 863 promotions were granted during 1982 (227 in Europe, 636 in France) (see graph 4);
- of the 49 Branch Managers in French subsidiaries, 15 began as engineers, 7 as sales engineers and 6 as operators, programmers or analysts;
- 12 of the 50 members of the Group Steering Committee started out as technicians, programmers or engineers.

Added to these four basic axes of CAP GEMINI SOGETI's policy for employee development are:

- **the Group's principles of information,** providing employees with numerous opportunities for contact with colleagues and with technical and general information on the Group's results, goals and strategy (welcome brochure, in-house bulletin boards, COGITAS, the magazine published by the Group's Communications Department, the Annual Report, etc.);

- **the Group's policy of geographic expansion:** as of the end of 1982, the Group maintained permanent technical and sales positions in 80 cities worldwide, while scores of localized and temporary assignments gave personnel the opportunity of meeting new countries, new customs and new techniques.

Finally, we note that men and women enjoy these career opportunities without discrimination. The proportion of women in the Group's information engineering workforce is increasing steadily, with women now holding 19.45% of positions in Europe (in contrast to 15.6% in 1978) 21% in the USA and 25.4% in France (vs. 19.8% in 1978).

| Overall workforce growth in the CAP GEMINI SOGETI Companies as at 31 december (excluding holding companies) | Breakdown by workforce activity type in CAP GEMINI SOGETI Companies (in percentages) ▲ Software Services ■ Machine-based services | Geographic workforce distribution in the CAP GEMINI SOGETI Companies as at 31 december 1982 (excluding holding companies) | Percentages of promotions in Group consulting companies (France + Europe) |
|---|---|---|---|
| 3957, 3541, 3068, 2688, 2317 | 16,23  14,36  13,46  11,18  7,8 | 2291 (FRANCE), 820 (USA), 846 (EUROPE) | 24,50  35  31  32 |
| Graph 1   78 79 80 81 82 | Graph 2   78 79 80 81 82 | Graph 3 | Graph 4   79 80 81 82 |

# A CAREER WITH CAP GEMINI SOGETI

Information engineering has steadily evolved into a major profession with increasingly significant implications for individual and social life.

Information engineering now constitutes an impressively-expanding field of professional activity.

At the same time, CAP GEMINI SOGETI is progressively passing the milestones which mark the development of very large corporate undertakings.

The meeting of these two paths has led industry professionals to contemplate the feasibility of a career in our Group.

In the following, the CAP GEMINI SOGETI Human Resources Management answers some frequently-encountered questions on this subject:

**Q:** Does the expression "career plan" have any meaning in your companies?

**A:** *In an industry serving a highly-diversified and continuously-changing economic community, the ability to adapt to new circumstances is a vital one. As a result, our Group's career plan cannot be likened to a formal garden. Instead, it more resembles a mountain park, threaded with more-or-less unexplored paths and trails. Every one of them offers opportunities for learning, for self-discovery, for testing one's ability to meet challenges, for coming across new perspectives.*

*Everyone climbs at his own speed, matching his own abilities, experience and will. But our "mountaineering" metaphor does not account for market growth and our Group's own dynamism. These two phenomena give impetus in the direction of individual advancement and are an added factor in satisfaction of personal ambitions.*

**Q:** What resources do you offer your employees to enhance their self-understanding and self-improvement?

**A:** *Every manager pays close attention to his people's performance levels and professional behavior. We encourage managers to get together with each employee for discussion of his or her strong and weak points. We request them to devote special attention and a highly realistic outlook toward the aspect of the employee's job satisfaction, in harmony with his individual scale of values. This is just as important as technical capability. Finally, we reject any lack of frankness with regard to an employee's chances of advancement. This applies to the entire hierarchy, from top to bottom. Each individual's career evaluation is supplemented by a* personalized growth plan, in which a major place is held by training.

