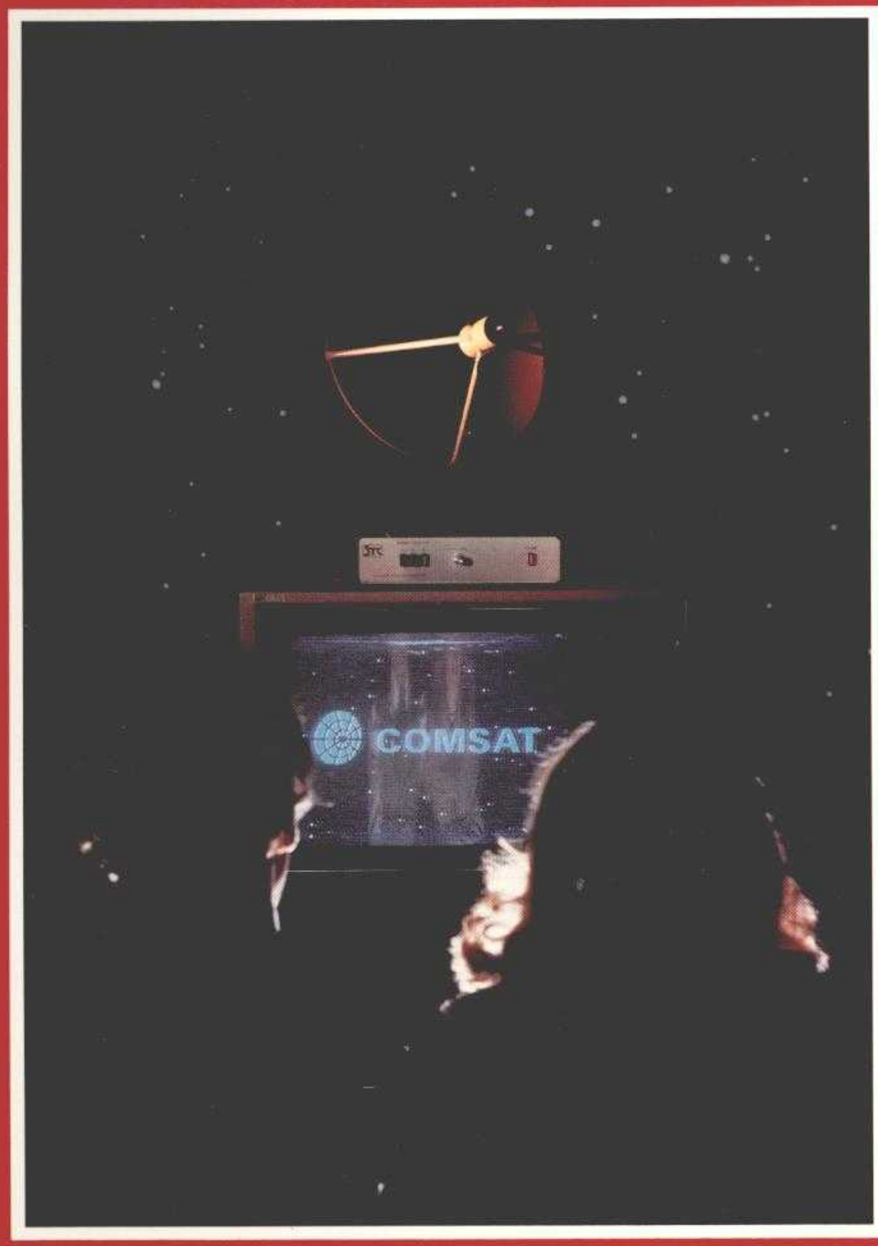
COMSAT®

COMMUNICATIONS SATELLITE CORPORATION MAGAZINE

1983



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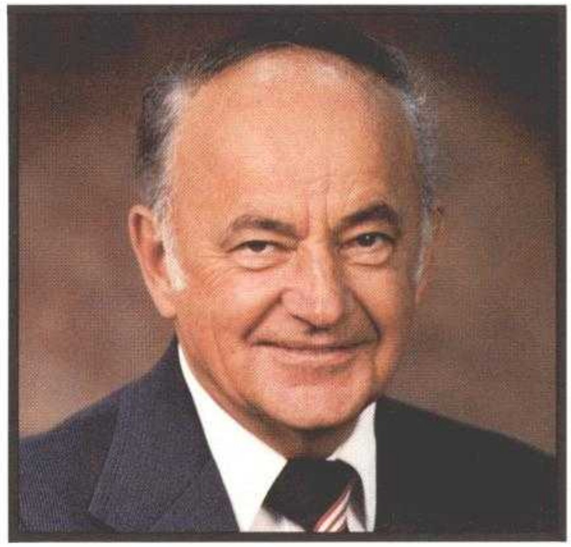

by Dr. Joseph V. Charyk
President and Chief Executive Officer
Communications Satellite Corporation

Just 20 years ago—on February 1, 1963—the incorporation document creating the Communications Satellite Corporation was signed in the District of Columbia. That seminal event and the recent granting of the first permit to Satellite Television Corporation (STC), our subsidiary, by the Federal Communications Commission to begin building a direct broadcast satellite system are striking in their contrast.

Twenty years ago, we had a mandate from the President of the United States and the Congress in the form of the Communications Satellite Act of 1962 to develop a global communications satellite system and, generally, to promote the commercial development of satellite communications technology. We had a Board of Incorporators who soon would become our Board of Directors, and we had strong hope that indeed we could do the kinds of things called for in the Act. And that was all we had.

Twenty years later, the global system we created is thriving under the management of Intelsat, a 108-member-country organization in which we are the U.S. representative and the largest single shareholder. Intelsat handles two-thirds of the world's transcontinental telecommunications services using 17 operating satellites and last year experienced an 18.3 percent increase in usage over the previous year.

Twenty years later, we are also the U.S. participant in Inmarsat, the 38-member-country organization operating a worldwide communications system, based on satellites, for ships and ocean platforms. We own and operate the Comstar satellites, whose capacity is used for domestic communications. We operate the Marisat satellites for maritime communications. We are a partner in Satellite Business Systems, an innovative company offering high speed, high capacity private network services and low-cost long-distance telephone services for the American consumer. We manufacture telecommunications products and provide extensive services in the electronics, telecommunications and environmental fields. And now we are embarking on yet another big challenge: to bring premium television programming directly to the homes of the American viewing public, once again via satellite.

The system that Satellite Television Corporation is bringing into being will be of the finest quality not just in programming content, but in terms of technical quality as well. And its high quality images will be receivable through low-cost, easy-to-install dish antennas as small as 2 feet in diameter. It is the development of the most powerful commercial satellite ever built that will make this possible.

From the vantage point of our 20th anniversary, we look back on a past brimming with accomplishments. We also look forward to a future filled with challenges but bright with the promise for still greater business rewards as we continue to fulfill our mandate to bring to the world the fullest possible benefits from satellite technology.

COMSAT

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Articles in Comsat Magazine reflect the authors' opinions, which may not necessarily be those of Comsat. Permission to reprint articles may be obtained by writing the Editor. Correspondence should be addressed to Stephen A. Saft, Editor, Comsat Magazine, Communications Satellite Corporation, 950 L'Enfant Plaza, S.W., Washington, D.C. 20024.

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Cover: Beginning in 1986, Satellite Television Corporation (STC) will be using satellites in geosynchronous orbit in space to transmit television programming directly to the homes of the American viewing public. Thanks to the use of high powered satellites, dish antennas as small as 2 feet in diameter will receive high quality TV reception for STC subscribers. The picture shown was put together from two different images created by William J. Megna. See the coverage beginning on page 9.

From the Editor

Each year we produce a map showing the locations of earth stations in the global Intelsat satellite communications system, and each year the task of preparing the map becomes more and more of a challenge. Between the end of 1981 and the end of last year, the system grew by approximately 100 earth stations and now consists of almost 500 antennas at over 400 earth stations operating in more than 150 countries and territories.

Tabulating all this information and locating it on a map of finite dimensions is no simple task, and we have the designers of Comsat Magazine, Baskin & Associates, Inc., and Tish Fonda and Dixie Berg of the staff of Comsat Corporate Affairs, and the staff of Comsat World Systems Division, Marketing, to thank for carrying forth the effort with such attractive results, as is evident from the version in the center of the current issue. The map should prove to be a valuable resource for most everyone with an interest in satellite communications.

Speaking of valuable resources, we are happy to be publishing once again our Index to subjects covered in Comsat Magazine, specifically subjects covered in the first 10 issues, beginning on page 41. Comsat Magazine's Editorial Assistant, Patricia A. King, did the lion's share of the work necessary to make the Index a reality.

