


HUGHES

HUGHES

Subsidiary of GM Hughes Electronics



*Global Solutions for a
Better Tomorrow*



For almost five decades, Hughes Aircraft Company has been a world leader in the design, development and production of high technology systems for scientific, military and commercial applications.

Hughes pioneered an array of technologies ranging from lasers to space satellites, from radar to information systems, from infrared imaging to computer-generated simulation.

With that breadth of technical experience, the company is able to bring many disciplines to bear on the complex issues confronting industry and commerce around the world.

The company is planning major thrusts to increase its leadership position in telecommunications, to expand its support for General Motors' automotive and transportation programs, and to pursue other industrial and commercial markets aligned with its core technologies.

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Telecommunications



Hughes is a world leader in satellite communications. It has become a one-stop telecommunications company. Changes are coming in direct-to-home broadcasting called DirecTV™ and mobile, maritime and airline communications.



Automotive



Hughes is transferring aerospace technology into commercial automotive products including the electric car, head-up display and holographic spotlight.

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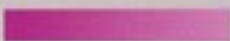
Transportation Systems



Demands on airports, highways and harbors are increasing. Hughes is applying its technology and systems management experience to improving air traffic control systems and developing smart highways.



Commercial Aviation



Flight simulation, flight deck avionics, passenger entertainment and cabin management systems are some of the ways Hughes is making air travel more efficient and enjoyable while maintaining current levels of safety.

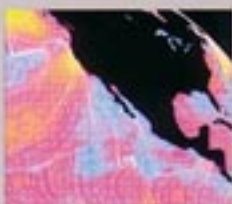
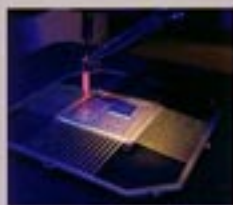
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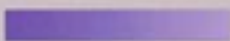
Industrial Automation



Hughes is an established supplier of precision production systems. With the same high standards, the company has expanded its line to bring an array of new solutions to manufacturing tasks.



Large Scale Information Systems



Confidence is a by-product of the decision-making process based upon reliable and dependable information. Environmental studies and resource management are challenging areas for the next generation of large-scale information systems.

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Professional and Consumer Products



Simulation systems. Audio products. Projection systems. Technologies explored by Hughes are catalysts for higher dimensions of sensory realism.



Hughes' greatest immediate commercial strength resides in communications systems. During the 1980s, Hughes put in place the telecommunications components that would assure its preeminence throughout the 1990s and beyond. Consumers were looking for more variety in TV programming. Businesses were searching for less expensive, more flexible and reliable ways to link dispersed locations. Nations were in need of improved communications systems. The world was poised for a telecommunications boom.

Hughes revolutionized telecommunications worldwide back in 1963 when it placed the first communications satellite into geosynchronous orbit—22,300 miles above the equator. Innovations over the years have enabled Hughes engineers to design and build ever larger, more powerful satellites. Today, Hughes leads the world in the design and fabrication of commercial communications satellites. In fact, half of all commercial satellites now operating bear the

Hughes imprint. Hughes is also the largest private owner and operator of communications satellites.

Hughes' satellites are designed to meet a



wide array of requirements...from widespread broadcasts to transmissions directly into an office or living room...from outright purchase for

large users to leased services for those who need only a transponder or two.

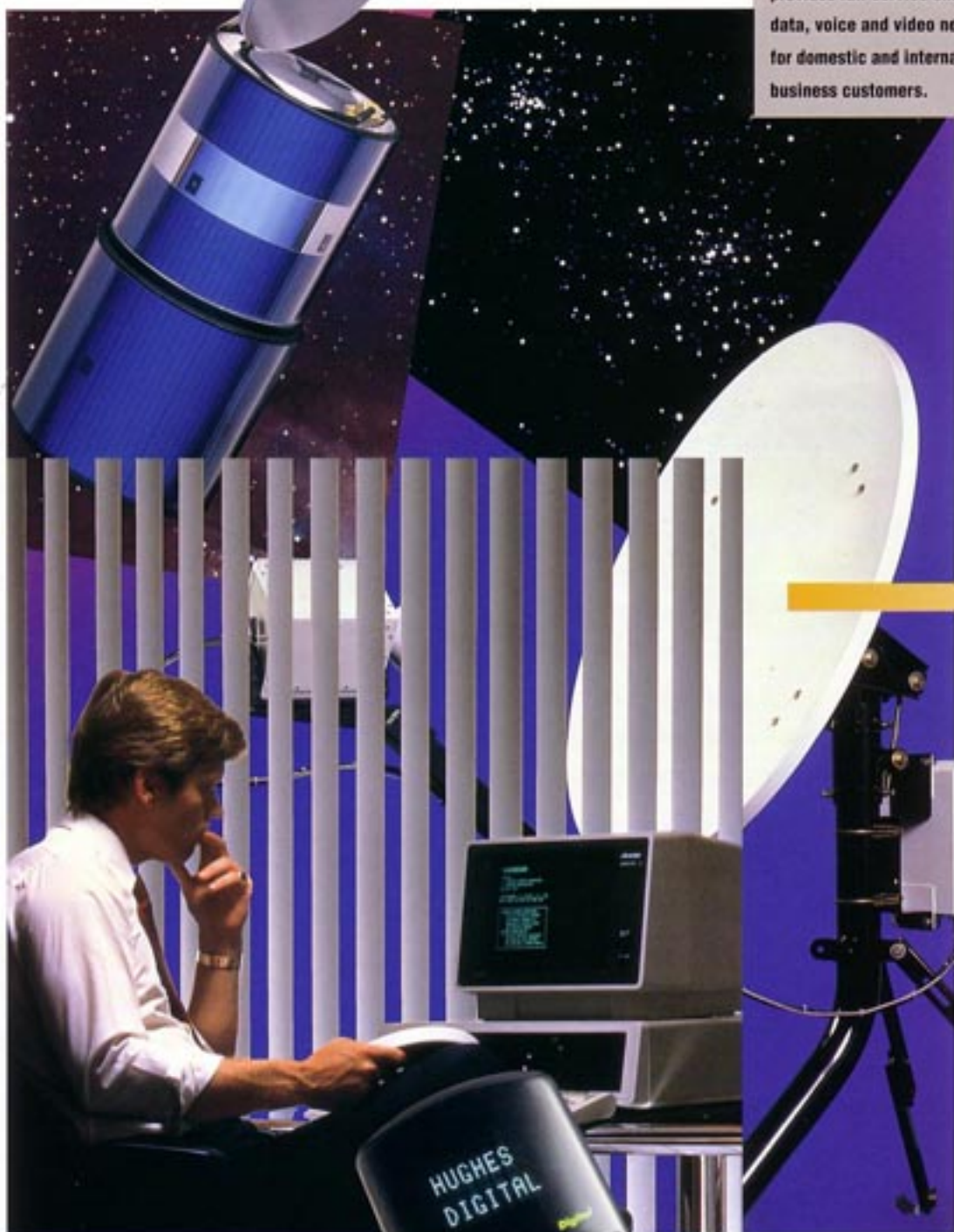
A satellite reliability rate of 99.99 percent assures customers of superior service. This reputation for reliability is a significant reason why many countries, faced with the challenge of building their first satellite system, turn to Hughes. It is also the reason why many customers, electing to move up to a more powerful spacecraft, return to Hughes.



Next-generation Hughes satellite, the HS 601, at left, is designed for such high-power uses as direct television broadcasting and mobile communications. Testing of electronics and circular antenna, above, assures reliability and quality.



A world leader in communications satellite technology, Hughes provides full-service end-to-end data, voice and video networks for domestic and international business customers.