**Q:** Why is it to CAP GEMINI SOGETI's advantage to offer jobs which satisfy their holders?

**A:** *Because we need the motivation and personal involvement of all members at every level of the Group. It is our conviction that the stages toward the success of our business are based on the individual growth and development of our employees' capabilities. The Group will be imaginative, tenacious, aggressive, flexible and self-demanding because the people breathing life into it themselves possess these qualities.*

**Q:** How much mobility do you demand of your employees?

**A:** *We are sailing between Scylla and Charybdis. On the one hand, we are trying to avoid the Brownian movement prevalent in some organizations: jumping from job to job prevents the accumulation of capability, of experience and maturity. But we are also avoiding an immobility which certainly acts as a sclerotic factor, harmful to both the Group and its individual members.*

**Q:** Are salary expectations comparable for a technician and a manager exercising equal degrees of responsibility?

**A:** *In government and industry, there is generally a hierarchy scaled in accordance with level of command and authority. But "brainpower" — based industries are discovering the need to set up a parallel hierarchy, with stages defined in terms of knowhow and ability to grasp increasing technical complexity.*

*These two ladders offer parallel salary increments. As of the present, CAP GEMINI SOGETI includes a number of high-level professionals whose salaries match those of managers, and this phenomenon will progressively assume greater scope.*

**Q:** Depending on my wish to work in a large or small company, would you advise me to join your Group?

**A:** *If you like to perform a clearly-defined job backed by a ramified structure with great technical, geographic and economic diversification, you will be comfortable in a large concern like CAP GEMINI SOGETI, with all of the development and training it has to offer.*

*If you like to tackle a large number of varied problems and you wish to work closely with your superiors, you will find greater satisfaction in a small-company environment. The CAP GEMINI SOGETI Branch is just such an organization: it will allow you to participate in the course of events and to measure the effectiveness of your activity at close quarters.*

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# CONSOLIDATED FINANCIAL STATEMENTS
## AT DECEMBER 31, 1981 AND 1982

**CONSOLIDATED BALANCE SHEET AT DECEMBER 31,**
*(in thousands of U.S. dollars*

| ASSETS | 1981 | 1982 |
|---|---|---|
| **Current assets** | | |
| Cash | 16,164 | 13,500 |
| Accounts and notes receivable | 27,207 | 37,156 |
| Inventories | 33 | 11 |
| Taxes (note VII) | 3,743 | 3,398 |
| Prepaid expenses (note VIII) | 4,470 | 7,665 |
| Other current assets | 1,532 | 2,216 |
| | **53,149** | **63,946** |
| **Non current assets** | | |
| Goodwill (note IV) | 12,552 | 16,131 |
| Equity investment in affiliates (note V) | 1,594 | 6,267 |
| Unconsolidated investments (note VI) | 604 | 953 |
| Other non current assets | 844 | 913 |
| Property, plant and equipment, net (note III) | 4,812 | 5,638 |
| Other fixed assets (note III) | 640 | 1,830 |
| | **21,046** | **31,732** |
| **TOTAL ASSETS** | **74,195** | **95,678** |
| Guarantees given by third parties (note XIV) | 520 | 416 |

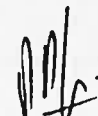| LIABILITIES AND SHAREHOLDERS' EQUITY | 1981 | 1982 |
|---|---|---|
| **Current liabilities** | | |
| Notes payable to banks | 9 | 413 |
| Current portion of long term debt and short term loans | 1,720 | 2,116 |
| Accounts and notes payable | 14,720 | 13,917 |
| Accrued liabilities (note XIII) | 12,922 | 18,081 |
| Taxes (note XII) | 3,774 | 6,007 |
| | **33,145** | **40 534** |
| **Non current liabilities** | | |
| Long-term debt (note X) | 8,563 | 12,134 |
| Employee profit sharing fund | 3,143 | 4,241 |
| Other non current liabilities (note XI) | 6,395 | 4,457 |
| | **18,101** | **20,832** |
| **Deffered income taxes** | **1,490** | **5,161** |
| **Minority interests** | **48** | **24** |
| **Shareholders' equity** | | |
| Common stock 442,000 shares of FF 100 each | 6,568 | 6,568 |
| Retained earnings at beginning of year | 8,460 | 14,907 |
| Shareholders' equity (note IX) | 15,028 | 21,475 |
| Net income for the year | 6,383 | 7,652 |
| **Total shareholders' equity and net income** | **21,411** | **29,127** |
| **TOTAL LIABILITIES AND SHAREHOLDERS' EQUITY** | **74,195** | **95,678** |
| Commitments and contingent liabilities (note XIV) | 1,053 | 1,452 |

## AUDITORS REPORT

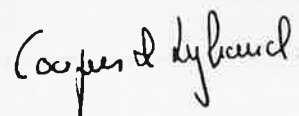To the shareholders and Board of Directors of CAP GEMINI SOGETI S.A.