Four of the feature articles in the current issue pertain to Satellite Television Corporation (STC) and the exciting television system it will be introducing to the American viewing public by 1986, and we wish to acknowledge with thanks the help of STC staff member David L. Price in making the four articles possible.

Stephen A. Saft

N O T E S

Financial results for 1982 show substantial increase

Comsat has reported that for the year ended December 31, 1982, Operating Revenues reached a record high of $409.5 million, an increase of 23 percent, or $75.5 million, over the amount reported for 1981. This increase is principally a result of growth in revenues for the Corporation's international communications satellite services and for its equipment manufacturing business. Equipment manufacturing business revenues for 1982 include those for Amplica, acquired during 1982. Operating Income for the year 1982 totaled $103.8 million, an increase of $22.4 million over the amount for 1981.

Comsat's Consolidated Net Income for 1982 was $43.3 million, or $5.41 per share. This amount represents an increase of 53 percent or $15.0 million ($1.88 per share) over Income Before Cumulative Effect of Change in Accounting Policy for 1981. Net Income for 1981 reflected a nonrecurring item in the amount of $11.8 million, or $1.47 per share, that resulted from a change in accounting policy for investment tax credits related to nonpublic utility property.

The increase in Net Income before the change in accounting is attributable primarily to higher revenues from the services Comsat provides through the internationally owned Intelsat global satellite system; a decrease in the share of losses from the Corporation's partnership interest in Satellite Business Systems (SBS); and an increase in operating income derived from satellite systems and services; partially offset by a decline in revenues associated with information services.

After recognizing federal income tax benefits and investment tax credits, Comsat's share of losses from its partnership interest in SBS decreased to $16.0 million in 1982 from $21.1 million in 1981. A major factor in this decrease was the reduction of the Corporation's ownership in SBS to 33.3 percent from 41.3 percent, effective October 1981.

Operating Revenues for the fourth quarter were up $21.0 million over the amount for the same period for 1981. Operating Income for this period increased by $2.9 million over the last quarter of 1981. The Corporation's share of losses from its partnership interest in SBS, after recognizing federal income tax benefits and investment tax credits, decreased by $2.6 million in the fourth quarter of 1982 compared to those for the same period in 1981. This reduction in SBS-related losses is primarily a result of investment tax credits that were associated with the launch of the third SBS satellite in late 1982.

Consolidated Net Income for the fourth quarter of 1982 was $11.2 million, or $1.39 per share, an increase of $3.8 million, or 47 cents per share, over those for the corresponding period for 1981. The fourth quarter of 1982 was the sixth consecutive quarter for which earnings have increased from those of the previous quarter.

Board votes 50th dividend

The Comsat Board of Directors, at its regular monthly meeting in January, declared a quarterly dividend of 57.5 cents per share, payable March 14, 1983 to shareholders of record February 11, 1983. The dividend is Comsat's 50th consecutive quarterly dividend and its 16th at the annual rate of $2.30 per share.

SBS Skyline will save money for residential telephone user

Satellite Business Systems (SBS) inaugurated a new interstate long-distance telephoned service—SBS Skyline—in late December for residential and small business customers. It offers customers savings of 14 to 30 percent over Bell System direct-dial service. SBS Skyline will be provided via a nationwide network of SBS satellites, earth stations, and switching centers.

Usage charges will be as low as 10 cents a minute for calls into neighboring states and as low as 14 cents a minute to any other interstate point in the contiguous 48 states, Washington, D.C., Puerto Rico, and the U.S. Virgin Islands during the late-night/weekend period. Subscribers will have access to Skyline 24 hours a day with no time-of-day calling restrictions.

SBS began its new service in Washington, D.C., followed by Minneapolis and Philadelphia in January. The service will be available later in 1983 on a phased basis in 17 other cities.

N O T E S

Inmarsat Council begins 12th session led by new officers

The Twelfth Session of the Inmarsat Council was held at the new Inmarsat headquarters in Euston Square, London, November 10-19. With this session, Edward J. Martin of the United States and Yuri S. Atserov of the USSR began their terms as Chairman and Vice Chairman respectively. The following are highlights of the sessions:

- Planning for Inmarsat's second generation space segment: Agreement was reached on August 1 as the target date for issuance of a request for proposals. The first operational satellite should be available in early 1988.
- A request for proposal is being prepared to solicit proposals from prospective suppliers on the basis of both a lease of dedicated or shared-use satellites and the purchase of dedicated satellites.
- In anticipation of a likely early saturation of capacity in the Atlantic Ocean Region, operational plans will be developed to permit the Council to consider two-satellite operation in the Atlantic Ocean Region in a four-satellite global system.
- The Inmarsat Director General will study methods that could delay saturation in the Atlantic Ocean Region, such as voice activation techniques, and develop a request for proposal for additional network coordination services suitable to operate with two, either closely located or widely separated, satellites in the Atlantic Ocean Region.
- Due to the loss of Marecs B, the Council authorized the Director General to exercise the option to extend the use of the Pacific Ocean Region Marisat from February 1 through July 31, 1984.
- The Council authorized the Director General to negotiate a firm fixed price for the replacement of Marecs B with the European Space Agency (ESA). ESA has stated that the replacement could be delivered in 15 months. The Council is expected to consider, at its next session, whether or not to proceed with a third Marecs.
- The Council approved applications by the United Kingdom and Denmark for access to the Inmarsat system by ship earth stations located on oil production platforms in the North Sea.
- The Council confirmed that existing charges for various uses of the Inmarsat space segment should continue unchanged for 1983.
- The Council authorized a 1983 R&D budget of $1 million. Studies to be undertaken include test of voice activation techniques, modulation, coding and speech processing techniques for new ship earth station standards, L-band propagation measurements and development of software simulation capability.
- The Council approved the appointment of Dr. Ahmad Ghais of the United States to replace Mr. Martin J. Votaw as Director of Inmarsat Technical and Operations Division.
- The Council agreed to the following schedule of sessions for 1983: Thirteenth Session, February 9-16; Fourteenth Session, May 11-18; Fifteenth Session, July 13-20; Sixteenth Session, November 9-16 (Provisional).

STC buys land, picks architect for Nevada Broadcast Center

In December, Satellite Television Corporation (**STC**) purchased 39 acres of land, for $525,000, northwest of Las Vegas for construction of a Broadcast Center to operate with **STC**'s direct broadcast satellite (DBS) service to be initiated in 1986. **STC** had taken an option on the land earlier last year.

The broadcast facility will be a major part of **STC**'s satellite-to-home pay television system. The heart of the Broadcast Center will be its video processing facilities. Program scheduling, editing, reproduction, technical quality control and airing will be controlled from the center. The complex also will contain equipment needed to control **STC**'s DBS satellites and to transmit programming to them.

In early January **STC** signed an $800,000 contract with Cornwall Associates of Pasadena, California for architectural and engineering services for the design of the center. Also, in January, **STC** signed a time and materials contract, estimated at $250,000, with the Communications Systems Division of RCA Corporation. RCA will provide design work for the integration of equipment for the center. (For more on **STC**, see page 9ff.)

N O T E S

News of Comsat officers

Bruce D. Smith, formerly Vice President, Comsat Corporate Development, has been elected President of Comsat Technology Products, Inc. In this newly created position, Mr. Smith is responsible for the management of the Corporation's telecommunications equipment manufacturing and marketing activities, and his election furthers the implementation of a Corporate reorganization announced in September of last year.

Comsat Technology Products, including two wholly owned subsidiaries, **Amplica** and **TeleSystems**, and several internal technology ventures, produces and markets digital and microwave telecommunications equipment. **Amplica**, based in Newbury Park, California, manufactures a wide range of standard, low-noise, medium-power and general purpose microwave equipment for defense and commercial markets. **TeleSystems**, located in Fairfax, Virginia, primarily manufactures digital electronics products, including echo cancellers and Time-Division Multiple-Access equipment, as well as maritime communications satellite shipboard terminals.

Bruce D., Smith is President of Comsat Technology Products, Inc.

In the previous issue of Comsat Magazine, it was noted that Robert W. Kinzie had been elected President of Comsat General Corporation. Both Kinzie and Smith report to Irving Goldstein, Executive Vice President of **Comsat**.

Francois Giorgio, formerly Senior Director, Project Management and Engineering, has been appointed Vice President, Intelsat Engineering and Development, of Comsat World Systems Division. In this newly created position, Mr. Giorgio will assume responsibility for the engineering and construction program conducted by the Corporation in support of **Comsat**'s role as the U.S. Signatory to **Intelsat**.

Robert D. Briskman, Vice President, Systems Implementation, of Comsat General Corporation, has been elected to the Board of Directors of the Washington Society of Engineers.