But telecommunications is more than just satellites, a lot more. To serve the needs of customers who are finding ever-widening ways to use this technology, Hughes has become a one-stop telecommunications company. Hughes provides end-to-end satellite and land-based communication services—from the satellite itself, to a host of transmission services, terminal receivers, and private business and local area networks. There's even broader variety coming in the form of direct-to-home broadcasting and mobile telecommunications. Notable capabilities include:

CABLE TELEVISION SERVICES

Cable changed the television industry, bringing a veritable smorgasbord of programming to the viewing public. Hughes is recognized as the premiere cable delivery system in orbit today, serving such well-known companies as HBO, The Disney Channel, CNN, Turner Broadcasting and ESPN. Hughes also provides AML[®] equipment for microwave distribution of CATV programming in local areas.

DIRECT BROADCAST SERVICE

Forty percent of American households do not have access to cable programming. That is about to change. Even the most remote reaches of the country will have access to a world of programming through *DirecTv*, Hughes' direct broadcast satellite network, starting in 1994. More than 100 channels of entertainment, news, sports and regional programming will be beamed from satellites directly to low-cost home antennas measuring only 12 to 18 inches in diameter. The innovative

system will also accommodate high-definition television transmission and digital audio service.

BROADCAST VIDEO/TIMESHARING SERVICES

By the end of 1992, CBS will be distributing all its network programming to affiliates via Hughes satellites. In addition, Hughes is already able to accommodate occasional use requirements such as television coverage of quickly unfolding world events through its video timesharing service.

VERY SMALL APERTURE TERMINAL (VSAT)

Since the telephone industry break-up, organizations have been searching for cheaper, faster, and more reliable communications technology to refine operations, improve customer service, and secure competitive market advantages. More and more, these organizations are turning to VSAT systems. These systems use satellites to transmit and receive data and video between headquarters and multiple locations.

Applications run the gamut from linking America's largest retail chain...to bringing innovative educational programming to public elementary schools in low-income urban and rural areas...to contacting doctors and emergency personnel needed in isolated areas around the world.

VSATs can fit any size requirements.

General Motors, for example, is networking 9,700 dealerships to increase operating efficiency and better serve GM customers. On the other hand, Barnett Banks opted for a VSAT network to communicate with its 550 branch offices in Florida and Georgia. Barnett shares a hub, or control center, with other companies to contain costs.



Network controller coordinates access to orbiting communications satellites, monitors signal power levels and resolves interference with other satellite signals.



Students in remote areas can be interactively linked to their teachers via satellite which provides two-way voice and data transmissions and television reception.



LOCAL AREA NETWORKS (LANs)

Hughes provides LANs for organizations needing either department-wide or enterprise-wide communications. Serving both small and large organizations, these networks incorporate from 100 to 20,000 connections. A typical LAN system includes terminals, PCs, workstations and host computers from all major computing vendors. Hughes provides universal connectivity from a single workstation, and a network that is flexible and easy to manage.

PACKET SWITCHING NETWORKS

The proliferation of complex information systems presents business with the challenge of keeping lines of communication open between diverse systems. Hughes' packet switching systems provide a flexible and cost-effective means of transmitting data between information systems via telephone lines. This technology ensures these businesses can talk, both within their country's borders and beyond.

MOBILE COMMUNICATIONS

Car phones are becoming more popular, but stray too far from town and the signal fades because cellular service covers only relatively well-populated areas. Actually, 85 percent of North America lies beyond the range of two-way radio towers used by cellular systems. That limitation will change by the mid-1990s when two Hughes satel-

lites enter service. This service will provide coast-to-coast communications for travelers in cars, trucks, planes or boats. The service will also reach homes and other fixed locations too isolated to use conventional networks.

MARITIME COMMUNICATIONS

Hughes' pioneering software and hardware provides a fast, reliable means of communication with ships at sea via satellite.

DIGITAL CELLULAR TELEPHONE SYSTEMS

Digital technology can increase the capacity of the nation's overburdened cellular telephone systems by a factor of 15, and provide callers with a far clearer signal. An innovative technique takes advantage of the pauses that occur during a typical phone conversation to allow a larger number of conversations to be handled over a single channel. Auto dealers will become dominant forces in the cellular telephone business in the 1990s. Hughes and Delco Electronics will provide General Motors customers a one-stop shop for cellular phones and service at GM dealerships.

AIRLINE COMMUNICATIONS

Commercial airline passengers will be offered higher voice quality telephone service, plus facsimile and computer data transmission, using digital technology.

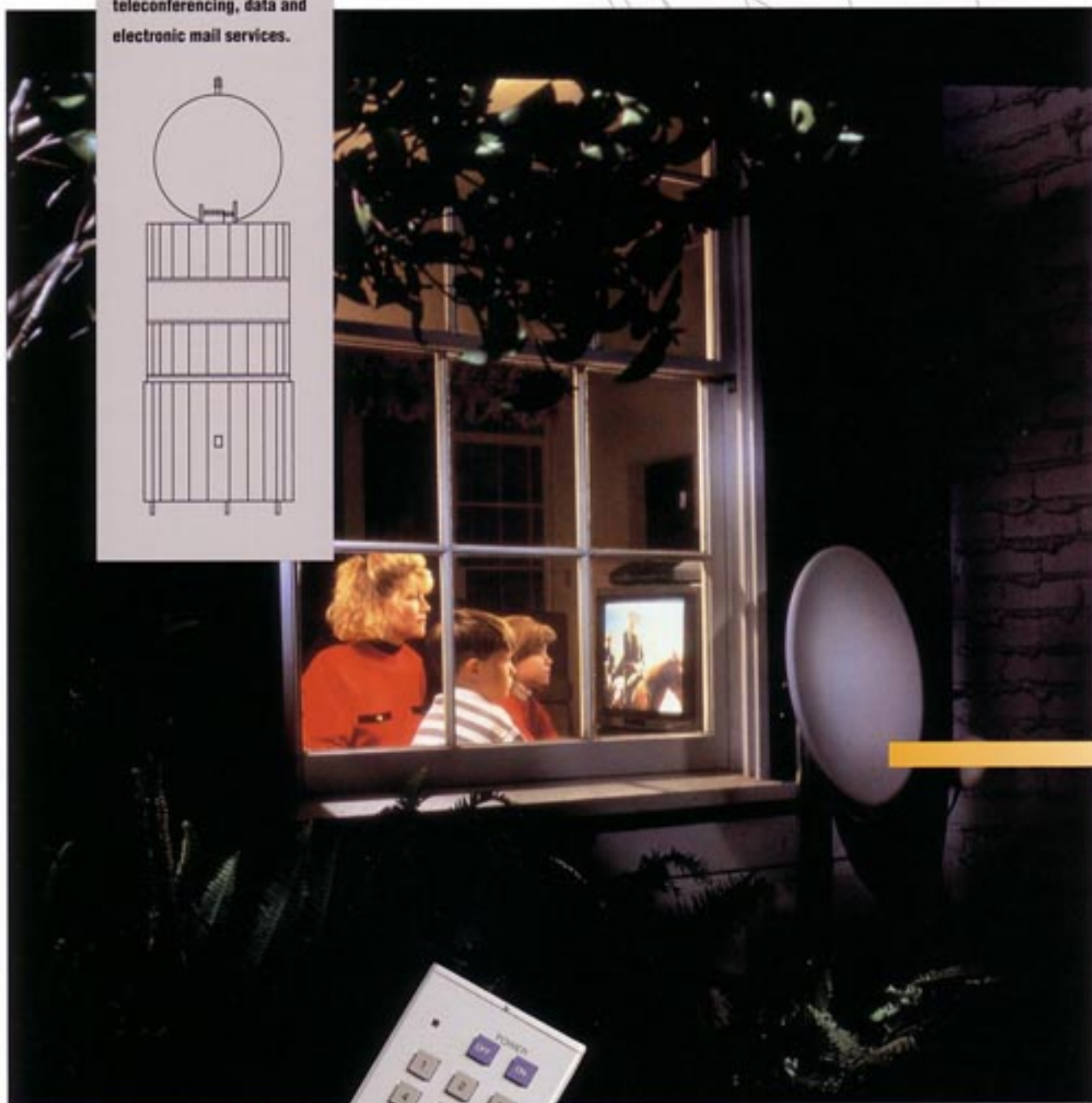
Throughout the past half century, Hughes has established its preeminence in the history of communications and positioned itself to be a leading force in the future of this rapidly changing field.