We have examined the consolidated balance sheet of Cap Gemini Sogeti S.A. and its subsidiaries as of December 31, 1982, and the related statement of net earnings, stockholders equity and change in financial position for the year then ended all expressed in French francs. Our examination was made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We did not examine the financial statements of certain foreign subsidiaries, which statements reflect total assets and net sales constituting 9.0% and 9.3%, respectively, of the related consolidated totals for 1982. These statements were examined by other auditors in accordance with generally accepted auditing standards. Our opinion expressed herein, insofar as it relates to the amounts included for these foreign subsidiaries, is based solely upon the reports of other auditors. The consolidated financial statements of Cap Gemini Sogeti S.A. and its subsidiaries for the year ended December 31, 1981, were examined by other auditors. Their report dated April 9, 1982, was unqualified.

In our opinion, based upon our examination and the reports of other auditors referred to above, the consolidated financial statements referred to above all expressed in French francs present fairly the financial position of Cap Gemini Sogeti S.A. and its subsidiaries as of December 31, 1982, and the results of its operations, and the change in its financial position for the year then ended, in conformity with the statements of accounting principles as defined by the International Accounting Standards Committee (I.A.S.C.), applied on a consistent basis.

Paris, April 8, 1983

J. BOURGUIGNON          B. PUGNIET
          Statutory Auditors

COOPERS & LYBRAND
Auditors

## CONSOLIDATED STATEMENT OF INCOME FOR THE YEARS ENDED DECEMBER 31, 1981 AND 1982
*(in thousands of U.S. Dollars)*

|  | 1981 | | 1982 | |
|---|---|---|---|---|
| **REVENUE (excluding VAT) (note XV)** | Amount | % | Amount | % |
| Fees from services rendered | 117,177 | 95.9 | 146,527 | 96.0 |
| Manufacturing of program-products (note XVI) | 244 | 0.2 | 371 | 0.3 |
| Other revenue (note XVII) | 4,797 | 3.9 | 5,670 | 3.7 |
| **TOTAL REVENUE** | **122,218** | **100.0** | **152,568** | **100.0** |
| **OPERATING EXPENSES (excluding VAT)** | | | | |
| Purchases | 2,100 | 1.7 | 3,807 | 2.5 |
| Wages and salaries | 76,912 | 62.9 | 97,813 | 64.1 |
| General and administrative expenses | 27,500 | 22.6 | 29,978 | 19.7 |
| Interest expense | 1,409 | 1.1 | 1,462 | 1.0 |
| Depreciation and amortization | 1,495 | 1.2 | 1,891 | 1.2 |
| **TOTAL OPERATING EXPENSES** | **109,416** | **89.5** | **134,951** | **88.5** |
| **NET OPERATING INCOME** | **12,802** | **10.5** | **17,617** | **11.5** |
| Employees profit sharing | (1,119) | (0.9) | (1,806) | (1.2) |
| Other profits and losses | 575 | 0.5 | 397 | 0.3 |
| **NET INCOME BEFORE TAXES** | **12,258** | **10.0** | **16,208** | **10.6** |
| **INCOME TAXES (note XVIII)** | **(6,148)** | **(5.0)** | **(8,361)** | **(5.5)** |
| Results of companies accounted for on the equity method | 256 | 0.2 | (144) | (0.1) |
| Minority interests | 17 | – | (51) | – |
| **NET INCOME** | **6,383** | **5.2** | **7,652** | **5.0** |
| **GROSS CASH FLOW** (net income plus income taxes, employees profit sharing, depreciation and amortization) | **15,584** | **12.8** | **19,978** | **13.1** |
| **NET INCOME PER SHARE OF COMMON STOCK (in dollars)** | **14.44** | | **17.31** | |

*The notes on pages 61 to 63 form an integral part of these financial statements*

**CAP GEMINI SOGETI**

# PRINCIPAL
# LOCATIONS

**HOLDING Company**
**Head office: Grenoble**
6, boulevard Jean Pain-BP 206 - 38005 Grenoble - ☎ 33 (76) 44 82 01
- **Finance: Lyons**
241, rue Garibaldi - 69422 Lyon Cedex 3 - ☎ 33 (7) 860 43 10
**General Management: Paris**
17, avenue George V - 75008 Paris - ☎ 33 (1) 723 61 85