Joseph H. O'Connor, Vice President of **Comsat**, died December 10, 1982. Mr. O'Connor came to **Comsat** in 1966 as Assistant to the Financial Vice President and rose to the position of Executive Vice President of **Comsat General** before assuming the position of Vice President with the parent corporation.

Full launch support services to be Comsat General activity

Comsat General Corporation will offer worldwide satellite launch support services beginning in late 1983. The new Comsat General service will offer the use of a global Launch Support Network (LSN) and associated satellite support services to satellite owners and manufacturers in connection with the launch and in-orbit placement of domestic and international satellites. Customers can select from a range of launch support services, from the provision of facilities to full mission conduct.

The LSN will provide telemetry, tracking, and control service (TT&C) at both C- and Ku-band frequencies and will control satellites during the launch, transfer orbit, apogee motor firing, and drift orbit phases of their missions. Existing Comsat and Comsat General-operated tracking, telemetry and control (TT&C) earth stations, plus a new TT&C station for Indian/Pacific Ocean Region coverage, will make up the network's system.

Robert W. Kinzie, President of **Comsat General**, commenting on the planned service, explained, "The rapidly growing global demand for launch support network services has opened up a new opportunity for us, one that complements our existing services." William L. Mayo, Vice President, Satellite Systems, added, "The multiple spacecraft payload capacity of both the space shuttle and the Ariane has resulted in a developing, commercially viable market for a global service of this sort. **Comsat General** is in a unique position to serve this market as it matures, largely because of our time-proven expertise and the fact that most of the operational elements of our LSN are already in place."

Frederick W. Weber, has been appointed Vice President, Operations, of **Comsat General**, and will be responsible for the development of the Launch Support Network business. He brings with him over 20 years of launch operations experience including direct participation and management in the launching of 46 craft, of which 35 are geosynchronous communications satellites.

N O T E S

New series of echo cancellers is available from TeleSystems

TeleSystems, a Comsat company, has introduced a new series of multichannel echo cancellers, the EC-5000. State-of-the-art technology makes the all-digital canceller highly efficient. Rack space is minimized significantly as a result of modular construction, while dynamic self-test features reduce maintenance. The EC-5000 has a T-1 (1.544 mbp/s) interface, which eliminates the need to demultiplex to VF for cancellation. An optional tone disabler is available for data applications.

An agreement also has been reached with Grove Telecommunications Ltd., whereby that Canadian company will become a major distributor for TeleSystems' MCS-9000 Maritime Satellite Communications Terminal. Grove, located in St. Johns, Newfoundland, will address the Canadian offshore oil industry as its principal market.

The MCS-9000, designed and manufactured by TeleSystems, is a shipboard satellite terminal designed to provide the maritime community with a full range of communications capabilities. The TeleSystems' terminal minimizes operator actions in call establishment and maximizes system availability through reduced complexity.

Grove Telecommunications Ltd. has represented TeleSystems in the sales, service, and leasing of Marisat/Inmarsat shipboard communications terminals since 1979. The role of satellite communications in the Canadian offshore oil/gas industry is the provision of reliable, high quality voice, data, and telex facilities for fleets of semi-submersible drilling platforms and dynamically positioned drill ships. Serving this region with experienced personnel and a complete inventory of spare parts—backed, when necessary, by TeleSystems support—Grove's response time is unsurpassed.

In October 1982, TeleSystems leased 15,000 square feet of additional space in Fairfax's Prosperity Business Campus, adjacent to the two buildings currently housing its lab, administrative, manufacturing and engineering facilities. TeleSystems' lab, design and drafting departments, and hardware and software engineering offices will move into the new space. The new space brings its total business area to 66,000 square feet.

Palau earth station carrying telephone, telex, data traffic

Direct communications satellite service between the Republic of Palau and other Pacific points, including Hawaii and the U.S. Mainland, was inaugurated by the Comsat World Systems Division in November. The Republic of Palau is located in the western Caroline Islands.

The new Palau earth station, equipped with a 42-foot antenna, relays international telephone calls, telex messages and data transmissions using a Pacific Intelsat communications satellite.

During an inaugural satellite call to Palau from Washington, D.C., Comsat President and Chief Executive Officer Dr. Joseph V. Charyk said, "We have worked together to witness the commencement of commercial satellite operations in the Republic of Palau. I take great pride as Comsat fulfills its commitment to bring the benefits of modern satellite systems to all peoples of the world."

Haruo I. Remeliik, President of the Republic of Palau, commenting on the new communications facility, said, "Today our Republic joins over 100 nations having access to the most advanced communications satellite system in the world. Our people now can be in contact with virtually any area of the world. Businessmen can improve and increase contacts with customers and suppliers."

Dr. John L. McLucas, President, Comsat World Systems Division, added, "Micronesia's isolation from the economic mainstream of the world begins to disappear today as satellite communications are introduced to the 14,000 citizens of the Republic of Palau. Telephone calls between Pacific points via satellite will bring a wealth of resources to Palau and aid the quality of life for all residents."

Comsat World Systems Division is building six other earth stations in Micronesia which will be operational in 1983, including four in the Federated States of Micronesia and two in the Marshall Islands. Comsat World Systems Division has operated an earth station in Micronesia on Saipan, Northern Mariana Islands, since 1980.

Robert W. Kinzie is President of Comsat General Corporation.

Intelmet videoconferencing service starts with free offer

The world's first public-access, fixed-facility international videoconferencing service has been introduced with a unique free trial offer, according to officials of Intercontinental Hotels Corporation and Comsat General Corporation.

In March 1982, the two corporations signed an exclusive partnership agreement to develop this international videoconferencing capability, called Intelmet. Designed for small executive conferences and adaptable for presentations to larger groups, the initial installation is a two-way system between New York and London.

Introduction of the new facility by a print advertising campaign with the headline "Free Business Trip to London" invites business executives in New York and London to "travel" electronically to conduct a face-to-face meeting with their associates across the Atlantic.

The free initial trial will utilize the Freeze Frame mode only. Free trials will be available to groups of three or more (up to 12) executives on each side of the Atlantic until May 1, 1983.

"The establishment of public access international videoconferencing is a benchmark in the communications revolution," noted Joseph P. Smyth, senior vice president, marketing of Inter-Continental Hotels. "The impact of this capability on international business communications will be dramatic, once executives experience firsthand the ease with which business meetings can be conducted via satellite videoconferencing."

The system utilizes communications links obtained from British Telecom, AT&T Long Lines, and Satellite Business Systems, using Intelsat satellites. Videoconferencing centers are located in the Hotel Inter-Continental New York, 48th Street, East of Park Avenue, and the Hotel Inter-Continental London at Hyde Park Corner. Inter-Continental's more than 100 hotels in 50 countries provide additional locations for potential videoconferencing centers and will be evaluated for future installations.

Intelmet offers three options at costs which vary with technological sophistication: Audio and Presentation Aids, Freeze Frame Video and Full Motion Video. Depending on user budget and needs, services can be combined to reduce the cost of a meeting without compromising results.

Full time U.S.-Australia TV service operating via satellite

Comsat World Systems Division has initiated 24-hour-a-day television service via satellite from Los Angeles to Channel 9 of Australia. Channel 9 of Australia is the first commercial customer to utilize a new satellite-based full-period video service that transmits news, entertainment and sports programming from the United States to viewers throughout another country. Programming originates from Channel 9's Hollywood, California, studios, where the signal is sent to a Comsat earth station located in Santa Paula, California, approximately 30 miles northwest of Los Angeles. The 13-meter antenna relays the programming via an Intelsat satellite stationed over the Pacific Ocean to an 18-meter receiving antenna located in Sydney, Australia.

Commenting on the first full-period international television service, Dr. John L. McLucas, President of Comsat World Systems Division, remarked, "Once again, a tremendous global distance shrinks as satellite communications forms a bridge between the United States and Australia. This new television service to our friends in Australia will further strengthen the social and economic ties of two great countries. Comsat World Systems Division is pleased to provide satellite facilities to Channel 9 Australia as we continue in our effort to expand the applications of current and future international satellites systems."

Mr. Russell Watkins, President, Channel 9 Australia, Inc., a U.S.-based subsidiary of Publishing and Broadcasting Limited, Sydney, Australia, commented, "The commencement of 24-hour satellite TV operation provided by this new and innovative service marks the beginning of a valuable cultural and social link between Australia and the United States. The news, entertainment and sports programming to be beamed via satellite, from the United States to Australia on a full-period basis, will expand the viewing choices for the Australian television audience. We look forward to the new satellite service and to the enjoyment and information it will provide. The immense physical separation of our two countries was lessened with the inauguration of the Nine Network of Australia."