Clearer calls and increased capacity of the cellular telephone system will result from Hughes' proprietary digital technology. The company leads the world in design and fabrication of commercial communication satellites including the HS 376, at right.



Hughes' HS 376 is the world's most-purchased commercial communications satellite for such uses as voice, video teleconferencing, data and electronic mail services.



Home subscribers with compact 18-inch satellite antennas will soon be able to receive more than 100 television channels of news, sports and entertainment programming.

As a member of the General Motors family, Hughes especially emphasizes applying its technical expertise to automotive products. Hughes is currently working on more than 150 projects to transfer aerospace technology into commercial projects related to GM products, production and services. In return, the company benefits from GM's formidable financial and industrial resources.

ELECTRIC CAR

Hughes is working with Delco Electronics on GM's future electric car. The company is developing techniques to package the power control systems for ease of manufacture and to explore battery technology that will extend the vehicle's range and improve battery life.

Other examples of advanced systems developed by Hughes for GM vehicles include:

HEAD-UP DISPLAY

Derived from head-up displays originally developed for fighter aircraft, the automotive wind-

shield display presents information such as vehicle speed, turn signals and a low-fuel warning within the driver's forward field-of-view. Display symbols appear to float in space above the front bumper. Safety is enhanced because a driver's eyes can remain fixed on the road ahead.

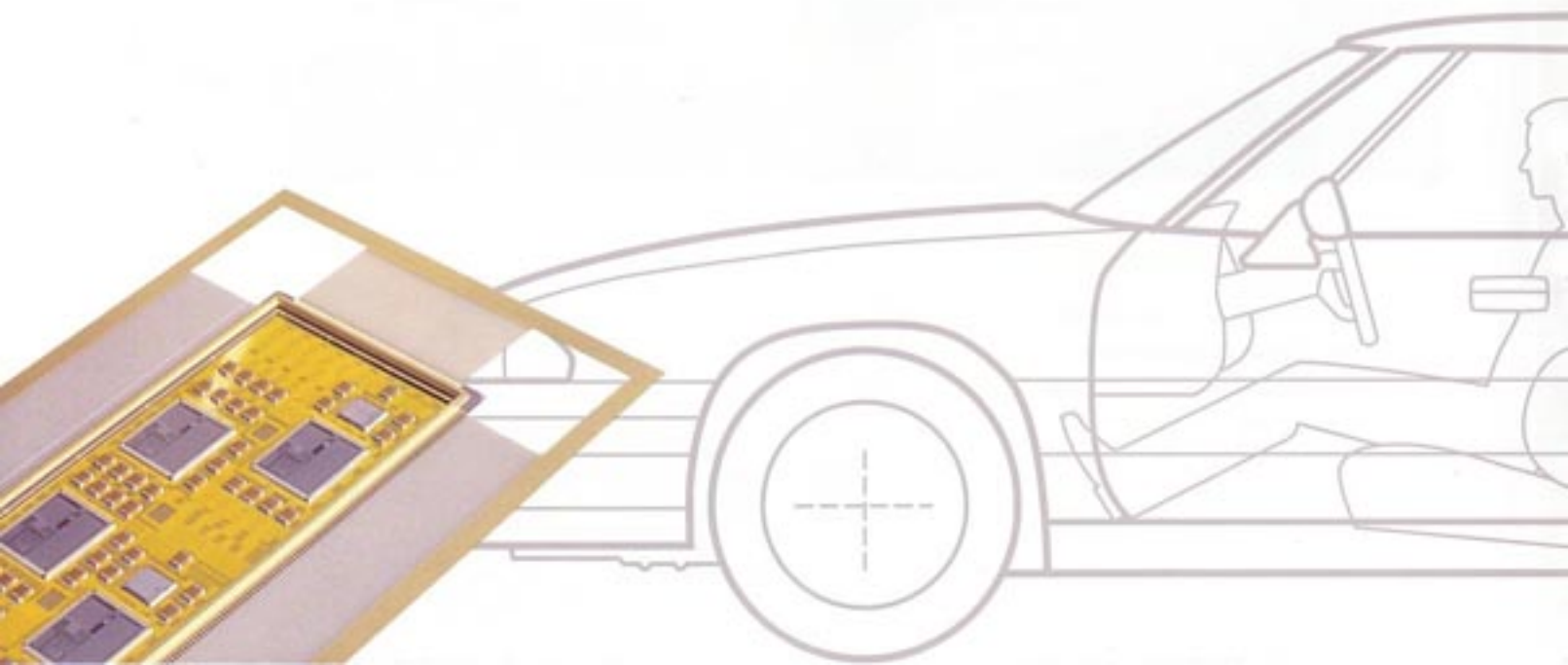
HOLOGRAPHIC CENTER HIGH MOUNTED STOPLIGHT

Red light beams are projected through a clear, circular hologram on a car's rear window, generating a brake light warning to trailing motorists when brakes are applied. To the driver, the light is invisible and does not obstruct rear vision.

General Motors will continue to be a major source of new business for Hughes. The adaptation of Hughes technology will result in increased safety and value to the automotive customer.



Hologram, developed by Hughes and Inland Fisher Guide, projects brake light on a car's rear window, but remains invisible to the driver.





Hughes is exploring battery technology for GM's future electric car, at top.

Auto simulation laboratory supports development and testing of automotive electronic systems, above.

M

More than 30 large-scale Hughes-built airspace management systems serve and protect a billion people in 23 nations around the world. Hughes is now applying this expertise not only in the air, but also on land and sea.

AIR TRAFFIC CONTROL

Applying decades of airspace management experience, Hughes entered the commercial market with the Korean air traffic control system in 1986.

The system provided uninterrupted service during the 1988 Olympic Games in Seoul and, since becoming operational, has been available with no down time.



Advanced workstations help improve the capacity, performance and economy of air traffic control services while maintaining current levels of safety.

Airports throughout Germany are equipped with Hughes' real-time, full-color digital display equipment and an advanced software package developed to run on standard commercial hardware.

Hughes is responsible for the modernization of Canada's air traffic control system. By automating data processing tasks and introducing modern, reliable workstations, the new system will significantly improve the capacity, per-

formance and economy of air traffic services in that nation. The system thus serves more aircraft while maintaining current levels of safety.

Transport Canada estimates that the Hughes-designed system will result in long-term operational savings of \$440 million and user savings of \$495 million.

With its long record of reliability and availability in airspace management, the company stands as a world leader in international air traffic control.