# in France

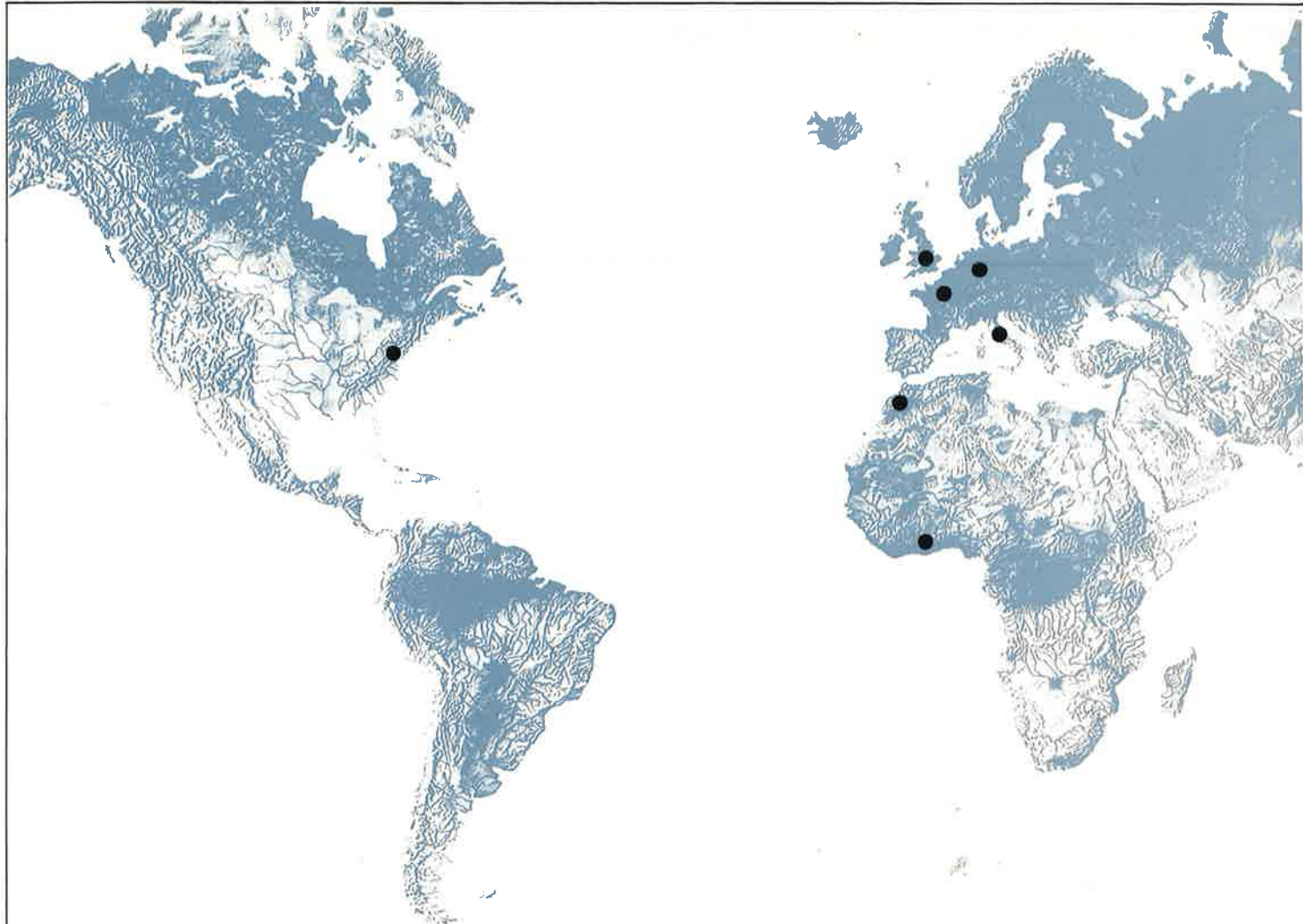| | | | | |
|---|---|---|---|---|
| CAP SOGETI EXPLOITATION | Paris | 207-209 rue de Bercy | 75012 PARIS | 33 (1) 346 95 00 |
| CAP SOGETI FORMATION | Paris | 92 boulevard du Montparnasse | 75682 PARIS CEDEX 14 | 33 (1) 320 13 81 |
| | Paris | 5 rue Louis Lejeune | 92128 MONTROUGE CEDEX | 33 (1) 657 13 31 |
| | Paris | 83-85 boulevard Vincent Auriol | 75013 PARIS | 33 (1) 584 15 40 |
| CAP SOGETI INSTRUMENTS | Paris | 15 rue de la Vanne | 92120 MONTROUGE | 33 (1) 656 52 08 |
| CAP SOGETI LOGICIEL | Paris | 5 rue Louis Lejeune | 92128 MONTROUGE CEDEX | 33 (1) 657 13 31 |
| | Lannion | 28 avenue du Général de Gaulle | 22300 LANNION | 33 (96) 37 72 80 |
| | Rennes | 107 avenue de Crimée | 35100 RENNES | 33 (99) 51 95 99 |
| | Toulouse | 1 chemin du pigeonnier de la Cépière | 31100 TOULOUSE | 33 (61) 41 30 40 |
| CAP SOGETI SYSTEMES | Paris | 92 boulevard du Montparnasse | 75682 PARIS CEDEX 14 | 33 (1) 320 13 81 |
| | Paris | 14-20 rue Leriche | 75738 PARIS CEDEX 15 | 33 (1) 539 22 25 |
| | Bordeaux | 31 rue de l'Ecole Normale | 33200 BORDEAUX | 33 (56) 02 00 57 |
| | Caen | 9 rue du Général Giraud | 14000 CAEN | 33 (31) 85 12 69 |
| | Grenoble | 6 boulevard Jean Pain BP 206 | 38005 GRENOBLE CEDEX | 33 (76) 44 82 01 |
| | Lille | 276/6 avenue de la Marne | 59700 MARCQ-EN-BARŒUL | 33 (20) 72 95 09 |
| | Limoges | 11 avenue St Surin | 87000 LIMOGES | 33 (35) 77 79 89 |
| | Lyons | 241 rue Garibaldi | 69422 LYON CEDEX 3 | 33 (7) 860 90 03 |
| | Marseilles | 90 avenue de Mazargues | 13008 MARSEILLE | 33 (91) 76 52 91 |
| | Montpellier | Allée Jules Milhau, Immeuble le Triangle | 34000 MONTPELLIER | 33 (67) 92 20 17 |
| | Mulhouse | 14 boulevard de l'Europe | 68100 MULHOUSE | 33 (89) 45 10 60 |
| | Nancy | 25-29, rue de Saurupt | 54000 NANCY | 33 (8) 351 43 96 |
| | Nantes | 9 rue Marcel Sembat | 44000 NANTES | 33 (40) 43 67 57 |
| | Nice | 42 avenue du Maréchal Foch | 06000 NICE | 33 (93) 62 02 78 |
| | Orléans | 19 rue de la République | 45000 ORLÉANS | 33 (38) 53 86 50 |
| | Rennes | 107 avenue de Crimée | 35100 RENNES | 33 (99) 51 95 99 |
| | Rouen | Immeuble le Montmorency Centre St-Sever, place de la Verrerie | 76100 ROUEN | 33 (35) 63 50 45 |
| | Toulouse | 1 chemin du pigeonnier de la Cépière | 31100 TOULOUSE | 33 (61) 40 55 58 |
| CSB BUREAUTIQUE | Paris | 12 rue Jean Jaurès | 92807 PUTEAUX | 33 (1) 776 42 01 |