Three contracts to monitor the air are awarded to ERT

Environmental Research & Technology, Inc. (**ERT**), a Comsat company, was recently awarded three air monitoring contracts.

A major contract by Niagara Mohawk Power Corporation of Syracuse, New York, has been awarded to **ERT** to upgrade air monitoring systems at three of the company's four steam stations in upstate New York. In addition, **ERT** will set up, at all four of Niagara Mohawk's stations, a quality assurance and audit program for the company's ambient air quality monitoring networks.

The ERT upgrade program at Niagara Mohawk steam stations in Albany, Buffalo, and Dunkirk is designed to bring 1980s state-of-the-art technology to existing air monitoring systems that were installed by **ERT** in the 1970s. **ERT** will replace existing air quality instruments with state-of-the-art design, systems testing, data acquisition, and equipment.

In October, the Massachusetts Port Authority (MASSPORT) awarded **ERT** a $195,000 contract to measure, monitor, and analyze nitrogen dioxide concentrations in the air around Logan International Airport in Boston. Important sources of nitrogen dioxide near airports are thought to be caused by automotive exhaust as well as jet aircraft exhaust. This monitoring program is intended to give MASSPORT information about the detailed pattern of nitrogen dioxide concentrations in communities near the airport.

Also in October, a major 30-month contract was awarded to **ERT** by the Electric Power Research Institute (EPRI) of Palo Alto, California, to prepare air pollutant emissions inventories for the continential United States, excluding Alaska, and for southeastern Canada. These inventories, along with the monitoring data from the EPRI Regional Air Quality Studies program, will be used to interpret sources of air pollution originating from human activities and also to develop and evaluate air quality models that simulate pollutant behavior.

Cape Verde becomes 108th member country of Intelsat

The island republic of Cape Verde became the 108th member country of **Intelsat**. The Cape Verdean Ambassador to the United States, Mr. Jose Luis Fernandes Lopes, signed the Intelsat Operating Agreement during a brief ceremony at the U.S. Department of State in Washington, D.C.

Cape Verde is currently constructing a Standard B earth station. This station is expected to begin operation with the Intelsat Atlantic Ocean primary satellite in the near future, supplementing the country's present cable and radio communications links.

Marketing agreement signed by CGIS with Harris Corp.

An agreement has been signed by **CGIS**, a Comsat company, with the Computer Systems Division of Harris Corporation for marketing assistance and customer support that will simplify customer acquisitions by allowing the purchase of compatible Harris computer hardware and CGIS Software from either **CGIS** or from Harris.

CGIS President Stephen A. Sygenda described the agreement as "an excellent marketing vehicle offering substantial advantages to the customers of Harris and **CGIS**. Those advantages are expected to translate into joint marketing efficiencies for both **CGIS** and Harris as regards their compatible hardware and software. With this new agreement, both of our companies are better prepared to serve the computer-aided-engineering market by providing single-vendor support through **CGIS**."

Under the agreement, **CGIS** will purchase Harris superminicomputers and integrate them with digital and analog CAE/CAD/CAM/CAT (computer-aided-engineering, design, manufacture and test) software. Products from **CGIS** will range from individual application programs to integrated turnkey systems with engineering work stations and system software. According to Dr. Szygenda, "Our products include microwave CAE, high-frequency circuit design, interactive logic creation and capture systems for digital electronics, and several industry standards, such as TEGAS and SUPER-COMPACT."

FOR THE RECORD

Excerpts of what officers of Comsat and subsidiaries said at recent speaking engagements

Remarks of Irving Goldstein, Executive Vice President, Communications Satellite Corporation, at the 1982 Satellite Summit Conference, Washington, D.C., December 7, 1982.

Irving Goldstein is Executive Vice President of Communications Satellite Corporation.

...Our primary commitment continues to be to our Intelsat and Inmarsat businesses. In this respect, we are an atypical U.S. company. As this nation's representative in both **Intelsat** and **Inmarsat**, we have special responsibilities and obligations. And, therefore, certain issues affecting the continued viability of these organizations are of paramount importance to us.

We strongly support the U.S. commitment to maintaining and strengthening the global character of **Intelsat**. Through this global system—whose services have been made available to all nations on a nondiscriminatory basis—the world has reaped the benefits of modern satellite communications. Growth in demand has exceeded all expectations. And the future promises to bring further successes. It is filled with opportunities for meeting new service requirements.

More than one hundred nations currently share in the investment in **Intelsat**. Many of the members are developing countries with inadequate domestic communications infrastructures. And they lack the resources necessary to invest in their own communications satellites.

Intelsat meets the needs of its members for such domestic services by leasing spare satellite capacity to them. And in recognition of the long-term needs of many countries for this type of service, **Intelsat** is considering ways to include such requirements in its planning of future space segment capacity, ensuring the continued availability of domestic lease services.

Intelsat also is investigating ways to ensure that the system can accommodate projected growth in demand for international television transmissions and digital business communications. The ability of **Intelsat** to respond in this fashion to the evolving needs of its members is one of its prime strengths. To jeopardize this flexibility by undermining the economic viability of the system would be unfortunate.

The commitment to a single global system has produced economies of scale that have enabled the cost of **Intelsat**'s space segment charges to decrease considerably, from $2,666 a month for a half-circuit in 1965 to $390 a month today.

If a proliferation of regional satellite systems were to lead to a transfer of substantial traffic from the Intelsat system, the result would be to place intensified pressure on **Intelsat**'s space segment costs. This would be especially troublesome in the next decade as **Intelsat** invests in the advanced satellites it will require to ensure continued prudent use of spectrum and orbital arc resources.

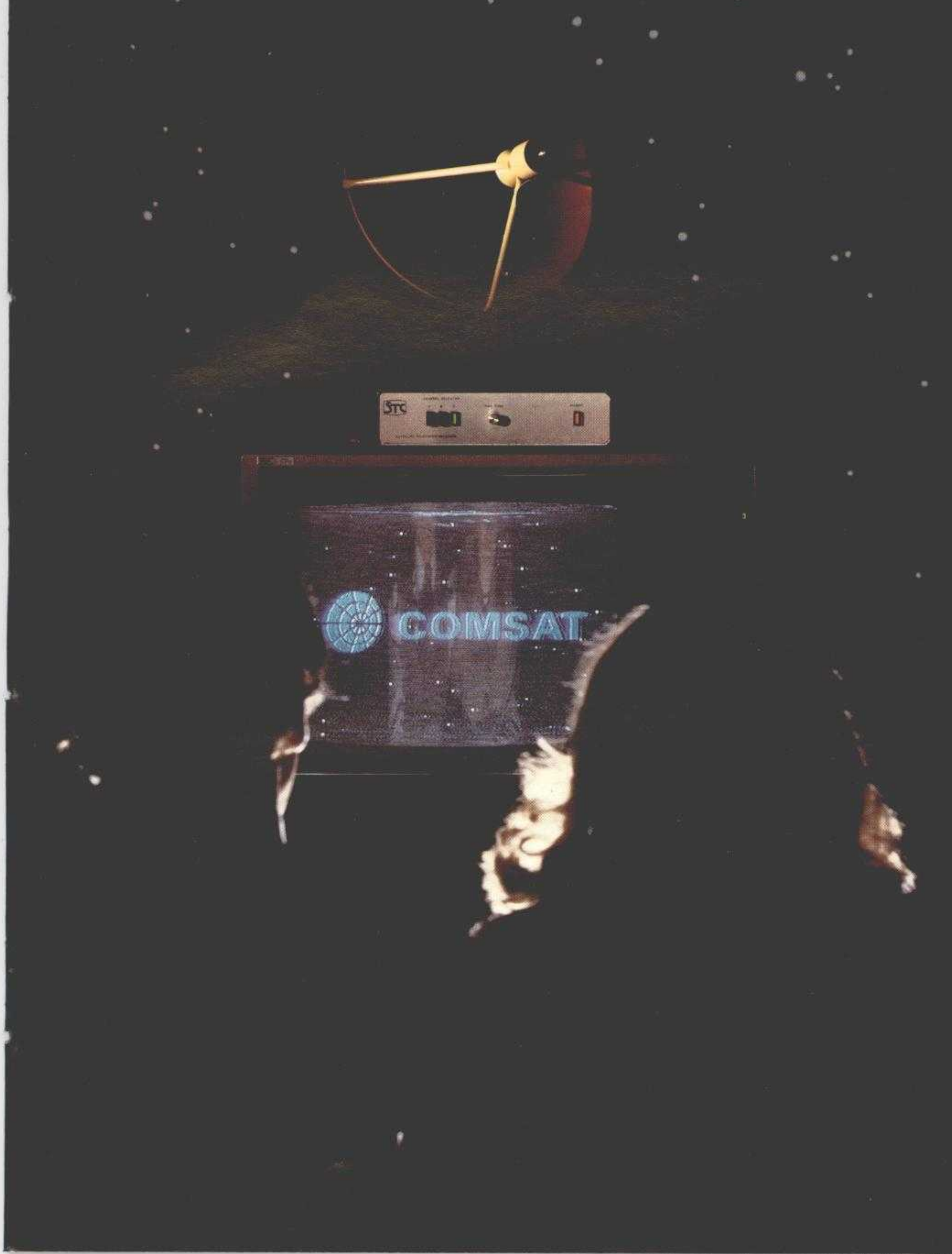
It is no overstatement to say that **Intelsat** is the most successful international commercial venture in history. Its efficient use of the spectrum and the orbital arc serves as a model for productive international cooperation. The increasing reliance on the Intelsat system by countries around the globe attests to the present economic well-being of this global enterprise.

