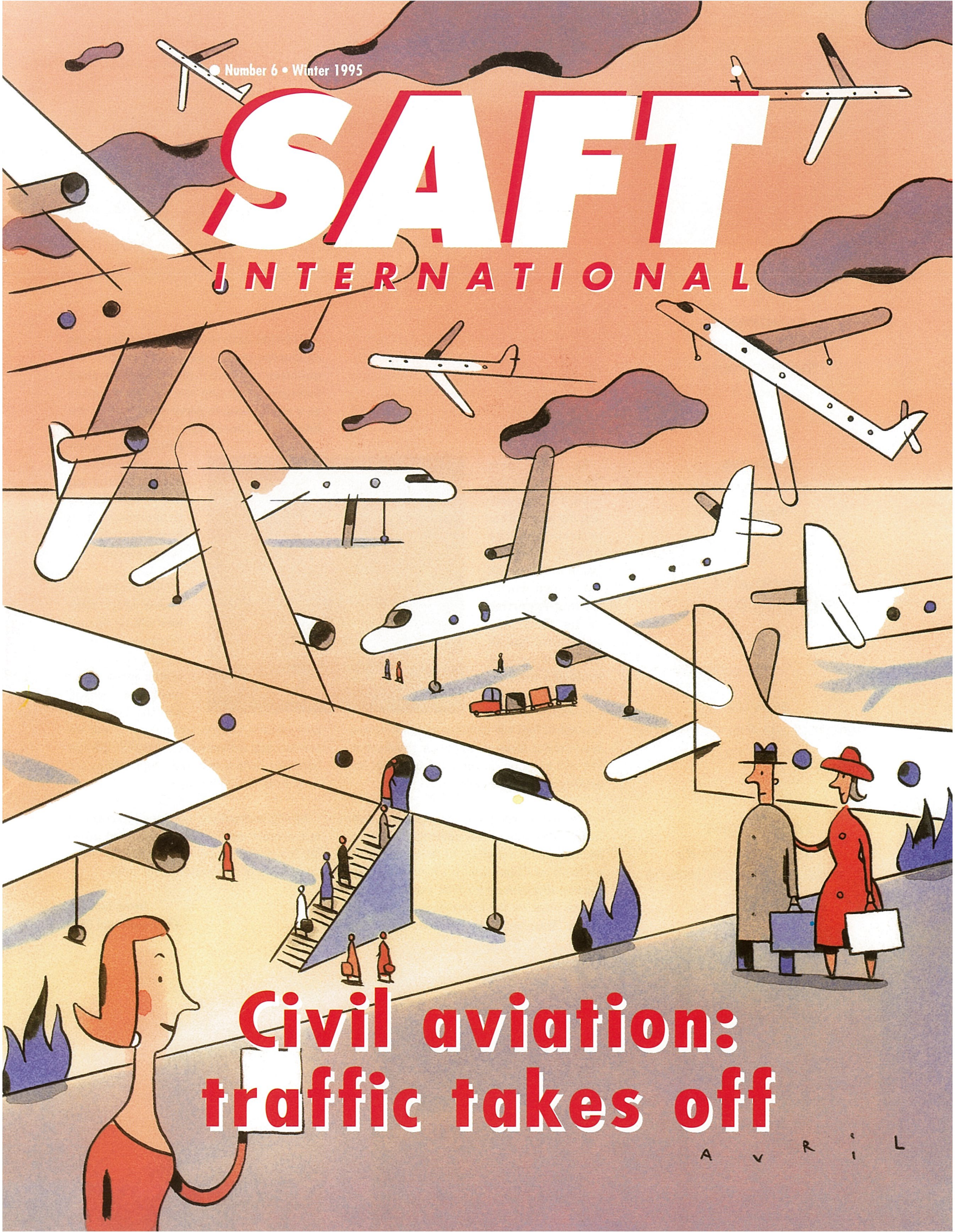


Number 6 • Winter 1995

SAFT

INTERNATIONAL



**Civil aviation:
traffic takes off**

A V R I L

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S A F T

SAFT INTERNATIONAL

A MAGAZINE FOR SAFT'S CLIENTELE AND BUSINESS PARTNERS

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WITH THE NEW YEAR, NEW LEADERSHIP TAKES THE HELM AT SAFT. DENYS GOUNOT, A DIRECTOR AT ALCATEL CABLE FOR THE LAST FOUR YEARS, HAS REPLACED BERNARD PIERRE (NOW HEAD OF ALCATEL CABLE) AS SAFT'S CHAIRMAN AND CEO.

As the new "coach" for the Saft team, I will be putting my years of experience with the Alcatel Alsthom group to work with Saft's own world-leading expertise in its field. My watchword has always been constant evolution towards higher potential and efficiency. In this spirit, Saft will continue to build on last year's major focus on customer satisfaction. We will keep up our concentration on improving service and cutting lead times.

We plan to reinforce our already established presence in the international arena by expanding activities to Asia, and most probably to China, where I have been conducting discussions for joint venture agreements. Also on the international front, our Safety Systems Division is launching new

worldwide activities, with special focus on Europe and Asia-Pacific. The 1994 acquisition of Minitronics, the Australian emergency lighting market leader, gives us a strong base to serve Asia. And on the important American market for space

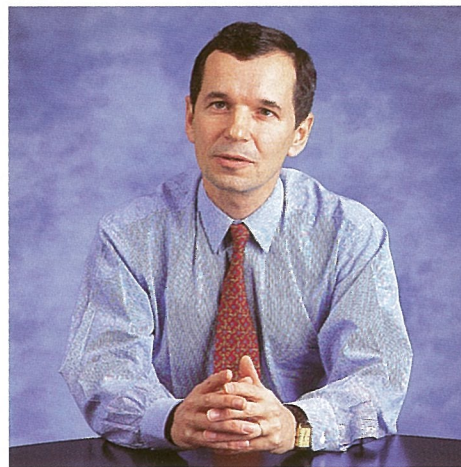
batteries, our space team has been enhanced by the addition of a highly experienced new member: Gates' space division.

Our portable and electric vehicle activities will be further reinforced by a strong push in research and development. This year will see the launch of

new electric vehicle technologies, and we are moving towards rechargeable lithium batteries, which will have applications for both portable and EV uses.

Strong technology, continued excellence in customer service, and a solid and growing international network will remain Saft's three poles of concentration for 1995.

DENYS GOUNOT
Chairman and CEO



P. Simard.

Cover illustration: François Avril.