# in Europe

| Country | Company | City | Address | Postal/City | Phone |
|---|---|---|---|---|---|
| **BELGIUM** | CAP GEMINI Belgium | Brussels | 49 rue du Châtelain | 1050 BRUXELLES | 32 (2) 649 96 40 |
| | | Antwerpen | Mechelsesteenweg 163 | 2018 ANTWERPEN | 32 (3) 218 77 52 |
| | | Liège | 10A quai Churchill | 4020 LIÈGE | 32 (41) 42 74 63 |
| **DENMARK** | BRA (See Sweden) | Allerød | M.D. Madsensvej 10 A | 3450 ALLERØD | 45 (2) 27 08 11 |
| **FEDERAL REPUBLIC OF GERMANY** | CAP GEMINI Deutschland | Düsseldorf | Grafenberger Allee 30 | 4000 DÜSSELDORF 1 | 49 (211) 67 50 05 |
| | | Münich | Lindwurmstrasse 117 | 8000 MÜNCHEN 2 | 49 (89) 725 30 25 |
| **FINLAND** | BRA (See Sweden) | Helsinki | Annankatu 16b | 00120 HELSINKI 12 | 358 (0) 64 86 48 |
| **NETHERLANDS** | CAP GEMINI Nederland | Utrecht | Jutfaseweg 205 | 3522 HR UTRECHT | 31 (30) 89 35 44 |
| | | Rotterdam | Westblaak 96 | 3012 KM ROTTERDAM | 31 (10) 11 02 20 |
| | PANDATA | Rijswijk | Sir Winston Churchilllaan 366 | 2285 SJ RIJSWIJK | 31 (70) 94 93 25 |
| | | Eindhoven | Stationsplein 39 | 5611 BC EINDHOVEN | 31 (40) 43 95 18 |
| | | Zwolle | Oude Vismarkt 21 | 8011 TA ZWOLLE | 31 (38) 22 44 42 |
| **NORWAY** | DATA LOGIC | Oslo | Torggt. 5 | OSLO 1 | 47 (2) 42 07 60 |
| | | Bergen | Nygårdsgt. 2 | 5001 BERGEN | 47 (5) 31 11 17 |