The worldwide explosion in communications that we are witnessing today shows no sign of diminishing. In the years ahead, the array of services will broaden. New providers will emerge. More and more people around the globe will benefit. And if past trends continue, these communications services will grow increasingly reliable—and decreasingly costly.

The satellite communications industry faces a period of expansion and change. It is a period during which the tendency may be to race ahead without recalling the past. We face a time when the enthusiasm over future potential may overshadow the fact that it has been global cooperation—focused through **Intelsat**—that has brought us to this point in less than two decades.

If the next twenty years are to be as fruitful, we must weigh carefully the consequences of what we do. Without such diligence, much stands to be lost.

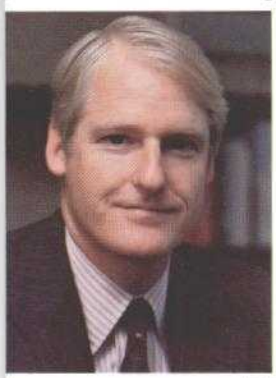
STC: TELEVISION FOR THE SPACE AGE



STC:

TOWARD THE DECENTRALIZED FUTURE

by ***Richard S. Bodman***, *President*
Satellite Television Corporation



Just as the forces of technology moved us toward centralization and mass production in the first half of this century, new technological developments in communications will free us to use our productive energies on a more decentralized basis. Evidence of the shift toward decentralization already can be seen in new forms of television programming. The emphasis on mass appeal is diminishing; programs of a more specialized nature are attracting viewers. In some cases, the viewer even has the opportunity for direct interaction with the medium, further personalizing the television experience.

Concurrently, there is demand for immediate access to information services. As our society moves away from centralization, the importance of delivering information to the home increases significantly. **STC** is at the forefront of the technological progressions that are enabling these societal changes and is developing a new television system that will allow the company to respond quickly and efficiently to evolving trends in entertainment and information services.

Until the mid-1970s, American consumers had limited viewing options. Programming and scheduling conformity were commonplace. With the advent of satellite-delivered cable television programming in 1975, a whirlwind of change swept across the country. Instead of the same conventional fare, viewers were offered a host of new programming options. The format of cable television was also revolutionary: By repeating programs at different times, the viewer was granted schedule flexibility.

The response of the television viewing public has been overwhelmingly positive. With the delivery of programming diversity to the homes, consumers expect more than ever before from their television sets. Instead of passively accepting the static mode of television, viewers are insisting on a dynamic medium to meet the needs of a dynamic world.

STC will meet the consumer demand for new entertainment options with subscription-supported programming delivered by satellite directly to individual homes. Multiple channels of pay television will establish a solid foundation for the STC service. But there are strong indications that television viewers want more than entertainment.

As the age of information progresses, the constraints of time and place are loosening their grip on the American consumer. For decades, the typical American has been bound to a way of life in which the watch and the automobile reign supreme. A dependence on mass production made it necessary for people to gather together in one place at the same time in order to maximize production.

But transportation costs are escalating and the amount of time wasted commuting to and from work is increasing. It is apparent that the system of centralization is not as cost-effective as it once was. With advances in telecommunications, the system can be decentralized by establishing home communication centers.

With DBS, information software can be piped conveniently and cost-effectively into the home. By linking the television to a home computer, complete with word processing capability, the home will have an advanced electronic system comparable to a modern office. Through these innovations, a system will evolve by which individuals can develop and use their talents whenever and wherever they wish.

The direct broadcast satellite system being developed by **STC** will be capable of delivering the true value of the television medium to the American consumer because of one critical aspect: flexibility. Every facet of the STC system has been designed so the most innovative television service can be provided initially and enhanced with later developments.

It is appropriate to compare this approach to developments in audio systems. Not long ago, the hi-fi console was a standard audio appliance in homes across the country. Innovations in equipment design and manufacture led to the introduction of stereo components, whereby a consumer could piece together the stereo system he desired. As the state of the art progressed and key elements such as reel-to-reel or cassette tape decks were produced at an affordable price, improved or additional components could be integrated into the base system. This modular approach to audio soon sent the hi-fi console down the short path to obsolescence.

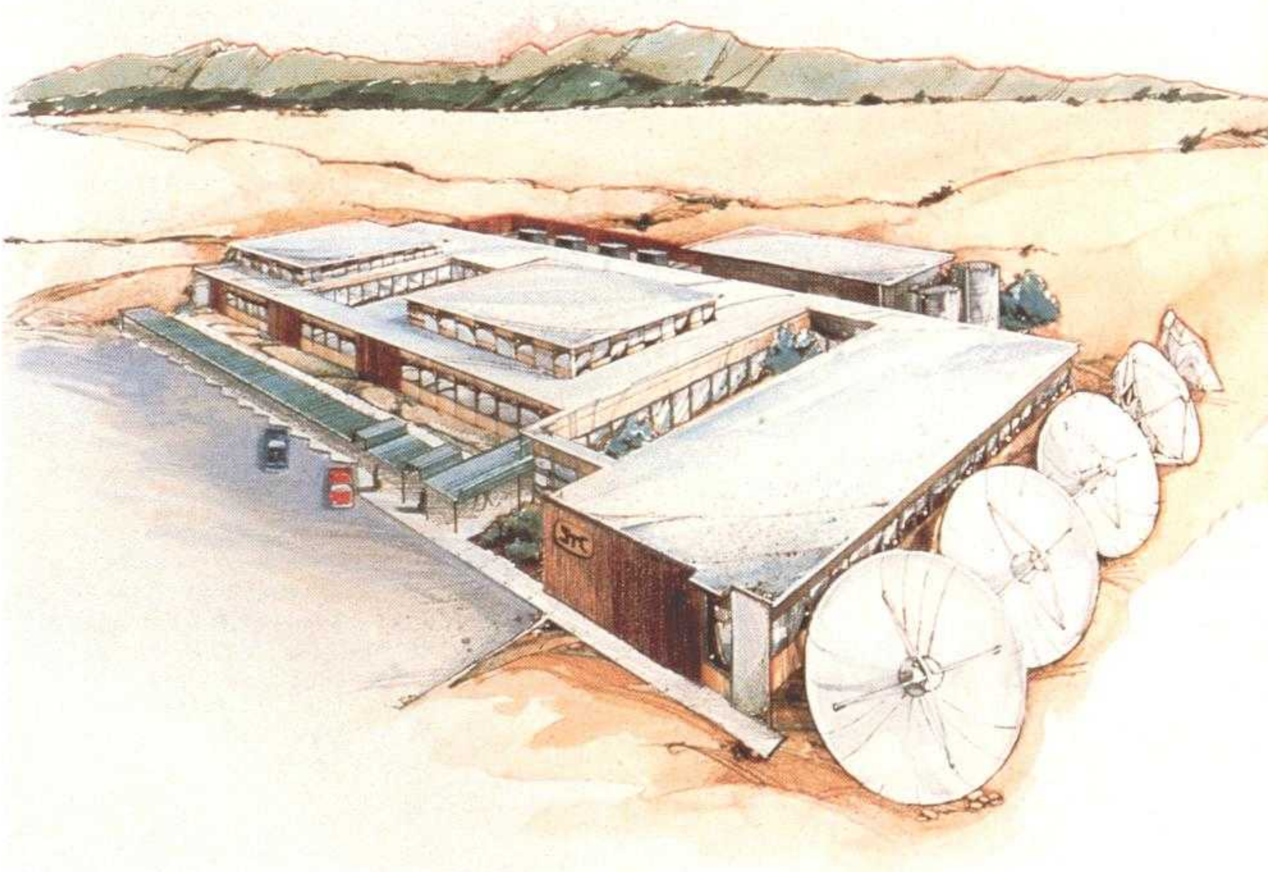
STC has designed a system that can be adapted to meet changing demands. From the first day of operation, the system will be totally addressable. By building this capability into the system from the start, **STC** will have rapid feedback on the programming preferences of its subscribers.