Civil aviation: the recovery



Traffic is expected to grow 5%

a year over the next decade

J. Alex Langley, Pictor.

The aviation industry is taking off again, after a strong setback in the early 1990s.

For two decades, during the 1970s and 1980s, civil aviation – passenger and freight transport on commercial airlines – not only grew at an impressive rate, but seemed set to continue doing so indefinitely. Confident of the future, from 1987 to 1990, airlines ordered new aircraft on an unprecedented scale.

Then very suddenly the whole picture changed. The Gulf War combined with the onset of recession led to a dramatic 10% drop in passenger and freight traffic in 1991. Large airlines flying high seat-capacity jets were more affected than regional airlines with smaller planes. Faced by financial commitments they were unable to meet, airlines stopped placing new orders and cancelled existing orders. Overall, aircraft production plunged by 30%.

■ BACK IN PROFIT, BUT...

Over the last eighteen months, the situation has brightened. Led by the upturn in the USA, passenger and freight volume is once again rising. Though the number of flights has not increased, seat occupancy rates are up to 60-70% worldwide (as opposed to 50-60% during the recession). Crucially, in 1993, the world's airlines (excluding the former USSR) recorded an operating profit, amounting to 1.1% on revenues – compared with a loss of 0.7% in 1992.

These positive trends must be qualified, however. First, the increase in operating profits will continue to be much lower than growth in traffic, as a result of fierce competition among airlines (which results in fare-cutting, free mileage offers, etc) and rising costs.

Deliveries of large jets will remain steady - but will not rise to the dizzying heights of the 1980s



Saft's Ultra Low Maintenance line reduces upkeep - helping cut operating costs



region. In a study by Airbus, it is estimated that by 2011 Asia-Pacific will account for 28% of fuel consumption on large jets as opposed to 18% in 1991, while the North American share will have fallen to 36% from 44% in 1991, with Europe remaining the same at 26%. In fact, with the exception of Japan, Asia-Pacific has not really been affected by the recession, and there is enormous growth potential intra-regionally. Europe too has room for further growth, especially if impending deregulation is carried through. The U.S. market, however, is effectively saturated.

Next, operating profit excludes the servicing of debt incurred in purchasing new aircraft. After the fleet expansion of the late 1980s such servicing charges are a heavy burden, around 2% to 3% of revenues. And since operating profit margins are still quite narrow, airlines are reluctant to incur further debt. So rather than acquire new aircraft, they are tending to operate their existing fleets.

This all means that any upturn in profits does not automatically translate into increased demand for, and hence production of, aircraft. In fact there are currently over 1000 older aircraft parked in the Arizona desert, due to airlines' current overcapacity worldwide.

MARKET TRENDS

Civil aviation traffic over the next decade is expected to grow around 5% per year. The projected growth for 1994 in terms of passenger-kilometres is 7.4%. Although these figures seem buoyant compared with the 1% average growth rate worldwide for the 1991-1993 period, they should be seen in relation to the markedly higher rates of the 1970s and 1980s, as well as against a background of continued tough competition and squeezed profit margins.

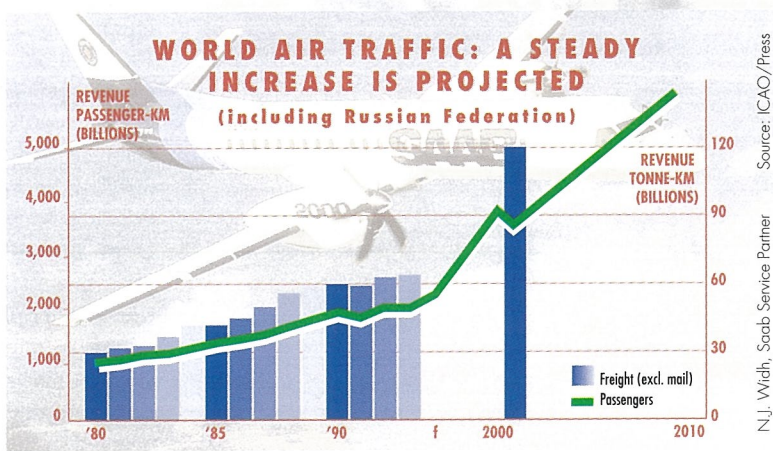
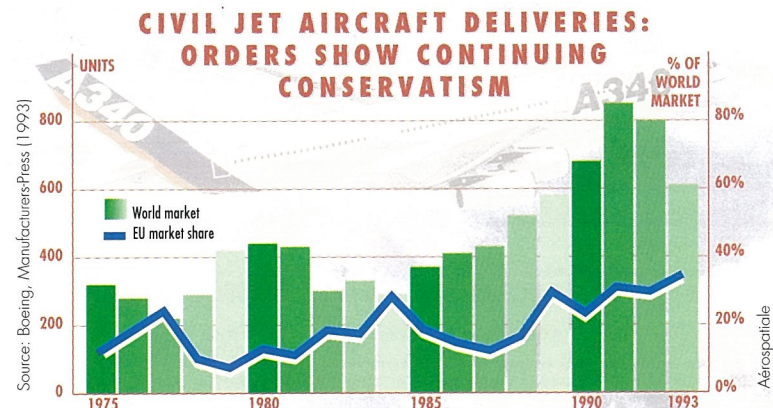
Globally, the situation is characterized by the shift away from internal towards international traffic (now 55% international, 45% domestic, as opposed to 50%-50%) and by the growing importance of the Asia-Pacific

Civil aviation growth is also subject to external factors. The most important is congestion, covering both availability of airport slots and crowded airspace. The number of flights cannot be increased beyond a certain point. One way to overcome congestion problems is for airlines to fly larger aircraft. The subsequent need to ensure that such aircraft are filled has been a contributory factor in the development of the "hub" system (see box).

AIRCRAFT PRODUCTION

What is the impact of all these market movements? Airlines purchase aircraft for two basic reasons: to enlarge their fleets to accommodate increased traffic, or to replace aging aircraft. New aircraft tend to be safer, cheaper to operate (modern jets, for example, consume up to 30%

less fuel than aircraft built in the 1970s) and comply with updated regulations (e.g. on permitted noise levels). However, the advantages of new aircraft have to be weighed against the additional debt servicing costs involved. Moreover, especially when airlines are planning on major fleet expansions





Airbus Industrie

– as in the late 1980s – there will be a backlog of orders waiting to be filled by aircraft manufacturers. Similarly, any reduction in demand will take a while to work its way through to actual aircraft deliveries. The net effect of these factors is visible in the following figures. Deliveries by the big three manufacturers – Boeing, McDonnell Douglas, and Airbus – for 1993 were 546, down from around 800 during the boom years of the late '80s, and are expected to average no more than 420 a year over the next decade.