| | | Trondheim | Kjøpmannsgt. 8 | 7000 TRONDHEIM | 47 (7) 53 37 65 |
| | | Skien | Telemarksgt. 8 | 3700 SKIEN | 47 (35) 27545 |
| | | Stavanger | Løkkeveien 14 | 4000 STAVANGER | 47 (4) 52 29 35 |
| **SPAIN** | CAP GEMINI España | Madrid | 58 Nuñez de Balboa | MADRID 1 | 34 (1) 431 43 04 |
| **SWEDEN** | BRA | Stockholm | Kungsgatan 38 | 10369 STOCKHOLM | 46 (8) 24 55 40 |
| | | Göteborg | Artillerigatan 25 | 41502 GÖTEBORG | 46 (31) 25 03 40 |
| | | Karlskoga | Kungsvägen 33 | 69131 KARLSKOGA | 46 (586) 50380 |
| | | Sundsvall | Storgatan 10 | 85230 SUNDSVALL | 46 (60) 12 55 40 |
| **SWITZERLAND** | CAP GEMINI Suisse | Genèva | 8c avenue de Champel | 1211 GENÈVE 12 | 41 (22) 47 88 00 |
| | | Bâsel | Lindenhofstrasse 7 | 4052 BASEL | 41 (61) 23 41 41 |
| | | Bern | Laenggass-Strasse 7 | 3012 BERN | 41 (31) 23 71 72 |
| | | Lausanne | 14 avenue d'Ouchy | 1006 LAUSANNE | 41 (21) 26 31 33 |
| | | Zürich 1 | Brauerstrasse 60 | 8004 ZÜRICH | 41 (1) 241 06 70 |
| | | Zürich 2 | Brauerstrasse 60 | 8004 ZÜRICH | 41 (1) 242 28 26 |
| | CAP SOGETI EXPLOITATION | Genève | 8c avenue de Champel | 1211 GENÈVE 12 | 41 (22) 47 88 00 |
| **UNITED KINGDOM** | IAL GEMINI | London | 133 High Street | YIEWSLEY UB7 7QL | 44 (8954) 44022 |
| | | Manchester | 80 Manchester Road | ALTRINCHAM WA14 4PL | 44 (61) 941 1922 |
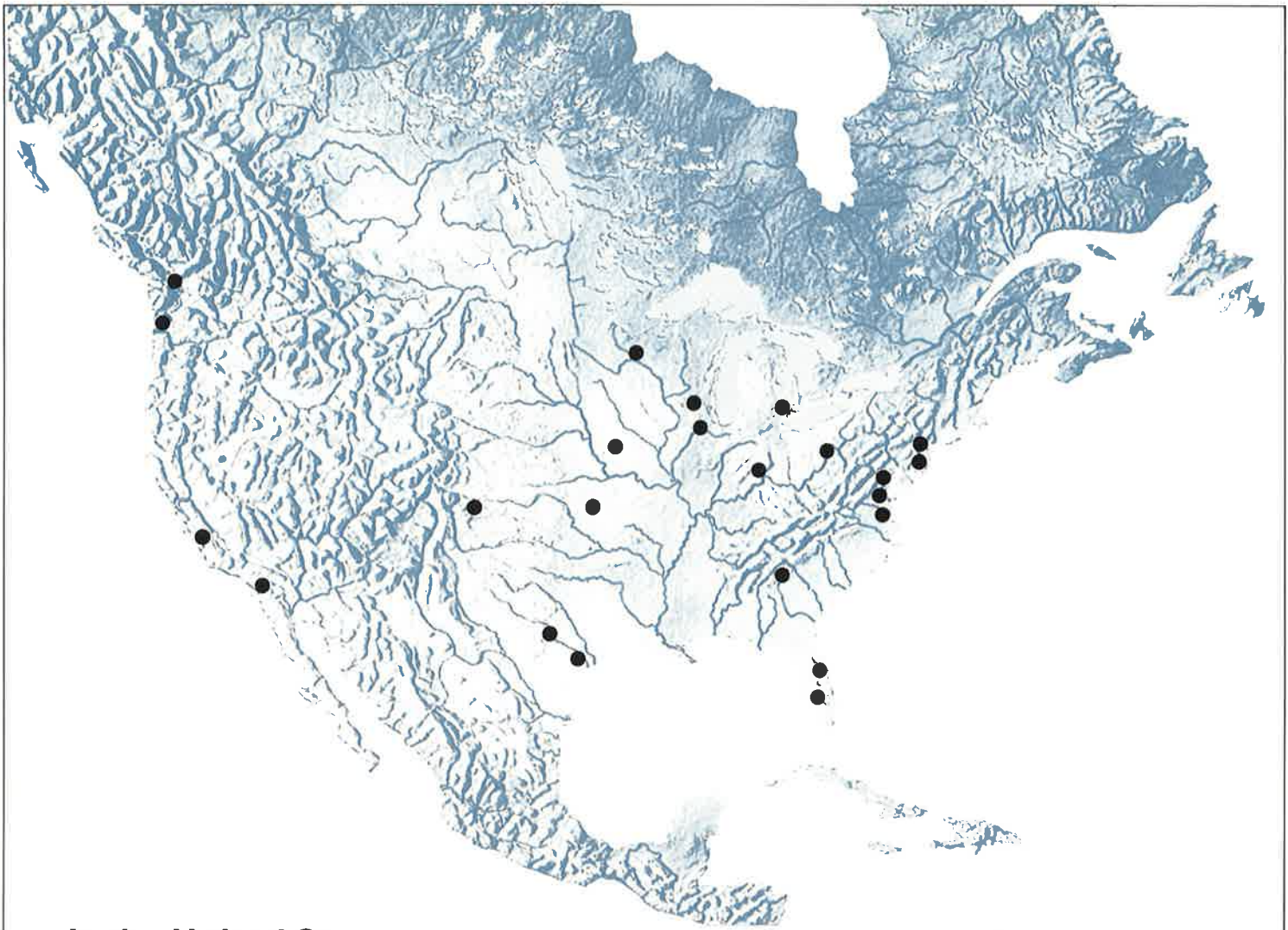
# In the United States