In addition, addressability allows **STC** to provide pay-per-view or pay-per-series services in an efficient and cost-effective manner. With a nationwide base of addressable subscribers, the pay-per-view business will expand from its current status as an interesting sideline to an essential service.

Delivering programming by satellite directly to individual homes has obvious geographic advantages. For millions of consumers in rural and in densely populated urban areas who receive a limited number of television channels, DBS will bring immediate programming parity. A broadcast service that is unencumbered by distance considerations will offer these people the diversity of programming that others already take for granted.

The DBS service of **STC** will also offer dramatic improvements in signal quality. Unlike terrestrial broadcasting, the signal strength from DBS satellites will be strong throughout the entire area covered by the satellite footprint. For millions of viewers, the technological advantage of DBS transmissions will offer greatly improved television images.

These improvements will be noticeable even on television sets currently in use, but will have the most dramatic effect on sets coming on the market. The DBS pictures of tomorrow will be crystal clear and offer brilliance and depth of color. Ultra high-quality stereo sound will



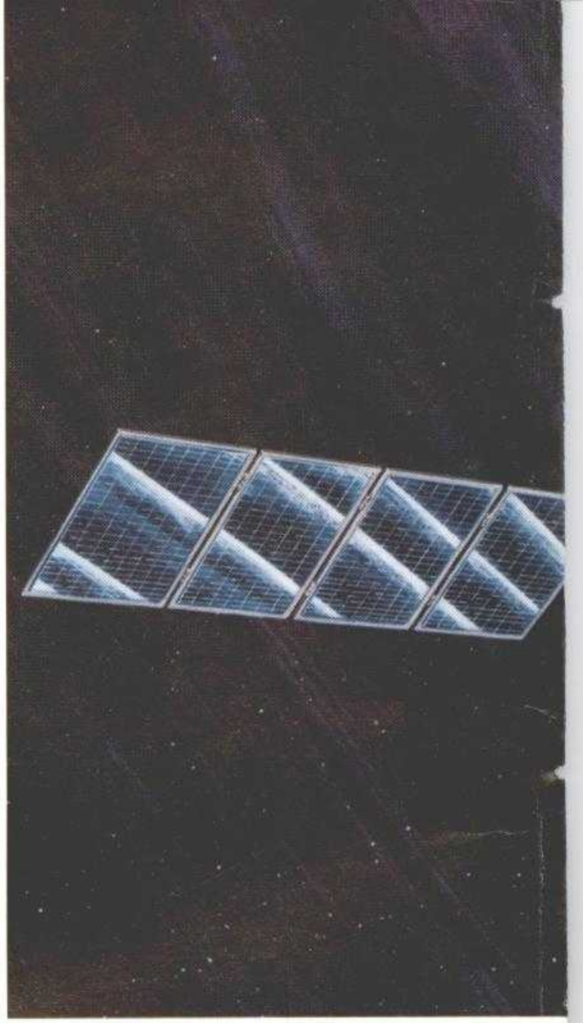
Artist's rendering of STC Broadcast Center that will be built on 39 acres of land northwest of Las Vegas. The major activities taking place at the center will be video processing, signal uplink and satellite control. Architect is Cornwall Associates, Inc.

complement the enhanced picture, revolutionizing the television viewing experience. It is natural to assume that consumers in all parts of the country will be captivated by these improvements.

In summary, satellite-to-home television will be another example of the social benefits created by **Comsat**. Twenty years ago, **Comsat** established an international partnership that evolved into the first worldwide communications network using satellites. This endeavor has linked the nations of the world, producing innumerable benefits for the American public.

Now, **Comsat** is undertaking a logical extension of its expertise. By establishing a direct broadcast satellite system, **Comsat** will once again be a driving force behind positive social developments.

Significant changes are under way in America. Our society is moving into an age where communications is of supreme importance. Direct broadcasting by satellite will be an integral component of the new world of telecommunications—a world marked by entertainment diversity and information efficiency.



THE SATELLITE

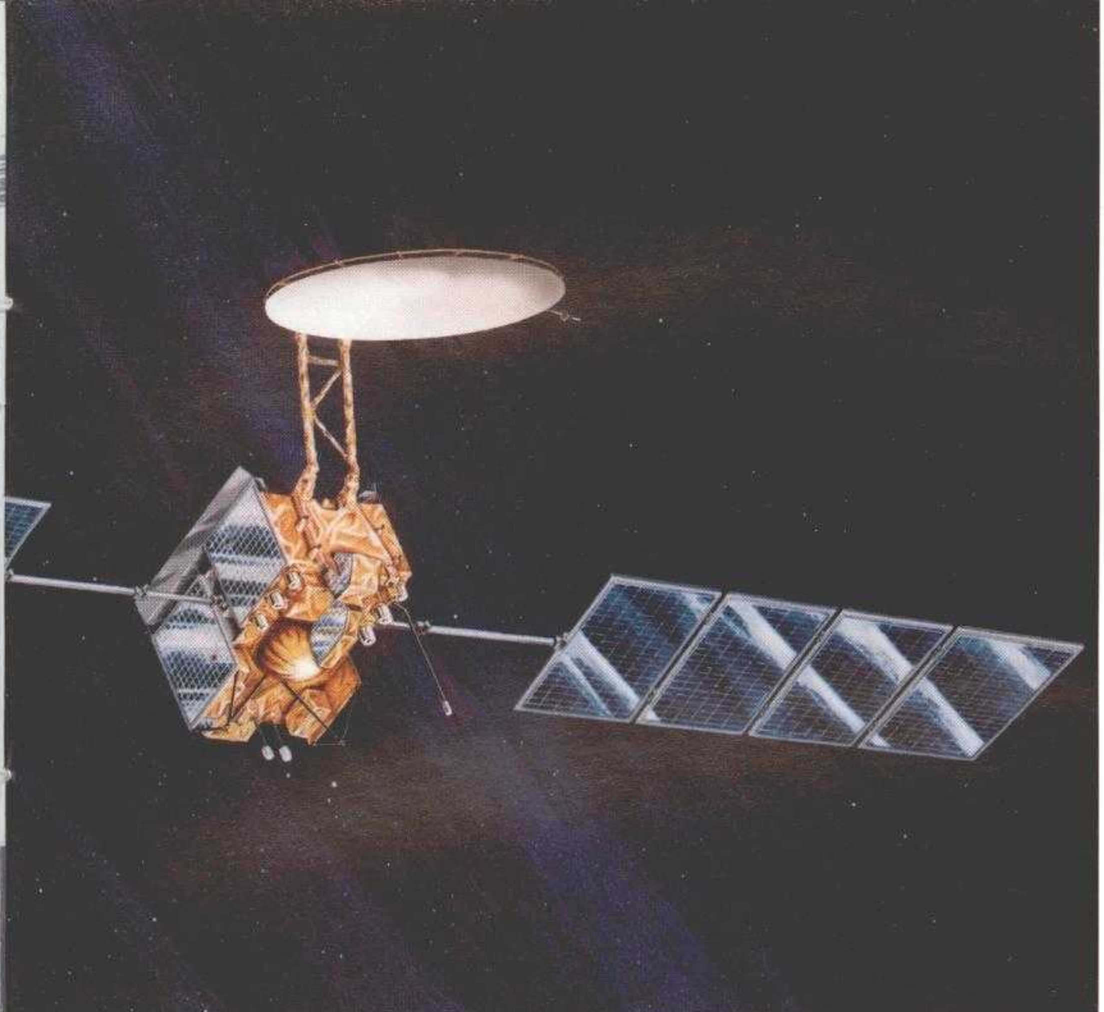
Anyone having a passing familiarity with the communications satellites designed, manufactured and launched during the early days of the satellite industry might be baffled by the appearance of the birds that will beam television programming for Satellite Television Corporation's direct broadcast satellite system.

During the formative years of satellite communications, an engineer would design a tidy little cylinder with most of the components tucked away inside. If anything were allowed to break the neat symmetry, it usually would be little more than a small antenna. These early generations of satellites were spin stabilized; that is, they achieved stability in orbit through the rotation of their outer cylinder, which contained their solar panels.

The design for **STC**'s direct broadcast satellites is derived not from the early and successful spin stabilization approach, but rather from the more recent but now equally proven three-axis-stabilized configuration as represented by **Intelsat**'s Intelsat V and RCA's Satcom.