Behind the overall figures, various trends emerge. There is a growing demand for new “commuter” aircraft (turboprops or jets flown by regional airlines feeding major hubs), especially in the 50-130 seat range. Passenger comfort is increasingly a factor, which translates into a call for wide-bodied jets for long-haul flights by large carriers. Finally, demand is strong in both categories for expanding Asia-Pacific operators.

In response to airlines' emphasis on reduced operating costs, aircraft manufacturers have developed aircraft that are more competitive in their life-cycle costs – planes that are more versatile and economical to operate and maintain. In this realm, Saft aircraft batteries play a vital role.

■ SAFT – MARKET LEADER

With more than 50% market share outside the ex-USSR, Saft is the world leader in aircraft batteries, supplying OEM equipment and replacement batteries for civil and military aircraft of all types.



The need to feed hubs has led to an increase in production of regional aircraft

DEREGULATION: BRINGING ON THE RISE OF THE HUB SYSTEM

With airline deregulation currently a hot topic of debate, the experience of deregulation in the U.S. provides an indication of what may soon be happening in Europe. Following deregulation of prices and routes, a large number of new airlines sprang up offering intensive price competition to established companies, resulting in a series of casualties in both camps. The surviving large airlines focused their efforts on high-intensity routes and reduced services on less-used routes, leaving a market niche for the new smaller airlines to move into. At the same time, they needed to ensure that aircraft were filled on high-intensity inter-city routes.

This requirement led to the development of the “hub and spoke” system, which features feeder commuter airlines transporting people to hubs for long-haul flights to other hubs. The challenge of keeping operating costs down has favoured the development of low or zero maintenance batteries – and Saft now offers two new Ni-Cd technologies to respond to their needs – ULM® and AMF®.

where some 400 airlines are currently licensed as a result of the breakup of Aeroflot. With trade liberalization, the CIS is now open to joint production incorporating western equipment. As of July 1, 1994, the CIS Airworthiness Authority (ARIAC) has given appliance approval for two Saft Delta Plus products that are interchangeable with their Ukrainian counterparts, standard fit on Russian-made airlines.

Finally, Saft's global service to the air transport industry is based both on designing new products in association with aircraft manufacturers and on responding to input from airlines. Saft's ultimate customers are airlines and their passengers, and every effort is made to ensure that the development of products and services is adapted to their evolving needs. ■

Saft's long history of supplying aircraft batteries dates back to 1932, when Saft batteries were used on trans-Atlantic Aero-Postale flights. Its product portfolio has developed hand-in-hand with evolving aircraft design, and covers a variety of applications, including engine starting, instrumentation backup and emergency lighting systems.

In 1979 the new Delta Plus product range was selected by Boeing for its 757 and 767 aircraft. This system has become the industry standard, and is the OEM choice for Boeing and Airbus large jets as well as for many commuter aircraft (built by Saab, Fokker, Jetstream, BAE/Avro, Canadair, Dornier, etc). The technology has also been retrofitted by airlines on many of their older aircraft.

■ NEW SAFT TECHNOLOGIES

The drive by airlines to reduce operating costs has led Saft to develop two new battery technologies. With ULM® (Ultra Low Maintenance), the periodicity of maintenance is extended without compromising on safety, performance, initial cost or life duration. What's more, it combines lower weight with higher energy density, and in most cases is interchangeable with Delta Plus batteries. Since its launch in 1993, ULM® has had extremely positive feedback from the field.

A more sophisticated approach is Saft's AMF® (Aircraft Maintenance Free) range, based on a new concept involving sealed recombination battery technology associated with a battery charger controller unit. The system's ultimate goal is to be maintenance-free for its entire lifetime, requiring only periodical checks which can be carried out directly in the aircraft with BIT (built-in test) features.

In parallel with its technical developments, Saft is actively developing strategies for the various regional markets. One field for expansion is the CIS (former USSR),

Smooth city moves

The electric bus market is poised for action – many successful experiments spell out a promising future for cities: less pollution, noise, fuel consumption...

In San Francisco, where electric trolley-buses take thousands of people to and from work each day, no one loses time when a route becomes blocked. Although these dual-mode buses are hooked to overhead wires, they can easily be unhooked. Then – powered by Saft batteries – the buses can drive without overhead power for up to 10 miles, skirting whatever obstacle may be blocking their path. They can also climb steep gradients on battery power alone – an important consideration in this city famous for its hills.

Throughout the industrialized world, from Sweden to the United States, communities are turning to electric buses, which cut air pollution, fuel consumption, and noise. These range from the all-electric, 17-person minibuses that now scoot through the German city of Oberstdorf, to the larger hybrid vehicles that are being used on a trial basis in Brussels and Amsterdam.

“The goal is to create a zero-emission vehicle or one that emits a very low level of pollution,” says Jean-Pierre Cornu, director of development at Saft’s industrial battery group. Saft research and development is working to make that goal a reality in communities around the world.

Saft has been a presence in the electric vehicle market since it developed two ranges of Ni-Cd STM and STH batteries specifically suited to electric traction in 1981. The three main types of electric urban transportation rely on these batteries in varying degrees. All-electric vehicles use high-energy ones. In hybrid vehicles, a constant-rate energy source (a fuel cell or internal combustion engine) supplies the standard power while a buffer battery ensures all power variation, including surges needed for acceleration and climbing hills. Finally dual-



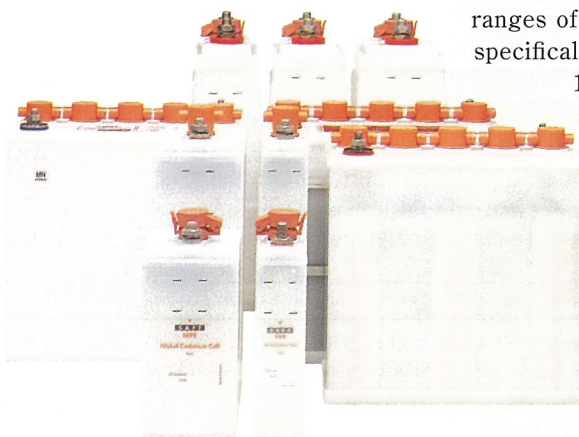
mode vehicles like the San Francisco trolleys are entirely powered by batteries for part of the journey or in case of incident.