| | | | | |
|---|---|---|---|---|
| CAP GEMINI SOGETI USA GROUP | New York | 1133 Avenue of the Americas Suite 3122 | NEW YORK, NY 10036 | 1 (212) 221 74 98 |
| DASD Corporation | Milwaukee | 9045 N. Deerwood Drive | MILWAUKEE, WI 53223 | 1 (414) 355 34 05 |
| | Atlanta | 2960 Brandywine Rd., Suite 202 | ATLANTA, GA 30341 | 1 (404) 455 93 01 |
| | Baltimore | 9160 Red Branch Road Standard Court East, Suite E-1 | COLUMBIA, MD 21045 | 1 (301) 730 20 02 |
| | Chicago | 1400 S.Wolf Road, Suite 145 | WHEELING, IL 60090 | 1 (312) 520 49 40 |
| | Dallas | 2350 Valley View Lane, Suite 240 | DALLAS, TX 75234 | 1 (214) 247 07 77 |
| | Denver | 3131 S. Vaughn Way, Suite 132 | AURORA, CO 80014 | 1 (303) 337 08 42 |
| | Des Moines | 1603 22nd Street, Suite 104 | WEST DES MOINES, IA 50265 | 1 (515) 223 60 95 |
| | Detroit | Doner Building, Suite 300 26711 Northwestern Highway | SOUTHFIELD, MI 48034 | 1 (313) 352 95 30 |
| | Houston | 8550 Katy Freeway, Suite 211 | HOUSTON, TX 77024 | 1 (713) 468 06 77 |
| | Indianapolis | 8606 Allisonville Road Castle Creek II, Suite 107 | INDIANAPOLIS, IN 46250 | 1 (317) 842 60 31 |
| | Jacksonville | 2121 Corporate Sq. Blvd, Suite 270 | JACKSONVILLE, FL 32216 | 1 (904) 724 09 36 |
| | Los Angeles | 22010 S. Wilmington Ave. Suites 101 - 102 | CARSON, CA 90745 | 1 (213) 549 89 70 |
| | Milwaukee | 4915 S. Howell Avenue | MILWAUKEE, WI 53207 | 1 (414) 747 19 30 |
| | Minneapolis | Pentagon Office Park, 4600 W. 77th, Suite 176 | EDINA, MN 55435 | 1 (612) 835 99 22 |
| | Philadelphia | 1730 Walton Road. Whitpain Office Campus | BLUE BELL, PA 19422 | 1 (215) 828 70 50 |
| | Pittsburgh | 711 Penn Building, Suite 400 | PITTSBURGH, PA 15222 | 1 (412) 391 86 60 |
| | Portland | 700 NE Multnomah, Suite 1429 | PORTLAND, OR 97232 | 1 (503) 231 81 14 |
| | San Francisco | 1633 Bayshore Highway, Suite 237 | BURLINGAME, CA 94010 | 1 (415) 692 60 50 |
| | Seattle | 33430 13th Place South, Suite 200 | FEDERAL WAY, WA 98003 | 1 (206) 838 36 00 |
| | St Louis | 201 Progress Parkway, Suite 121 | MARYLAND HEIGHTS, MO 63043 | 1 (314) 576 21 20 |
| | Tampa | 4511 N. Himes Avenue, Suite 120 | TAMPA, FL 33614 | 1 (813) 876 31 30 |
| | Washington DC | 301 Maple Avenue West | VIENNA, VA 22180 | 1 (703) 938 22 07 |
| SPIRIDELLIS & ASSOCIATES, Inc. | New York | 1133 Avenue of the Americas | NEW YORK, NY 10036 | 1 (212) 221 72 70 |
| | New Jersey | 225 Old New Brunswick Road | PISCATAWAY, NJ 08854 | 1 (201) 981 11 14 |
| CAP GEMINI INC. | Washington DC | 301 Maple Avenue West | VIENNA, VA 22180 | 1 (703) 938 22 07 |
| CAP GEMINI SERVICES | Washington DC | 301 Maple Avenue West | VIENNA, VA 22180 | 1 (703) 938 22 07 |