Two solar arrays, each extending 17.5 feet out from the body of the satellite and resulting in a total span of 55 feet, will give this first generation of DBS satellites a true bird-like appearance. Also extending out from the body of the satellite, attached by sturdy supports and cocked at a rakish angle, is the satellite's single large broadcasting antenna.

In terms of general appearance, therefore, **STC**'s DBS design belongs with the family of satellites that includes the Satcoms and Intelsat Vs, but look



by **David L. Price**, Manager
Communications Services
Satellite Television Corporation

again. When inspected more carefully, the new design proves itself to be startlingly different from even these established three-axis-stabilized satellites. First, there is the matter of the traveling wave tube amplifiers (TWTAs).

Instead of carefully covering the TWTAs to keep them from harm's way, as in satellites currently in use, **STC**'s direct broadcast satellite exposes the ends of its TWTAs to the space environment. There is a simple explanation why this is done, an explanation that can be stated in a word. That word is "power."

The enormous array of solar cells will generate roughly three times the amount of power of conventional satellites—1,700 watts at the end of the satellite's seven-year life expectancy. The TWTAs will also operate at dramatically higher power levels. On conventional satellites, such as the RCA Satcom III-R that transmits programming to cable head-ends, the TWTAs operate at about 5.5-6.5 watts of power. But on the STC DBS satellites, the TWTAs will operate at a minimum of 185 watts. The exceptionally high power levels necessitate the unique design. Since so much heat is generated, it must be dissipated directly into space. Therefore, the TWTAs cannot be completely enclosed within the satellite.

The dramatic increase in power means that radio frequency (RF) signals are sent to the earth at unprecedented levels, but the power isn't the only part of the equation. In order to boost the power so television signals can be received on home antennas as small as two or two-and-a-half feet in diameter, the RF beam emanating from the satellite must be configured for maximum efficiency. The result is a shaped-beam antenna system.

Such a system is not unique. Many satellites—including those of Satellite Business Systems, Intelsat V and Intelsat VI—are designed to use shaped beams. The SBS satellite has a shaped beam that illuminates the entire United States. Indeed, the beams of most domestic communications satellites effectively cover the entire U.S. mainland. But since each STC satellite will transmit to an area roughly equivalent to a time zone, the satellite beam must be concentrated into that area. If the energy from the antenna on the satellite that will serve the Eastern time zone were projected onto a screen, and if the screen could sense radio frequency instead of light, the image would form a map of the Eastern time zone.

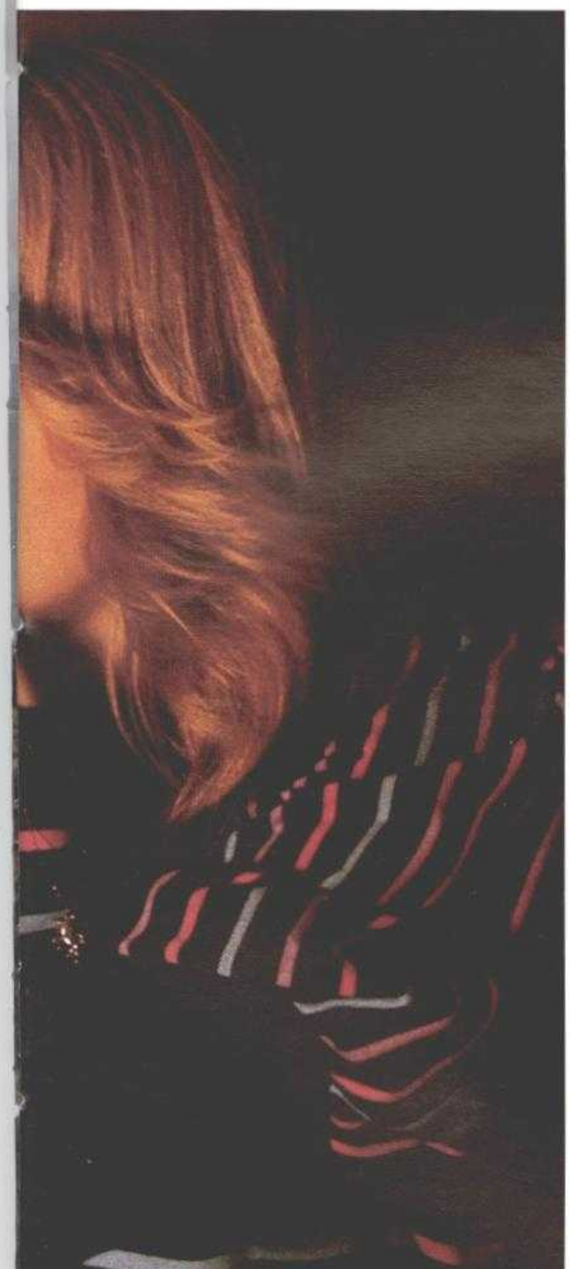
The signals generated by the DBS satellites will be 20 times more powerful than those of conventional satellites. By adding the shaped-beam antenna system that concentrates the beam on a single time zone instead of the entire country, a fourfold increase in signal power is realized. Together the combination produces signals 80-100 times stronger and allows for small, affordable receiving antennas on individual homes.

The unusual nature of the satellite design is not accounted for by just the need for impressive power levels.

Joining the TWTAs outside the body of the spacecraft will be the output multiplexers. These RF filters that determine

the transmission frequency from the satellite are also traditionally found inside the bird, but the international regulatory uncertainties have forced another victory for pragmatism. The final frequencies for DBS transmissions will not be allocated until after the 1983 Regional Administrative Radio Conference (RARC-83). Once the conference decides on the broad allocations, the Federal Communications Commission must specify the frequencies for each DBS applicant.

While there is no set timetable for the specific allotments, satellite construction will be well under way by late 1983. Since timing is of the essence in building a DBS system, a way to begin the initial stages of construction without knowing the exact downlink frequencies was devised.



The indoor electronics portion of the home equipment that will be required to receive television signals from the STC satellites will be housed entirely within a small unit that can be placed on a standard television set. Photo by **William J. Megna**.

The engineers designed the satellites so the output multiplexers could be installed after the satellite body was constructed. That way there would be no delay in construction and the output multiplexers could still conform to the decisions made at RARC-83.

The result of all this pragmatism and innovation is a three-transponder satellite that has more power than the Intelsat V, but which weighs less than half as much. Because of the small comparative weight, a DBS bird will be less expensive to launch. And since it only uses three transponders, it will be a relatively simple comunications system. Yet the satellites are opening a new vista in television broadcasting that can basically be attributed to their unusually high radiated power levels.

An apt analogy would be to compare a DBS bird to a feisty boxer. The satellite will be very concentrated, very compact. But in this tiny boxer there is an impressive amount of power.

There is a final major idiosyncrasy that separates DBS and conventional satellites. Twice a year—around the vernal and autumnal equinoxes—the sun's illumination of the satellite solar panels is blocked by the earth. During these "eclipses," the DBS satellite becomes inoperational for periods each day that can be as long as an hour and a half. Up to 72 minutes is directly attributable to the blockage of solar illumination. The remaining time is needed to restore the power levels in a very cold satellite, since the temperature inside the bird will plummet as soon as the eclipse begins.

However, the effect of eclipses can be accommodated by proper positioning of the satellites. Since the first satellite will serve an area roughly equivalent to the Eastern time zone, one would naturally assume that the satellite would be positioned in the geosynchronous orbit at a longitude somewhere over the Eastern time zone. If the satellite were positioned there, the eclipse at the equinox would begin promptly at 11:00 p.m. Since this is a time when a large percentage of the television audience is watching, it would be better if the eclipse occured later, in the wee hours of the morning.

By positioning the satellite at 115° west longitude (all geosynchronous satellites are positioned over the equator; the corresponding meridian passes through Las Vegas, Nevada), the eclipse would not begin until 2:00 a.m.—a time when fewer viewers are watching television. Alternative positions are also being considered. The satellites have been designed to function at a variety of orbital locations, taking the eclipse factor into account as well as the decisions made at RARC-83.

The satellites for the Eastern time zone phase of STC's system will be constructed by the Astro Electronics Division of RCA Corporation. On October 25, 1982, STC ended a four-month negotiating effort by signing a contract valued at more than $100 million with RCA.

Two satellites, one operational and one spare, will make up the first phase of **STC**'s satellite-to-home pay television venture that is slated to begin in early 1986. Included in the contract are options for the additional DBS satellites that would be used to expand the service to other areas of the country.

The cost of the two spacecraft is $113 million, plus performance incentives. Under the contract terms, the first satellite is to be delivered 39 months from the signing of the contract; the second must be delivered within 42 months.