Both dual-mode buses and hybrids thus rely on two energy sources, either alternating the two or operating them simultaneously. Not surprisingly, these systems present the greater technological challenge. “In a hybrid system, there are interactions in the whole ensemble,” Cornu explains. “It’s a system with a lot of parameters. An all-electric system, by contrast, is simple.”

■ MOSTLY MINIBUSES

While they may be technically straightforward, all-electric systems are not yet the optimum solution for larger buses – the sheer bulk and weight of the batteries needed to run a 40-foot bus make them impractical. For now, minibuses, such as the ones that run in Tours, France, or in Santa Barbara in the U.S., are about as large as an all-electric vehicle can get. In Tours, for example, minibuses have been running 23 days a month – a total of more than 104,000 km (c. 60,000 miles) since August 1989 – without any power failures.

The target lifetime for electric vehicles is 10 years, representing 250,000 km – which translates into 2,500 charge-discharge cycles for their batteries. Thanks to new Saft technology boosting the lifetime of the



Saft’s STM and STH ranges have been powering vehicles since 1981

C. Jorlan

San Francisco's dual-mode buses are partially powered by Saft



D.R.

cadmium electrode, a battery has been developed that can last for the life of a vehicle – an STM 5-200 module tested to the necessary 2,500 charge-discharge cycles at 80% depth of discharge.

While electric buses are a promising development, much of this traffic – as in the hybrid fuel cell bus project subsidized by the U.S. Department of Energy in Washington, D.C. – is being run on an experimental basis. Other types of electric buses are well established: about 70 dual-mode trolley buses are already on the streets of Milan and San Francisco, for example. So are hybrids running on internal combustion motors and batteries, such as New York City's Orion buses.

Cornu emphasizes the newness of the electric bus program. "1995 is still going to be dedicated to experimental tryouts," he says. "It will take off commercially after 1996. It's the birth of the market."

Potentially, this market is vast. In the near future, at least, the countries ordering these buses will probably be the relatively prosperous, industrialized ones where pollution control is a priority, including the United States, the European Union and Asian countries like Japan and Singapore. Eventually, though, all the world's buses could be electric – and Saft is ready to equip them. ■

GETTING A NEW LINE ON PORTABLES

Saft has launched its first fully automated battery assembly line for prismatic cells, at the portable plant in St. Yrieix, France. Operational since September 1994, the line can turn out prismatic Ni-Cd and Ni-MH batteries at a rate of close to 8 million units a year. The line has a dual objective: to offer clients a competitive battery assembly cost, and to increase reliability, ensuring faultless soldering. It is designed to respond to the demand of the rapidly growing GSM mobile phone market worldwide. ■



D.R.

SETTING WORLD RECORDS

In October 1994, Saft helped win one of the world speed records for electric vehicles. Manufactured by the Malaysia-based PK Industries, the electric racecar "Speeding Ticket" accelerated from 0 to 100 kilometers per hour in a record-breaking 5 seconds, ultimately reaching a top speed of 169.54 kph (about 100 mph). Speeding Ticket was powered by innovative EV technology: it ran on Saft silver-zinc batteries usually used to power military torpedoes! The 180 30RA3 batteries helped earn its place in history – officially recorded in the *Guinness Book of World Records*. ■

SAFT SETS SAIL

In the 1995 America's Cup, the Australian racing yacht will not be relying only on the wind. Sponsored by Saft Nife Australia, it will also use 6 x 5 cell blocks of Saft STM 140 Amp batteries to power all on-board electronic equipment. The batteries will run computers and instruments to measure wind and sailing speeds, as well as constant communications links to port. Their major advantage is a relatively compact size-to-weight ratio. And after the race is over, the STMs are recharged with a Saft charger. ■



Sport. The Library

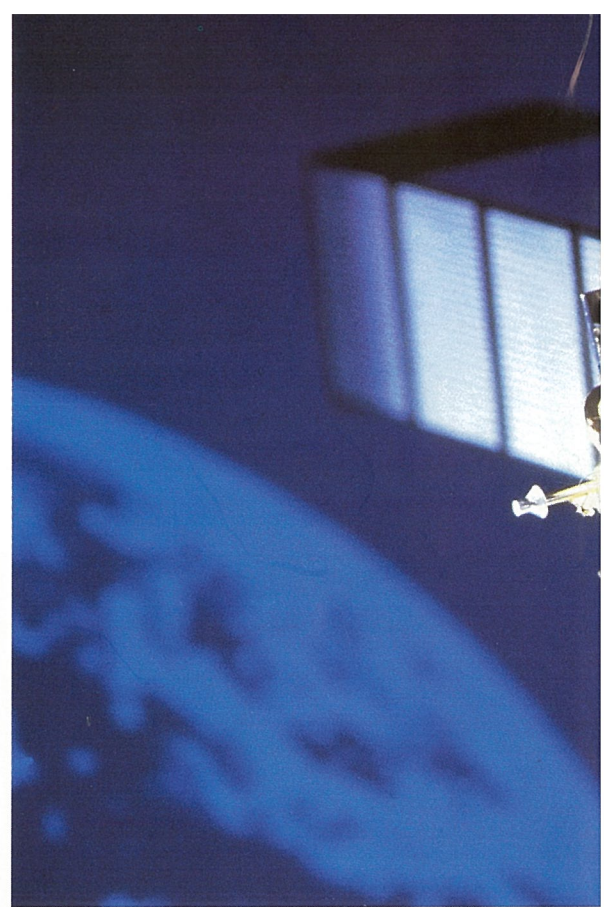
THE HIGHWAY OF THE FUTURE

No more traffic jams at toll booths... A new computerized car accessory will record tolls paid in advance and allow drivers to zip through electronic tollbooths, without slowing down. Saft is supplying the staying power behind these devices: Norway's Saft Nife AS is providing 350,000 LS 14250 lithium cells to Micro Design, manufacturer of the systems. They will power a mini-computer which is activated by high-frequency beams emitted at toll stations. The lithium batteries' long life and compact design make them ideal for this application. ■



Colas

The final frontier



Ni-Cd batteries manufactured by Saft equip over 70 satellites and have taken off in more than 65 launch missions. Portrait of a space star...

Transport companies around the world can now pinpoint the location of their trucks within 10 meters, avoiding all manner of scheduling problems. This feat – made possible by global positioning systems (GPS) satellites – is just one of a host of new capabilities that owe their existence to satellites, many equipped with Saft batteries. During the Gulf War, for example, pilots of downed allied planes could be located within two hours. And satellites, of course, are still indispensable for more everyday uses like weather forecasting and telecommunications.