AIRPORT INTEGRATION

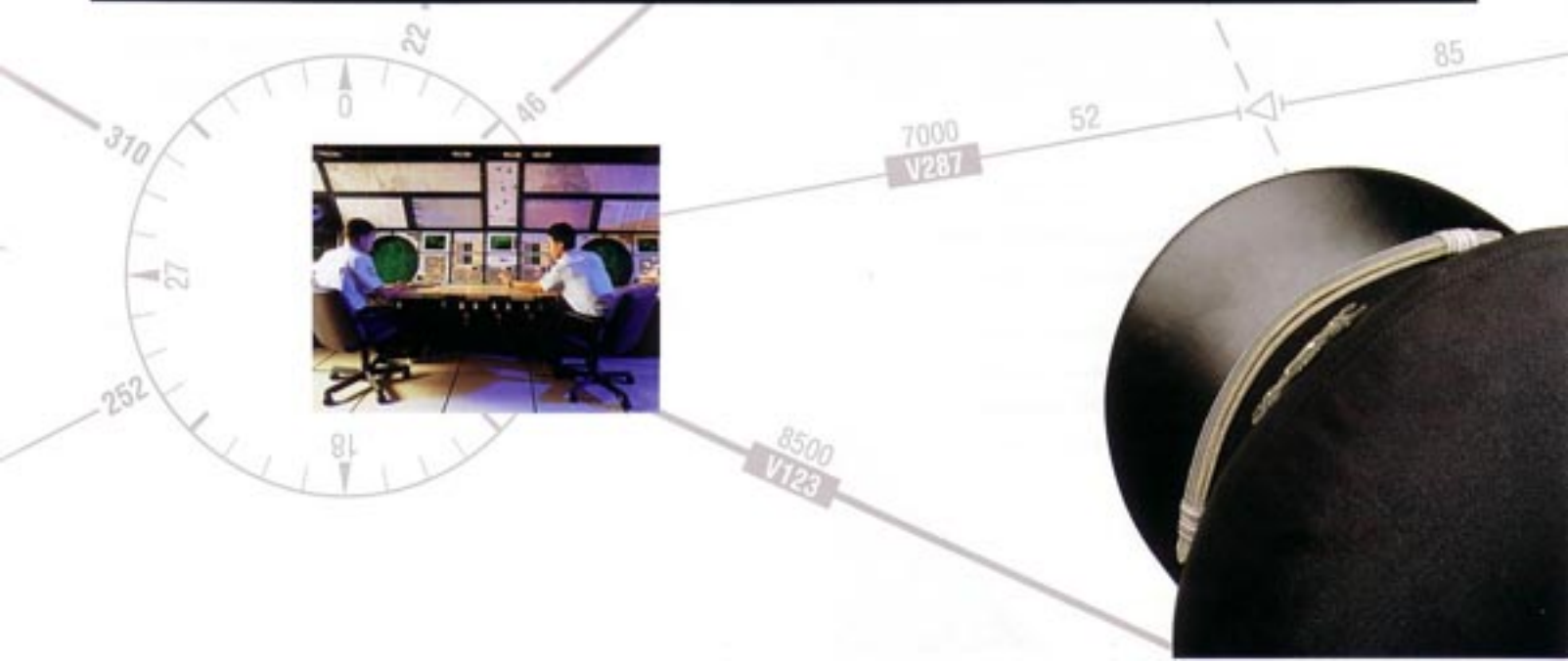
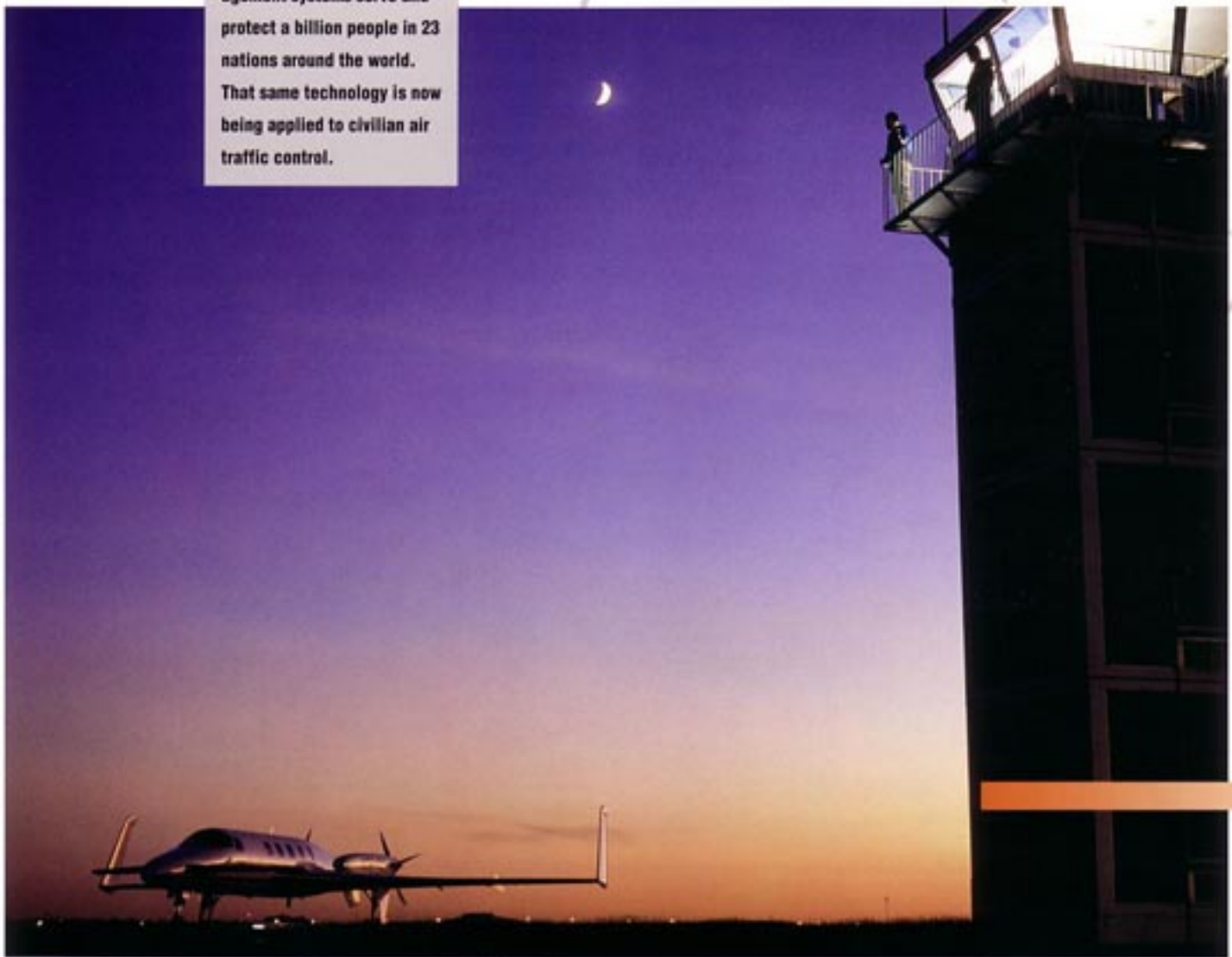
Hughes is turning its large-scale systems management capabilities to increasing operational efficiency at airport facilities. The effective coordination of airport services such as security, emergency, maintenance, landing aids including runway lights, and surface street traffic control will lead to more efficient operations, even with fewer personnel.

ADVANCED TRAFFIC MANAGEMENT SYSTEMS

Working with GM, the Federal Highway Administration and several state and municipal agencies, Hughes is exploring the use of advanced technology in "smart highways," part of the national initiative for an Intelligent Vehicle/Highway System.

Advanced Technology: Radar, television cameras and infrared sensors can monitor vehicle flow 24 hours a day. Small satellite terminals are a highly flexible alternative to telephone lines for

Hughes-built airspace management systems serve and protect a billion people in 23 nations around the world. That same technology is now being applied to civilian air traffic control.



connecting widespread highway sensors to traffic control centers. These command hubs will be fortified by Hughes' expertise in systems engineering, computer software development, digital communications, image processing and interactive displays.

More cars are coming. Fewer roads are being built. Traffic management aided by Hughes technology will keep drivers moving.

Motorist Benefits: Congestion is believed to cause two billion vehicle hours of delay annually. That is a \$73 billion loss in productivity and wasted assets. Traffic managers will be able to detect vehicle breakdowns and accidents to expedite their clearance. Additionally, traffic management systems will provide the motorist with warning of congestion in time to select an alternate route.