# Associated companies

| | | | | | |
|---|---|---|---|---|---|
| **FEDERAL REPUBLIC OF GERMANY** | C.E.G. | Düsseldorf | Adlerstrasse 42 | 4000 DÜSSELDORF 1 | 49 (211) 36 09 71 |
| **FRANCE** | GROUPE BOSSARD | Paris | 12 rue Jean-Jaurès | 92807 PUTEAUX | 33 (1) 776 42 01 |
| | SESA | Paris | 30 Quai National | 92800 PUTEAUX | 33 (1) 776 41 00 |
| | TESSI | Grenoble | 137 Cours de la Libération | 38100 GRENOBLE | 33 (76) 96 97 40 |
| | TESSI-SAISIE | Paris | 25 rue Leriche | 75015 PARIS | 33 (1) 539 22 25 |
| | VS | Paris | 23 rue de Courcelles | 75008 PARIS | 33 (1) 563 12 12 |
| **ITALY** | SYNTAX | Milan | 8 via Gaetano Negri | 20123 MILANO | 39 (2) 87 74 44 |
| **IVORY COAST** | Sté Ivoirienne de Conseil et de Services en Informatique S.A. | Abidjan | Rue du Commerce | 04 BP 1085 ABIDJAN 04 | (225) 32 84 26 |
| **MOROCCO** | ISMA | Casablanca | 61 rue Lamoricière | CASABLANCA | 21 (2) 27 92 52 |
| **UNITED KINGDOM** | IAL | Southall | Aeradio House, Hayes Road | SOUTHALL UB2 5 NJ | 44 (1) 574 24 11 |
| **UNITED STATES** | VSA | New York | 520 Madison Avenue | NEW YORK, NY 10022 | 1 (212) 308 78 30 |

CAP GEMINI SOGETI