The world's number-one manufacturer of nickel-cadmium space batteries, Saft produces hermetically-sealed products for applications including missiles and launchers as well as satellites. Spacecraft need constant, dependable energy supplies to keep their instrument panels functioning. Satellites are particularly demanding, because of the cyclical nature of their energy needs. They rely on solar power, so when the earth blocks the sun – about 15 times a day for certain satellites – Ni-Cd batteries kick into gear to power all vital functions. In launchers and missiles, batteries furnish energy for backup, for measuring and trajectory instruments, and for pyrotechnical circuits.

Saft has been part of the world's space programs since the 1960s, participating in some of the first European space launches in 1966. In 1990, the company entered the American satellite market; four years later, it acquired the Aerospace Battery Division of Gates. Saft's client list reads

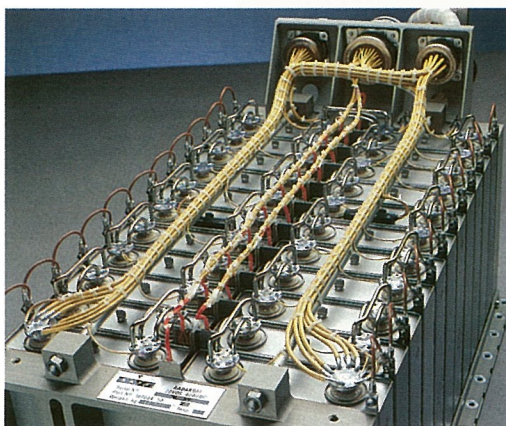
like a Who's Who of the world's aerospace industry, including – among many others – Aérospatiale, Matra Marconi Space and the American companies Space System Loral, Martin Marietta, Rockwell and TRW.

■ A DEMANDING ENVIRONMENT

"These are very powerful products," says Jacques Boscher, project manager for Ni-Cd for space applications, of the Ni-Cd batteries that make up the bulk of the company's space program. They must stand up to the challenges of space travel: intense vibration, acceleration, shock, temperatures ranging from -10°C to +35°C. And in satellites, lifecycle is critical: lower orbit satellites, from 200 to 1500 km from earth, generally have lifespans from two to seven years, while geostationary satellites, 36,000 km from earth, are built to last at least ten years. For any space application, weight is of utmost importance: 1 kilogram costs approximately FF50,000 (around \$10,000) to launch into low orbit, and four times as much to place in geostationary orbit.

Although some countries have cut back on their space programs, the increasing importance of satellites in private industries like telecommunications means the space market has remained dynamic. A recent Saft market survey indicates that \$27 million is spent annually for cells, and \$31 million for batteries, for space applications worldwide. The market is evolving, of

Saft's nickel-cadmium battery, designed to power all types of satellites



C. Jorlan



Satellite batteries are built to last up to fifteen years

Michel Reynaud, France Telecom

course. Because it's lighter than Ni-Cd and offers more capacity, nickel-hydrogen (Ni-H₂) technology is now used for many higher-orbit craft, including new telecommunications satellites. But Ni-Cd remains the ideal choice for lower-orbit, medium-capacity satellites. "Nickel-cadmium is unbeatable in terms of price and relative compactness," says Caroline Bastien, Saft's marketing and sales manager for space products. She also cites Ni-Cd's capacity range of 10-50 Ah, which is very well adapted to low-orbit satellites.

"A lot of companies are building smaller spacecraft," adds Christopher Reed, director of sales and marketing for Saft space products in North and South America. "They're getting more realistic about power requirements." The CNES, the French space agency, for example, is planning to develop a line of mini-satellites, at the rate of up to two a year, using Saft's Ni-Cd technology.

And other manufacturers around the world continue to depend on nickel-cadmium. Saft has recently secured major contracts to supply batteries for the European polar platform; two French military observation satellites; and the Indian telecommunications satellite INSAT, which will be launched in 1996. These orders, among others, only confirm the fact that, as Bastien puts it, "Ni-Cd is still the most cost-effective candidate." ■



P. Simard

A SHOWCASE FOR NEW ELECTRIC VEHICLE TECHNOLOGY

Saft's EV technology was on show at the 12th Electric Vehicle Symposium, held in Los Angeles in December. Saft introduced its latest nickel-cadmium battery, the STM 5-100 MRE, which offers 10% greater capacity than current models. Even more important are its rapid recharge – an hour to regain full capacity – and radically reduced maintenance – requirements are now divided by 10. Saft also showcased prototypes of new technologies. Nickel-metal hydride, the medium-term EV solution, will result in a 25-30% increase in range, taking EVs up to 150 km on a single charge. Lithium anode technology will bring range up to 250 km and should be on the market in 2005. ■

SAFETY SYSTEMS GOES GLOBAL

Saft is expanding its activities in Safety Systems to a worldwide arena. Currently the European market leader in emergency lighting, Saft has production centers in France and Spain. And its scope was further broadened by the 1994 acquisition of Australian emergency lighting leader Minitronics, based near Sydney. This puts Saft in a good position to serve the entire Asia-Pacific region, where new construction has created a growing need for safety system expertise. ■

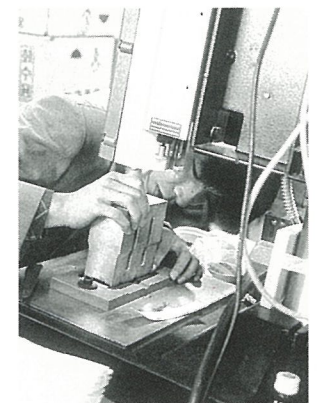


HELPING PREVENT HOME BURGLARY

The French leader in domestic burglar alarm systems, Atral, has awarded Saft its partnership prize, in honor of eight years of collaboration. Since 1986, when Atral was a young company just attacking the market, Saft has been supplying it with high-performance lithium batteries that lengthen the life of its alarms. Atral is now Advanced Batteries' top non-military client in France, buying 250,000 lithium cells per year. Together they keep homes safer longer! ■

KOREA EXPANDS TO MEET DEMAND

Saft has doubled its production space in Korea. The new battery assembly plant in Seoul will be able to accommodate steadily growing business in portable consumer products. Since its establishment in 1989, Saft Korea has gained a 30% share of the domestic OEM market. The new facility is designed to respond quickly to the fast-changing needs of the consumer market, where requirements often vary from one order to the next. This flexibility will allow Saft to better serve major customers like Samsung, its biggest client, and Goldstar, whose camcorder batteries are 100% Saft. ■



D.R.