Current Projects: Hughes is participating in TravTek, a GM project in Orlando, Florida. TravTek will demonstrate and evaluate use of an integrated system of smart cars and smart highways. One hundred Oldsmobile Trofeos will be equipped with a computer to receive relevant traffic and travel services information from a traffic control center, to calculate alternate routes and to present map displays for navigation guides. In related projects, Hughes is investigat-

ing the expansion of the radio spectrum in traffic control systems and is helping develop a center to test advanced traffic management systems.

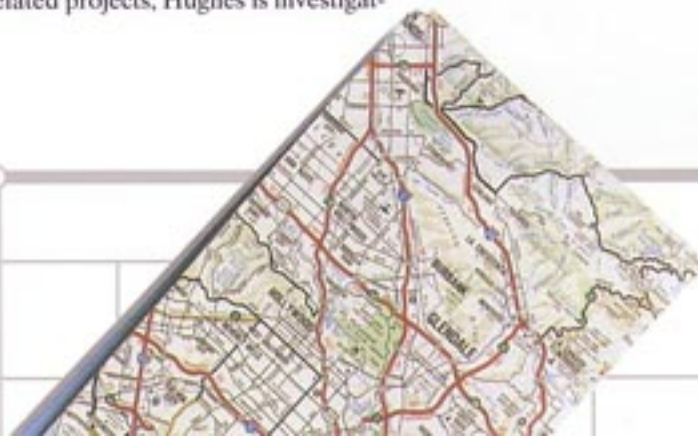
RADIO IDENTIFICATION OF AUTOMOBILES

Another Hughes technology with implications for smart highways is radio frequency identification using low-cost miniature radio transponders to transmit identifying codes. Properly equipped automobiles could pass through toll booths without even slowing. The car would be identified and a fee deducted from the motorist's prepaid account.

MARITIME TRAFFIC MANAGEMENT

Hughes is providing systems to improve efficiency and safety of busy ports around the world. With electronic surveillance and command and control technology, the direction of ship traffic and allocation of cargo handling resources will improve—and harbor pilots will be available to accommodate more vessels.

Transportation is the lubricant of commerce. Demands on airports, highways and harbors are accelerating. To respond to these demands, Hughes is applying advanced technology and decades of systems management experience to improve the safety, reliability and efficiency of global transportation systems of the future.





Busy seaports, top photo, are being equipped with resource management systems to improve efficiency and safety.

Hughes, GM and government agencies are applying advanced technology to enhance traffic flow on highway systems, above.

The sky's the limit? Not anymore. For decades, Hughes challenged that notion by developing technologies for the civilian aviation market.

The result is an intriguing array of products with far-reaching implications.

FLIGHT SIMULATION

Through the magic of computers, airline pilots can "land" at San Francisco International Airport. They can "see" the Bay, the terrain, the buildings and the terminal approach—all without ever being near the Golden Gate. Inside simulators, pilots see a realistic scene through the cockpit windshield, they feel the motion of flight and landing, and they hear the sounds of flight systems responding to controls.

Simulation can expose pilots to every type of condition, including dusk, fog and rain. Pilots can also be trained to react to abnormal situations that could never be made part of real-life flight training—situations such as wind shear, system malfunctions and engine fires, or landing with partial landing gear. Flight simulation improves aviation safety, significantly reduces training costs and saves fuel. It frees high-value aircraft for their principal purpose: to transport travelers and cargo safely to their destinations.

Flight simulation has become so realistic, its controls so sophisticated that airlines are confident enough to qualify pilots on aircraft they have never flown. The upgrade is totally by simulator.

Every major airline in the world uses simulators or computer-generated visual systems devel-

oped by Rediffusion Simulation, a unit of Hughes.

The company has been a leading innovator in simulators, trainers and visual systems for more than 40 years. These visual systems account for over 70 percent of those ordered worldwide in the past five years.

Rediffusion's Concept 90 flight simulator has advanced the design of modern flight simulators. Extensive use of composite molded panels has given Concept 90 a sleeker, more modern appearance. But the concept is not simply an exercise in aesthetics. The advanced design also reduces life-cycle costs through easier maintenance and provides a truly ergonomic environment for instructors who have greater control via their touch-screen control stations.



Flight simulation trainers permit airline pilots to qualify on aircraft they have never flown. Concept 90, right, is a state-of-the-art pilot training tool.





Radar imagery of runway, viewed through pilot's head-up display, is just one of Hughes' many sensor technologies.

Next-generation passenger entertainment systems, at right, will give travelers more options.

FLIGHT DECK AVIONICS

Hughes' radar, laser, and infrared technology will provide significant benefits to pilots under a wide variety of flight and taxiing conditions.

A new holographic head-up display takes advantage of advanced sensors and provides pilots with flight guidance information not available on traditional instrument panels. This flight data is superimposed conformally on the pilot's view of the outside world. It greatly improves the pilot's ability to make the transition from instrument to visual flight conditions.

The company's subsidiary, Hughes Flight Dynamics, is the only firm certified by the Federal Aviation Administration to provide head-up display technology for commercial airliners operating under category IIIa landing and takeoff conditions.

PASSENGER ENTERTAINMENT AND CABIN MANAGEMENT SYSTEMS

Airlines around the globe are equipped with Hughes passenger entertainment, service and communications systems. The company has been in the business for the past two decades. Its systems offer high-quality audio transmission, with the added advantage of keeping cables—and weight—to a minimum. Engineers applied innovative signal processing techniques to transmit multiple signals on a single coaxial cable.

The most advanced cabin entertainment and service system designed and built by Hughes is in service on the new Boeing 747-400 jetliners. It



uses state-of-the-art digital technology to integrate all cabin communications and control functions.

Soon commercial airline passengers will be watching personal television screens, ordering merchandise in flight by credit card and conducting business as usual by telephone—all without leaving their seats.

Hughes continues to stretch the technical envelopes needed to train pilots more effectively and to make air travel safer, more efficient and more enjoyable. The sky has no limit.



For more than three decades, Hughes has supplied precision production equipment and systems to manufacturers. These were originally designed to meet rigorous specifications of company programs. However, their quality and reliability rated so highly that other companies, including competitors, became customers. With the same high standards, Hughes has expanded its line to bring an array of solutions to industry's manufacturing challenges.

AUTOMATION EQUIPMENT

Experienced in design, implementation and integration of computer systems for large-scale and complex assignments, the company is taking its knowledge of automation to the factory floor. With Hughes' systems engineering expertise, highly automated operations have been brought on-stream with minimal downtime. Now, Hughes is assisting parent General Motors to develop and test computer software that controls automated production equipment at GM plants.

MACHINE TOOL CONTROLLER

Open architecture lets users of computer systems alter hardware and software as needs change or technology progresses—without being captive to a single supplier.

Hughes' machine tool controllers offer this wider choice and facility for incremental improvement. In partnership with GM, the company is developing modular, open-architecture control systems which, even in early stages, are increasing productivity and accuracy.

The Hughes open-architecture approach will give machine tools and other highly automated equipment greater flexibility.

TRAINING SYSTEMS

From personalized training classes conducted with Hughes material and personnel to computer-based training courseware to sophisticated simulators, the company prepares people to operate complex systems. Desk-top simulators replicate functional and operational characteristics of an automated injection molding machine that makes plastic parts and assemblies for GM vehicles. The simulator brings operators and maintenance personnel quickly up to speed, minimizing the time a machine is off-line for training purposes. Subsidiary Rediffusion Simulation uses simulators to train chemical process operators, British Rail drivers, food manufacturers and many other production workers.

SECURITY SYSTEMS/

RADIO FREQUENCY IDENTIFICATION

The company has developed automated systems capable of monitoring and controlling security at large commercial, industrial and government facilities. Hughes is designing electronics-based monitors and controls for fire and security systems at General Motors facilities. Centralized monitoring will afford quicker, more dependable detection and response to emergencies. Another Hughes-designed fire and security system helps protect the nation's treasures at the Smithsonian Institution.



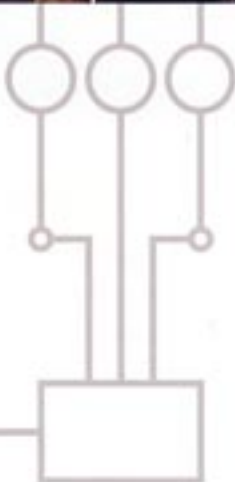
Machine tool controllers enable operators to program factory equipment for increased productivity and precision.



Transponders encased in plastic cards transmit identification code and afford access to secure areas.



Desktop simulator replicates the characteristics of an injection molding machine.



Radio Frequency Identification: Low-cost, miniaturized transponders encased in a variety of packages, including capsules and plastic cards, can transmit identifying codes used to control access to facilities or secure areas. The Hughes microchips also can track baggage, locate items in materials handling applications or enable the remote collection of data without intrusion. Hughes is exploring an array of potential applications in commercial, industrial and transportation sectors.

MONITORS FOR QUALITY

Automated chemical analysis is used in maintaining correct balance and consistency of complex solutions on the production line. Hughes developed a continuous, real-time monitor for complex manufacturing solutions and hazardous emissions by integrating laser and fiber optics technologies with computer science. The result: accurate absorption spectroscopy data for detection and prediction of imbalances in solutions.

PRECISION EQUIPMENT/COMPONENTS

Traditional industrial products of Hughes include production equipment: automatic testers, bonders, welders and solder systems. The FACT® (Flexible Automatic Circuit Tester) system is an automated circuit analyzer and continuity tester of cables

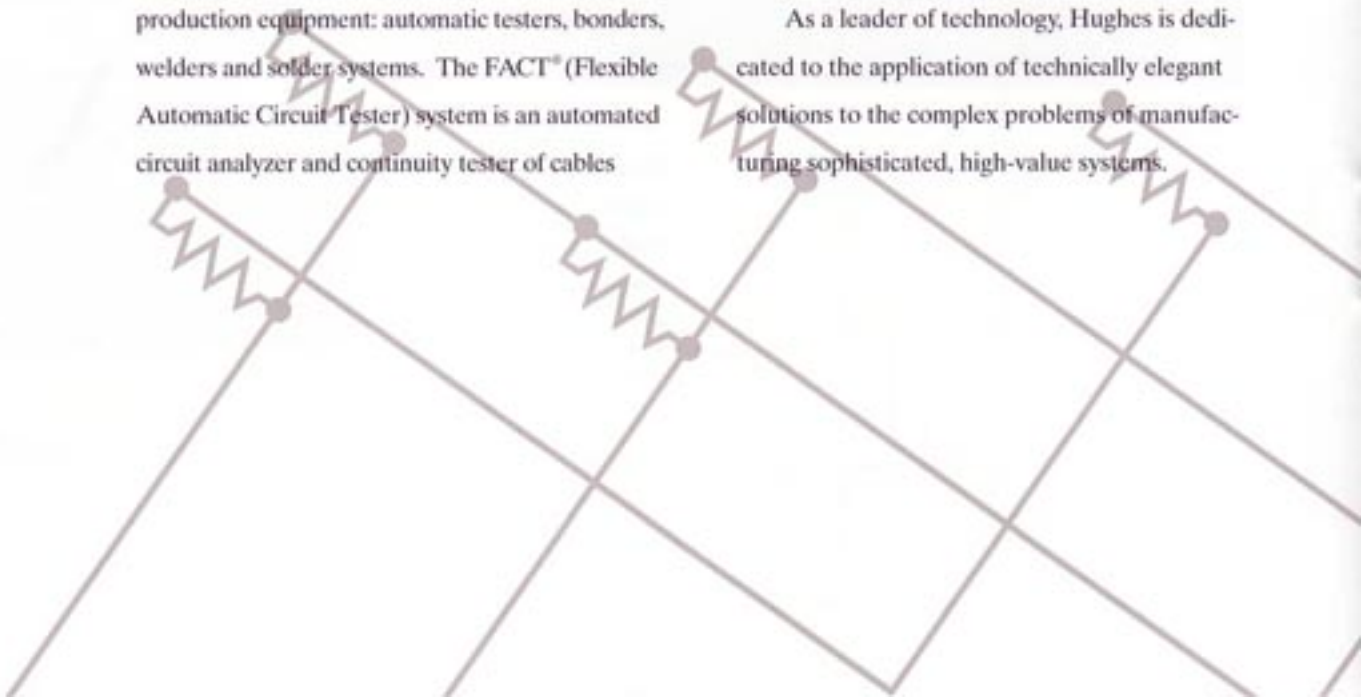
and printed circuit boards. Computer-controlled wire and die bonders and tape-automated bonding systems used in microelectronics assembly feature advanced programming and pattern-recognition capabilities. Other products include calibration and quality assurance equipment, resistance welders, welding quality controllers, reflow soldering systems and custom assembly equipment. Hughes is now exploring applications of laser welding with ultra-precision beams.

Components: The company supplies high-density electronic circuits to manufacturers of high-performance equipment such as computers, state-of-the-art test instrumentation and miniaturized, implantable medical devices. Gallium arsenide integrated circuits are being developed for automotive uses. Other Hughes components include traveling-wave tube amplifiers for communications satellites and fiber-optic and electrical connectors, cable assemblies and flexible printed circuits for computer, automotive, telecommunications and electronics testing industries.

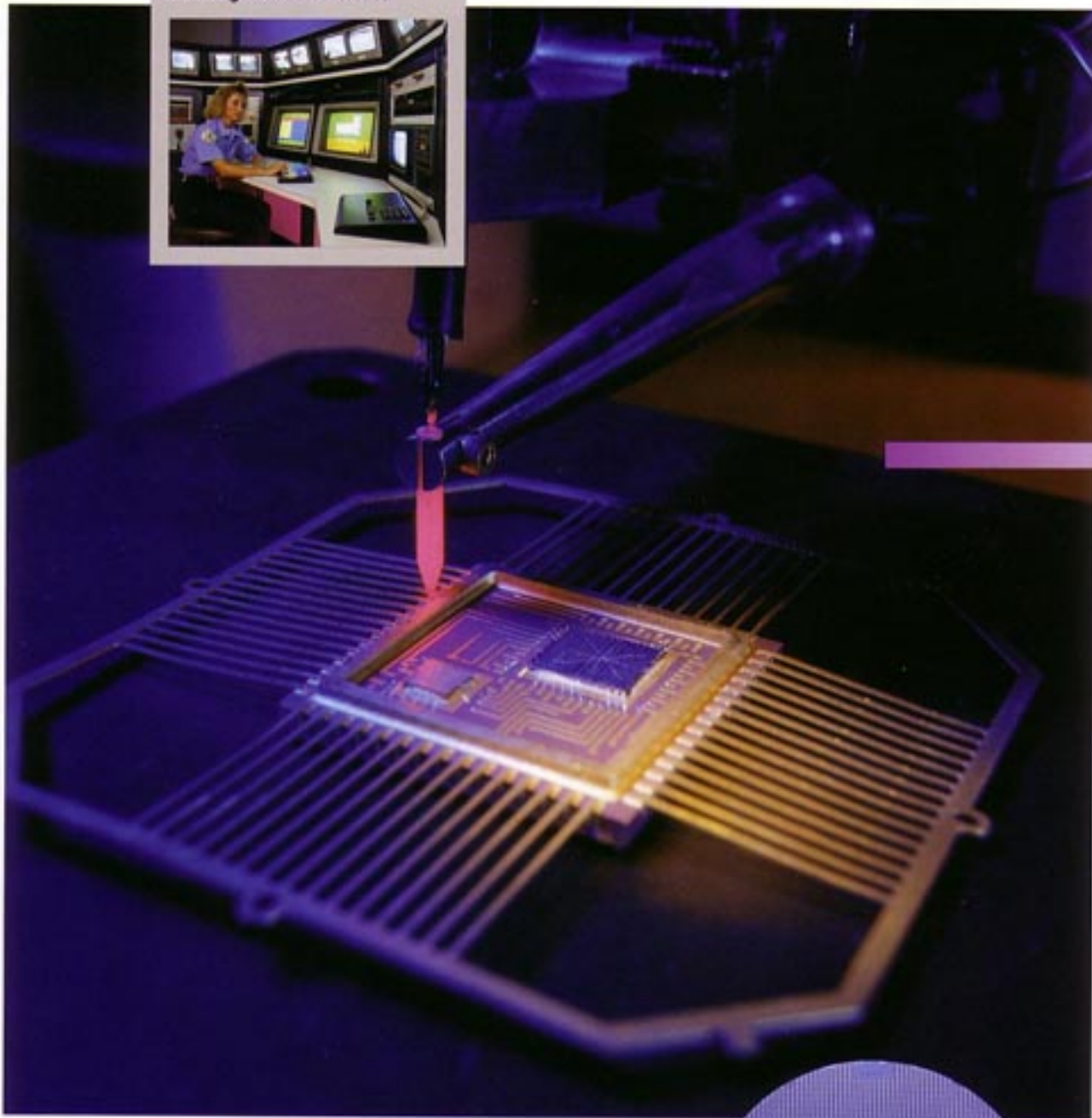
As a leader of technology, Hughes is dedicated to the application of technically elegant solutions to the complex problems of manufacturing sophisticated, high-value systems.