Charging up the consumer

In the wake of the new wave of environmental awareness, rechargeable batteries are gaining ground in stores worldwide.

Saft chargers help keep batteries going 300 times longer than throwaways



D.R.

As anyone who's addicted to family movies can tell you, buying a home video camera is just the beginning of its cost. Add to that the price of keeping it supplied with batteries and watch the expenses rise. The same goes for any other of the many portable appliances with high energy requirements on the market today – including portable tape players, video games, and mobile telephones.

Fortunately, as more and more consumers around the globe are discovering, there is a solution to runaway energy costs – portable rechargeable batteries. Although these have been around for a decade or more, there are good indications that this product is coming into its own.

“Our strategy in Europe is to furnish a private label product,” says Patrick Houze, Saft’s marketing director for portable batteries. “We have been the number-one supplier of private label rechargeables for the last five years.” The company provides these batteries to retailers all over the globe.

Rechargeable sales are “steadily growing,” Houze says. Customers are drawn to rechargeable batteries because of the long-term savings involved: one rechargeable can replace up to 300 primary batteries. “Even if you factor in the cost of the recharger, the economy is considerable,” Houze says. Typically, rechargeable power appeals to teenagers, to operate their video games and portable stereos – and also to the parents of small children, who need batteries for toys. The ecologically-minded are also drawn to rechargeables.

With rechargeables, it's not just the consumer who benefits. Retailers also appreciate the fact that these products have a unit margin potential of 45-50%, as opposed to 30% for regular batteries, according to

Pete Bryant, director of consumer sales and marketing at Saft America. And their price per unit is higher than that of throwaways, which is also good for retailers. In addition to questions of profit, they can boost a store's image: “We market them as recyclable, environmentally-friendly products,” Bryant says. “And that appeals to both retailers and their customers.”

■ AN EVOLVING MARKET

The consumer rechargeable battery market is evolving at different rates throughout the world. “In Europe, the biggest market is Germany,” Houze says. “The Germans are very sensitive to ecological and economic arguments.” In general, he says, northern Europeans consume more rechargeable batteries than southern ones. “The smaller the country, the more sensitive they are to ecology.” While only 2% of batteries currently sold in Europe are rechargeable, this rate is growing. Rechargeable sales are strongest in France and in England. In Spain and Italy, the market is only beginning to develop. To tap it, consumer education will be key. “We need to explain the advantages of rechargeables to the consumer. Some of them don't know the difference,” says Jeannine Michaux, marketing manager for southern Europe and France. “We have to invest more in communication.”

In Japan, the public is only beginning to be aware of rechargeable batteries, says Nigel Harthan of the marketing division of GSS Battery Co. Ltd, a sales company which is jointly owned by Saft and Japan Storage Battery. But Harthan has high hopes for early 1995, when GSS Battery will introduce a new prototype (complete with Japanese-language label and instructions) of the product to the region. The company plans to first target supermarkets, as well as convenience stores, such as Family Mart and 7-11 – which are widespread in Japan. Owing to the experience which Saft has



Sony



The young are big consumers of rechargeable power

developed in private label customizing for clients, the choice exists of offering Saft-brand cells or private label brands. The company's strength lies in this flexibility to meet retail as well as industrial clients' applications, and the intention is to remain attentive to customers' needs in both of these key areas.

In the U.S., rechargeable products are rapidly gaining force. For the last few years Saft has been supplying a wide range of rechargeable batteries, from cordless phone replacer batteries to simple cells, to Radio Shack, an electronics chain with 7,000 stores across America. In the last year, Saft sales to Radio Shack skyrocketed by 67%. At Dantona, a New York-area chain, sales of Saft private label batteries rose by 50% in the same time period.

If these rates are any indication, consumers are finally set to make rechargeable batteries a household word.



Consumer education is key to the growth of this market

D.R.

M. Morceau, EDF



I N B R I E F

MORE POWER IN LESS TIME

Users of portable phones, laptop computers, and camcorders can now talk, type or film longer between recharges. Saft has introduced new cylindrical nickel-cadmium A and 4/5A VSE cells, which offer a 40% increase in energy when compared with standard cylindrical cells. Its combination of foam and plastic-bonded electrode technology assures not only high capacity but also longer life and fast recharging. Like other Saft Ni-Cd products, VSE cells are recyclable.



P. Simard

DAMMING THE FLOW IN SOUTH AMERICA

The hydroelectric plant at Yacyreta, on the border between Argentina and Paraguay, started up its first turbine in September 1994. One of the world's biggest hydroelectric dams, it will have a total of 20 turbines producing up to 3200 megawatts when completed in 1998. To power the plant's auxiliary services, like emergency lighting and alarm systems, Saft Nife Argentina is supplying 6 SBM-625 batteries and 12 110V 150 AC rectifiers manufactured in Argentina. A joint project of the Argentinian and Paraguayan electrical companies, the dam will increase both countries' current energy supply by 65%.

HITTING THE ROAD

City scooters will soon be electrified. Peugeot is launching the first industrialized scooter running on electric energy. Dubbed the Scotelec, Peugeot's scooter will be powered by 3 Saft STM 5.100 monoblocs. This will give it a range of 50 to 80 km, which is comparable to that of a gas-powered scooter. According to existing road traffic regulations, maximum speed has been limited to 50 kph. The Scotelec will be undergoing pre-production testing throughout 1995 and will be on the market next year.



PSA

HIGH-FLYING HELICOPTERS

McDonnell Douglas Helicopter Systems has chosen Saft to equip its MD Explorer Helicopter in a long-term partnership. Saft's 24V 22Ah Nicad battery 2386-1 starts the helicopter engine. The MD Explorer's civil applications include corporate and charter transportation, environmental protection, and law enforcement. In the military realm, it can perform light attack and scouting operations, reconnaissance, medical evacuation and VIP transport. In any situation, the Saft battery's proven reliability won't let it down!

In just two decades, mobile technology has changed the face of communication, establishing a link from person to person – rather than from place to place. An overview of a burgeoning market.