Printed circuit boards are repaired by parallel gap welding system, one of Hughes' automated bonding products.

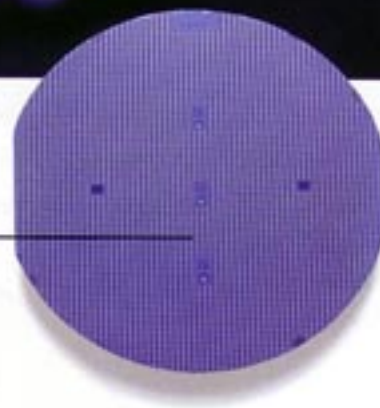


Automated security system monitors and controls assets at large commercial and government facilities.



Automated bonding system integrates laser, fiber-optics and ultrasonic technologies in soldering process.

Semiconductor wafer consists of intricate, RF programmable microelectronic circuits.



Decisions are only as good as the quality of the information on which they are based. This is especially true as the volume, flow and nature of information gets more complicated. Many of the widespread, complex systems being managed or developed provide very fast computer-generated information processing, presentation and communication.

These large-scale information systems weave multi-hued threads into a tapestry that can be grasped clearly and quickly. Data from multiple sources is collected, compressed and fused. The resultant information is presented in forms that are comprehensive and comprehensible. Analysts and managers have greater confidence in their decision-making process.

Hughes has amassed years of experience—from sensors, processors and software to interactive displays, communication networks and systems integration—that qualifies the company as a leader in information management technology.

ENVIRONMENTAL STUDIES

Earth science studies are accelerating and enlarging as investigators delve into the complexity of earth's environmental systems and the interrelationship of how these systems contribute to global change.

Vast stores of data already are amassed. More measurements inundate the scientific community daily. In coming years, fresh data with

global dimensions will increase exponentially. The sheer volume would overwhelm analysts...if not for large-scale information systems.

Experienced in design and integration of complex hardware and software systems for space surveillance and airspace management, Hughes is mobilizing to meet the challenges for large-scale systems: easy access, operational flexibility, expandability and compatibility.

RESOURCES MANAGEMENT

Effective management of large wilderness areas, harbors, urban land use, transportation networks and other infrastructure elements depends more and more on computer systems that transform widespread, often dissimilar data into visual information. With this spatial data technology, those engaged in resource analysis, policymaking or planning can visually capture a wide variety of dynamic subsystems in the context of a holistic system.

Hughes' Geographic Information Systems interlayer and fuse data from numerous sources. This approach provides a multidimensional perspective to analysts, resource managers and planners. Such visualization techniques offer new vision for future action.

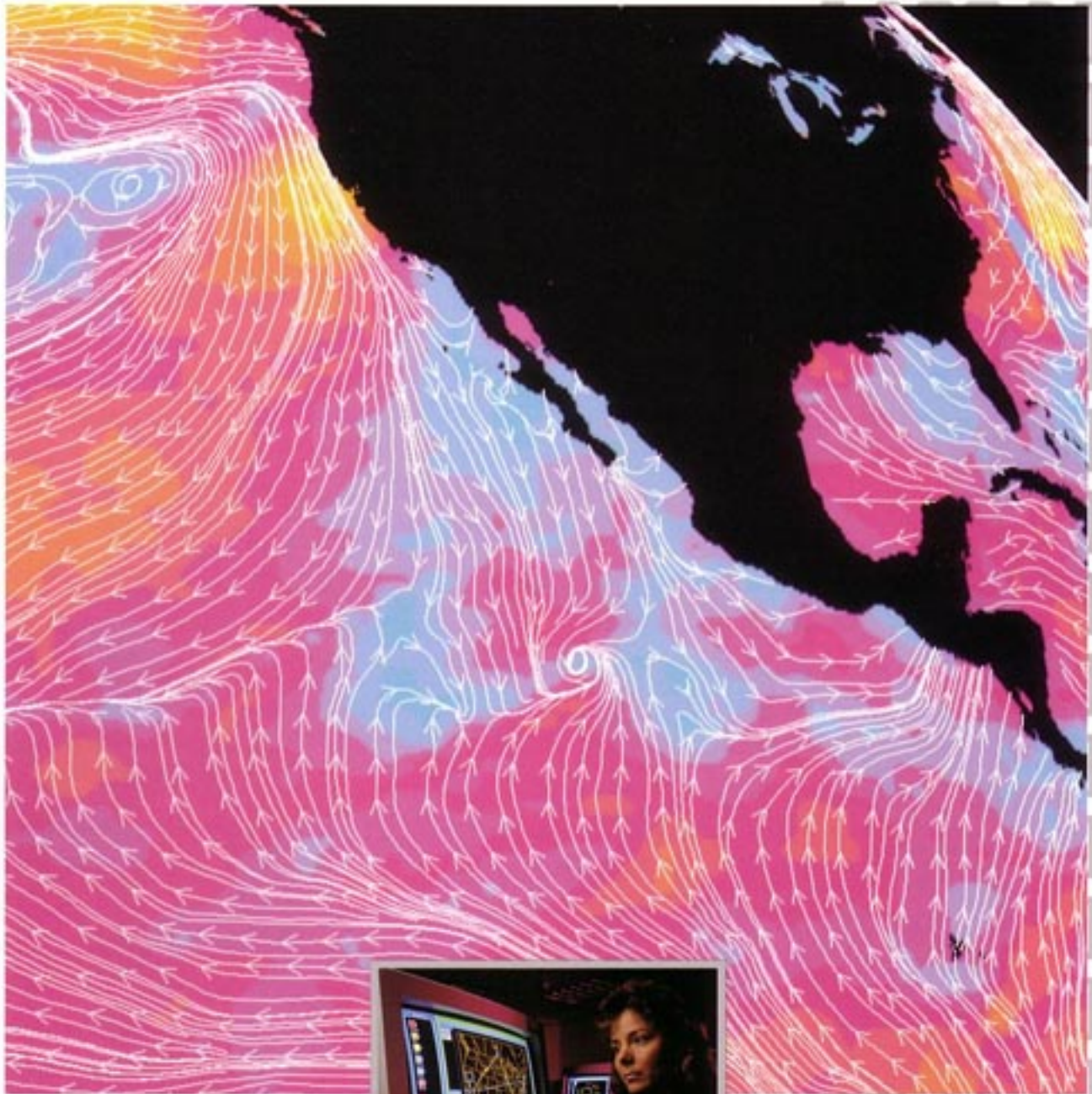
Provided with more coherent, useable information, analysts and decision makers can formulate more realistic objectives and policies. They also can have greater confidence that the consequences will match intentions.



Control centers use Hughes' high-resolution projectors for large-screen display of computer-generated graphics information.

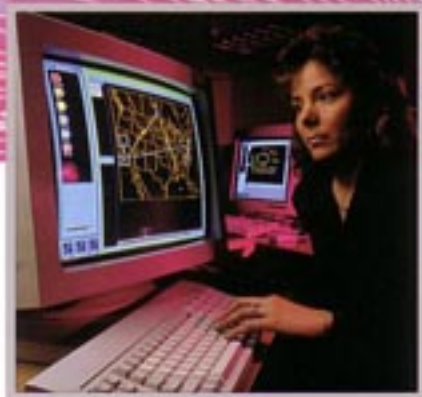


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Satellite technology reveals surface wind flow patterns over eastern Pacific. Information network manager, at right, evaluates, controls and keeps data flowing.



4700 DISKE



4733 DISKE
4740 DISKE

TTechnology has a flair for drama. The laser, first demonstrated at Hughes Research Laboratories in 1960, now energizes rock concerts. Holograms grace art galleries and ballrooms. Little wonder that technologies explored by Hughes are catalysts for higher dimensions of sensory realism.

SIMULATION SYSTEMS

Grandpa plummets down the world's highest ski jump. Little Johnny pilots a jet into the Grand Canyon, barely avoiding jagged crags. Mom careens along white water rapids. They're seated safely in a simulator where people of all ages can feel, see and hear sensations with a realism most never will be able to experience in real life. Such vicarious experiences are the results of life-like simulations created by computers.

Hughes, a world leader in military and commercial airline pilot training simulators, is transferring that sophisticated technology to an exciting two-seat, you-are-in-control leisure industry simulator. Commander™ is the only interactive public entertainment simulator that integrates joystick control, dynamic motion and compact disc-quality stereo sound with high-resolution, three-dimensional computer graphics. It provides instantaneous responses to operator actions and reactions.

No mere enhanced video game, Commander is a logical extension of virtual reality in the entertainment and leisure industry.

Designed with unparalleled flexibility, this

twin-seat, fully enclosed capsule can pit both operators against each other, or the two can team against a second pair in another simulator, or several Commander capsules could "fly" in squadron formations.

Larger, film-based simulators by Rediffusion Simulation, ranging from 60 to 14 seats, provide collective experiences with realistic scenarios sharpened by high-resolution imagery, super-quality sound and hydraulically generated movement. Hughes simulators can be found in theme parks from Paris to Tokyo, from Orlando to Anaheim and Montreal.

AUDIO PRODUCTS

A revolutionary invention, the Hughes Sound Retrieval System, practically wraps the home listener in sound. From a recording or sound track, it vividly recreates a three-dimensional audio hologram that approaches the realism of a live performance.

The Hughes-patented system is featured in several manufacturers' top-of-the-line TVs and is applicable to high-fidelity, stereo or home theater systems, car stereos, motion picture sound tracks and electronic musical instruments. Another audio product, the Hughes Optimum Radiation Baffle, uniformly disperses phase-coherent sound in existing home sound systems.

PROJECTION SYSTEMS

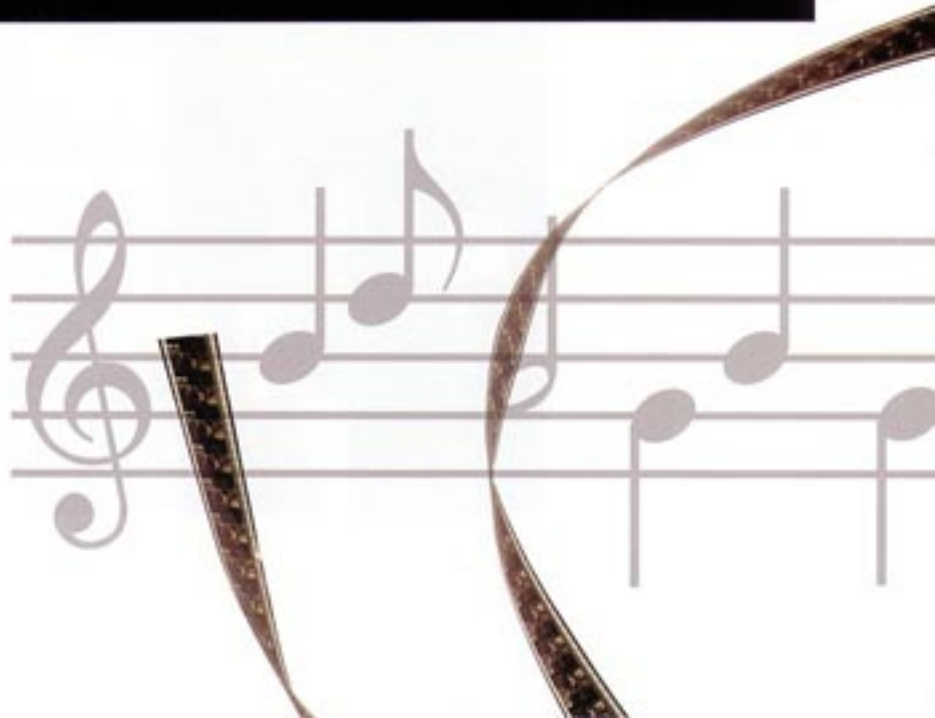
Sophisticated computer graphics projection systems, built by Hughes using patented liquid



Liquid crystal light valve holds the key to Hughes graphics projector which produces bright, high-resolution large-screen displays even in lighted rooms.



Two-seat Commander is the world's first truly interactive entertainment simulator. Sound Retrieval System, below, expands the "stereo images" without additional speakers.





Illumination optics direct high-intensity light to liquid crystal light valve in lab test of video projector.

crystal light valve technology, have visually enlightened command-and-control centers, company board meetings and business training sessions for years.

Now, Hughes has refined the technology to permit projection of imagery at video rates. The result: clear, sharp images presented in wide-angle format on large screens. This development will augment High-Definition TV and enhance visual realism in commercial video projection systems.

The Hughes Series 300 liquid crystal light valve projection system brings unparalleled brightness and crisp resolution to large screen video displays—up to five times more lumens than available from typical cathode ray tube projectors. And that's across a theater-size screen.

Immediate applications are in corporate videoconferencing and training, top-of-the-line

home entertainment, simulation, commercial airliner entertainment and information systems, education and medical programs.

In the future, integrated technologies of Hughes may supplant conventional film prints, distribution methods and projection rooms at motion picture theaters. Electronically generated signals in digital form could be transmitted by Hughes' direct broadcast satellites or Hughes' optical fibers, then displayed automatically on a movie screen via a Hughes-built super-high-speed projector employing Hughes' liquid crystal light valves.

All to lighten up our lives.

Adventurers of all ages, right, eagerly await the thrill of "plunging" over Niagara Falls in a Hughes leisure industry simulator.



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Because of the dynamic nature of the commercial/industrial marketplace, information contained herein may be relevant only at the time of publication, May 1992.