A user's guide to mo

Mobile communications embraces everything from the simple tone pager to advanced data transfer systems, but the most dynamic component of the sector is the cellular telephone, now entering its second decade of service in the developed world. Between 1986 and 1993 the worldwide cellular phone subscriber base grew to 32 million, and in certain countries (including Scandinavia and the U.K.) new mobile connections now exceed fixed-line connections. On current trends there will be 200 million cellular subscribers by the year 2000, representing up to 25% of all connections. Since every portable phone requires a battery to operate, Saft has a major role to play in this booming market. Indeed telecommunications are becoming one of Saft's most important applications. In France, for example, telecom battery sales have shot up to 50% of Saft's portable sales, up from 10% four or five years ago. Saft originally pioneered its battery development for military wireless applications and is reinforcing its offer through new product development backed by a dynamic marketing approach. Saft is

global market leader in prismatic battery technology as well as in segments of the cylindrical market (including the foam range, AA, 4/5 A).

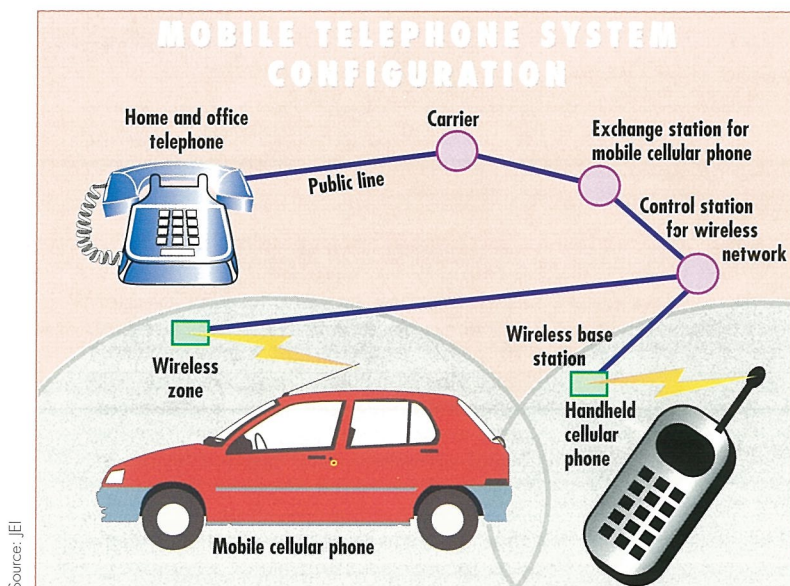
The underlying principle of cellular telephony and other mobile communications systems is straightforward – two-way radio transmitter-receivers interfacing via base stations with standard telephone networks. But because the details and different standards can get complicated, *Saft International* offers this brief guide to the field.

— WHY "CELLULAR"?

Cellular phones allow users to conduct conversations out of doors and while traveling, and it is this feature that has driven the market until now. In 1981, the U.S. communications authorities adopted cellular Amps (Advanced Mobile Phone System). The Scandinavian countries adopted NMT (Nordic Mobile Telephone), while in the U.K. Tacs (Total Access Communications System) has been available since 1985. Similar systems were developed in France and Germany.

All these systems are configured on the same approximate basis. The territory covered is divided up into small zones or cells, ranging in radius from 10 km down to 3 km, each with its own base station for transmitting and receiving on the appropriate wavelength. Car phones or portables transmit to and from the nearest base station. This is radio-linked to a control station operating the wireless network, which in turn is linked to an exchange station that converts radio signals to electrical signals for transmission through the fixed-line telecom network, and hence to the number being called. Subscribers moving from one cell to another automatically hook into the new base station, and the call continues without interruption. (See diagram, left).

The big breakthrough came in the early 1990s with the launch of digital systems. The vital difference between digital and



Source: JEt

mobile communications



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analogue systems is that, instead of a continuously variable signal in sine-wave form, information is converted into and transmitted in binary form – a coded string of ones and zeros, on the same principle as digital computers. Because it is mathematically exact, digital mobile communications provides high transmission quality, as well as opening up the way for data transmission from computers and other digital-based technologies.

Digital systems have other advantages over analogue. Their smaller cell size means that more calls can be handled for any given area, thus easing congestion. Lighter and more compact equipment can be produced, thanks to microchip technology – and also because less power is needed for the smaller cells involved. More efficient use can be made of frequencies, and calls remain immune to radio eavesdropping.

Over the past two years the European-developed GSM (global system for mobile telecommunications) has become the technology of choice for large parts of the

globe. The first GSM networks were launched in Germany, France and Denmark in mid-1992, and similar services are in operation, or in the works, across Europe, the Middle East, Africa and Asia-Pacific.

Only in the Americas and Japan have alternative systems been adopted. In Japan, a relative newcomer to the field, there are parallel digital carphone and Personal Digital Cellular (PDC) systems. In the U.S. there are two rival digital systems – digital Amps, and the newly developed CDMA technology.

— GSM: A WORLDWIDE NORM

One big advantage of GSM is that it is a single standard, enabling equipment manufacturers to benefit from economies of scale. Another key selling point is the fact that the GSM handset can be used anywhere in Europe. “Roaming agreements” among service providers enable users to receive and make calls in whatever country they happen to be in. This effectively opens up the possibility of continent-wide – and in principle planet-wide – “person to per-

Power sources must be extra-light to satisfy constantly increasing customer demand

son” communication (rather than “place to place,” as with fixed line systems and car-phone mobiles).

Another recently launched European digital standard – DCS 1800 – operating on a higher frequency and using smaller cells, is more suited to the urban environment. Since its higher-frequency signals are much less affected by walls, DCS can function in places inaccessible to GSM, notably basements and the interiors of buildings.

— NON-CELLULAR CORDLESS SYSTEMS

Even more local still in terms of their application are various cordless systems, which are increasingly becoming features of companies’ within-office communications, doing away with the need for fixed line terminals.

Europe has two rival cordless business systems – CT2 (cordless telephone 2nd generation), and the more recent DECT (digital European cordless telecommunications) standard, which has been adopted by major equipment suppliers including Alcatel, Siemens, Ericsson and Philips. The key feature of DECT is its use of fiber optic networks, which give it a performance comparable to GSM at a lower cost. It effectively functions as a small-scale cellular network within the area covered by the fiber optic cabling. Unlike standard CT2 systems such as the French Bi-Bop, DECT uses the high transmission rate of the fiber optic system to provide a constant scan from terminals to identify handset location, enabling users to receive calls at any time. DECT has been installed on a trial basis in cities in France, the U.S. and Norway. (See diagram on page 14 for DECT configuration).

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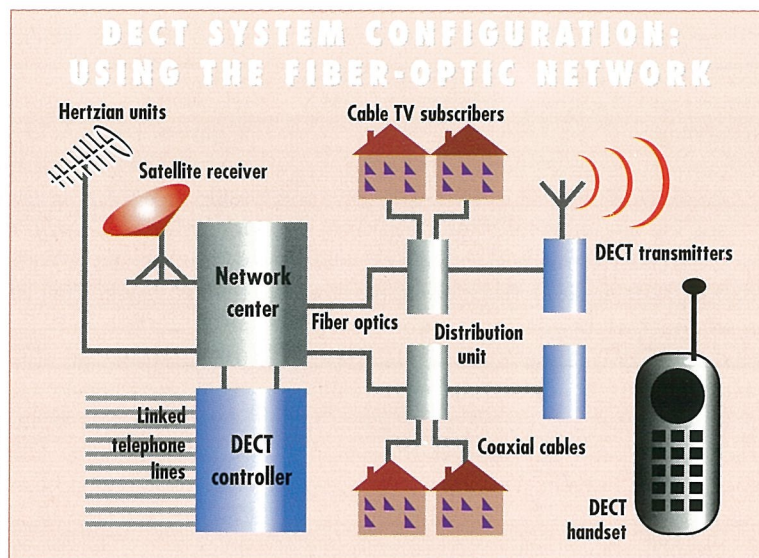
If current trends continue, there will be 200 million cellular subscribers worldwide by the year 2000

Telepoint systems like the Bi-Bop and the Dutch Greenpoint are also effectively extensions of the cordless home telephone. They function as “the callbox in the pocket” for pedestrians in cities. Though economical to use, they suffer from being non-cellular – incoming calls can only be received within range of the terminal where the last call was placed. At the other end of the scale, a new generation of telecommunica-

tions satellites such as Globalstar, Iridium and Immarsat-P are poised to provide global mobile telephone services, using lightweight pocket-sized handsets for voice as well as data communications. As opposed to the geostationary satellites in use for telecommunications since the 1960s, the new generation of Leo (low-earth orbit) satellites operate from 700 km to 1600 km from earth.

Globalstar will use 48 Leo satellites orbiting at 1300 km to provide a low-cost service. Iridium will involve a “constellation” of 66 small Leo satellites weighing around 700 kg at a height of 750 km. Handsets for use on the system will be dual mode satellite/cellular. When a call cannot be routed via the local terrestrial cellular network, it will be relayed to the nearest satellite, transferring between satellites if necessary, before being beamed down through one of some 20 “gateways” connected to the public telephone service.

Another long-term project is Teledesics, with a planned 840 little Leos in 700 km orbit, to provide high capacity data, video and voice services worldwide using receivers and small antennas installed in homes and businesses.



Source: Science & Vie

— THE TERMINAL

Practically all mobile communication terminals – the telephone apparatus itself – contain the same basic units, though their configuration will vary according to type and model. Basically, a terminal consists of a radio transmitter/receiver plus electronics, one or more batteries (which are generally removed to be recharged), a connector (for linkage to the charger for *in situ* recharging), a screen (in the new generation of digital terminals) and a casing. The charger is not part of the terminal, and is normally kept elsewhere – though car-phones have their own charger inside the car. Thus users normally recharge batteries at their office or home, and simply carry spare batteries with them in case of need.

Digital communications like GSM open the way for transmission from computers and other technologies

Terminals may also be harnessed together with other technologies – e.g. computers, CD Rom, faxes etc – to form multi-media terminals. These include the keyboard-less IBM Simon (currently available in the U.S. only) and Apple Newton. Such developments are likely to progress much more in years to come.

A persistent trend over the years has been for terminals to decrease in size and weight, and to operate on less and less power. From the heavyweight fixed car phone, complete with its built-in charger, there developed in the 1980s the “transportable” and “hand-portable” terminals (the latter weighing something over 500 g). The market took off around two years ago with the development of digital systems. The era of the truly portable phone had begun. In the past four years the weight of portable terminals has come down to 200 g (including batteries) or less for models like the Alcatel HB200, the Ericsson G337, and Nokia’s 2110 and Technophone 515. The Motorola Microtac Elite, recently launched in the U.S., weighs in at just 110 g. These new lightweight terminals are also smaller in size – a typical model being 20 cm long, 6 cm wide and 2 cm thick.

— SAFT BATTERIES FOR MOBILES

Mobile communication systems have at least one feature in common – from the relatively large carphone to the pocket-sized portable, they all require an independent power source. Their effectiveness and convenience depends in large part upon the characteristics provided by terminal batteries. Prime considerations, which are prioritized differently following specific requirements, are low weight and volume, durability and power, and cost.

From the technical point of view, Saft offers a complete range for today’s market, with two format options – prismatic or cylindrical – and three electrochemical couple options – Ni-Cd, Ni-MH (nickel-metal hy-

dride), and lithium rechargeable (Li-ion). The type used in particular cases depends on the market and on user priorities. For example, where lightness and small volume are priorities, the smallest prismatic battery, using Ni-Cd, Ni-MH and now Li-ion technology, will be used. If power/durability is a priority, higher-energy but more bulky cylindrical batteries may be used. Where low cost is not a priority, but high power and low weight are, lithium rechargeable batteries may be the solution. And so on.

Of the three battery technologies, Ni-Cd is the cheapest; Ni-MH is more expensive, but provides slightly more power; while lithium rechargeable – the top-of-the-range option – is very small and light and provides high power, but is quite expensive. In terms of watt-hours per kilo, Ni-Cd gives 55, Ni-MH 65, and Li-ion 110. Thus lithium provides twice the power/weight ratio of Ni-Cd, but at a cost of more than triple the cheaper option. In terms of format, cylindrical batteries provide high energy and are less expensive; prismatic batteries

are smaller and lighter, but more expensive.

To put these figures into a more practical context, a terminal using five rechargeable AA Ni-Cd batteries gives 2-3 hours talk time. (Disposable primary batteries last longer, but the cost of replacement is high, and they are only used in CT2 systems like Bi-bop). Recharging takes about an hour, and batteries can be recharged from 300 to 500 times. This means that a battery pack for an average business mobile phone can be expected to last for a year or more.

Saft technology has been in the forefront of developing lightweight, compact, high-power batteries for analogue and digital systems of all kinds. Saft batteries are to be found in many of the leading mobile phone brands and play a major role in all technologies – GSM, DCS 1800, DECT, CT2, etc., plus the emerging satellite and multi-media technologies. Saft’s constantly evolving battery technology, along with its flexible and rapid charging systems, is an indispensable ally in the development of today’s and tomorrow’s mobile communications systems. ■

Saft leads the market in prismatic batteries for today’s ultra-compact handsets