The contract signing ended a procurement process that began in January 1982, when **STC** issued a request for proposals to American satellite manufacturers. After an extensive evaluation process, RCA was invited back for further negotiations. Former STC Chairman John A. Johnson headed **STC**'s negotiating team.

After the negotiations were completed, a contingent of RCA executives flew to Washington from the company's headquarters in Princeton, New Jersey, for the formal contract signing. Charles A. Schmidt, Vice President and General Manager of RCA Astro-Electronics Division, headed the RCA group and signed the contract along with Richard S. Bodman, STC President.

The advent of television from direct broadcast satellites (DBS) will increase greatly the television viewing options for the American public. Photo by ***William J. Megna.***

The signing was a memorable occasion in the remarkable history of both television and satellite technology. Never before has a company undertaken a domestic project that could so dramatically alter the way television programming is provided to consumers: by transmitting signals directly to small receiving antennas on individual homes.

The drama of the moment was realized by all. Comsat President and Chief Executive Officer Dr. Joseph V. Charyk heralded the signing by saying a new era in television had begun.

"It is an era made possible by **Comsat**'s 20 years of experience in satellite communications," Dr. Charyk said. "**Comsat** pioneered international, maritime and domestic communications via satellite. Now we will expand dramatically the benefits of satellite technology that are delivered to the American public."

Mr. Bodman termed the signing a significant milestone for the entire television industry. With DBS, he said, programming parity will be established for all American consumers.

"Millions of viewers who receive a limited number of channels will be offered the most advanced system of television," Mr. Bodman said. "They will leapfrog overnight from a scarcity of programming to a world of video diversity."

To mark the occasion, Mr. Schmidt presented a crystal orb to Mr. Bodman. Within the orb were elegant bubbles of crystal portraying a microcosm of planets spinning around the sun.

Soon, the DBS satellites of **STC** will be gliding through the cosmos. These tiny powerhouses, so unlike the satellites that preceded them, yet similar in so many ways, will usher in a new era of television—an era made possible by direct broadcast satellites.

Richard S. Bodman, STC President, right, and Michael S. Alpert, Executive Vice President, hold 0.6-meter-diameter (about 2 feet) STC antenna prototype. Small, easy-to-install antennas like this one are possible with the STC system because of the high power of its satellites. Signals from lower power, non-DBS satellites would require larger, cumbersome antennas such as the one in the background—1.2 meters in diameter (about 4 feet). Photo by ***William J. Megna.***

HOME EQUIPMENT

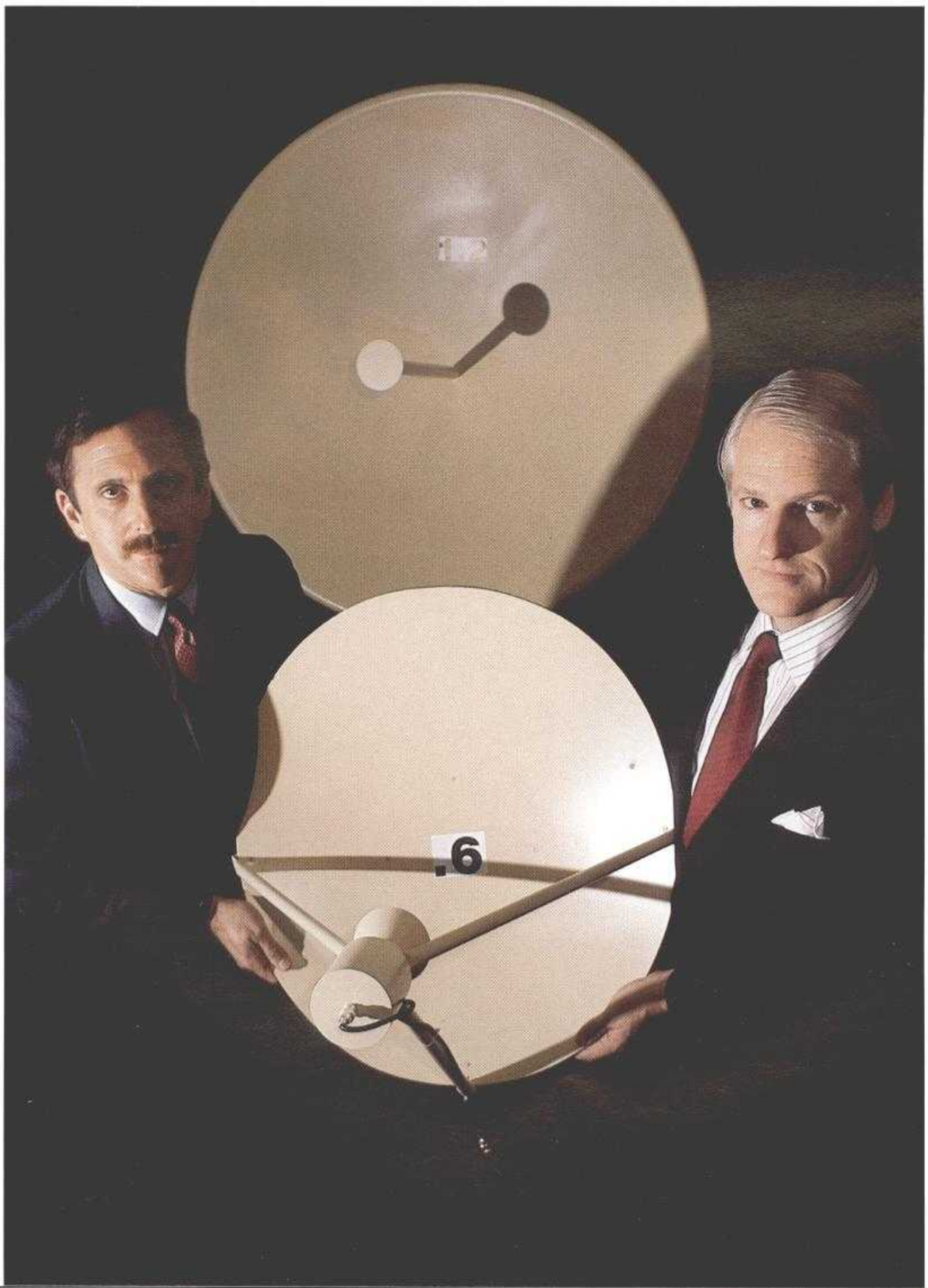
THE PERSPECTIVE

by *Michael S. Alpert*
Executive Vice President
Satellite Television Corporation

In early 1982, **STC** directed a question to the electronic manufacturing community: Can you mass produce affordable home equipment for the direct broadcast satellite (DBS) industry? The answer was a resounding "yes."

Last spring, provisional specifications for the home equipment were sent to numerous interested manufacturers. Each company was asked to submit prototype units that could make up a complete system: a receiving dish, the outdoor electronic unit (low noise amplifier/converter), and the indoor electronic unit (FM demodulator and channel selector).

The release of the provisional specifications was a significant overture by a company developing a new broadcast



STC's DBS system will be a cost-effective way to deliver television programming to densely populated urban areas.

technology. It represented the initiation of a collaborative effort between **STC** and the manufacturing community. Since the beginning, **STC** has solicited input from the manufacturers to refine the specifications. This joint effort has given **STC** assurance that affordable units that meet performance requirements can be produced in the necessary quantities.

It also has afforded the manufacturing community a unique opportunity for early involvement in developing what promises to be a lucrative new market. The DBS system of **STC** will require the mass production of sophisticated microwave equipment for the consumer market. Up to now, microwave components for use in radio frequency equipment generally have been produced in lots of a hundred, or perhaps by the thousands. The vast potential of the DBS industry will give manufacturers a chance to have millions of components rolling off the assembly lines.

In response to the release of the provisional specifications, a number of companies delivered prototypes of partial and complete systems to **STC**. These units have undergone rigorous examinations by a team of engineers, and the results of the tests are extremely promising.

For example, **STC** specified antenna performance that would require 55 percent efficiency. Antenna efficiency is the factor that relates the actual signal received by the home antenna to the maximum signal level that the physical dimensions of the dish would intercept. This figure is a measure of the quality of two major design elements: the feedhorn, which funnels the radio frequency signals to the dish, and the surface of the parabolic dish.

Some companies are projecting antennas that can be manufactured at low cost with efficiency in the range of 65-70 percent. Testing indicates this indeed may be possible. Such superior performance may allow **STC** to reduce the planned dish size from two-and-a-half feet to around two feet in diameter.

Obviously, this is not merely a contest to see how small the dishes can be. Dish size is a critical factor in that the larger the dish, the more critical the pointing and the more difficult it will be to maintain the pointing. A larger dish entails a more difficult installation and more maintenance problems, both factors that increase the cost of providing the DBS service.

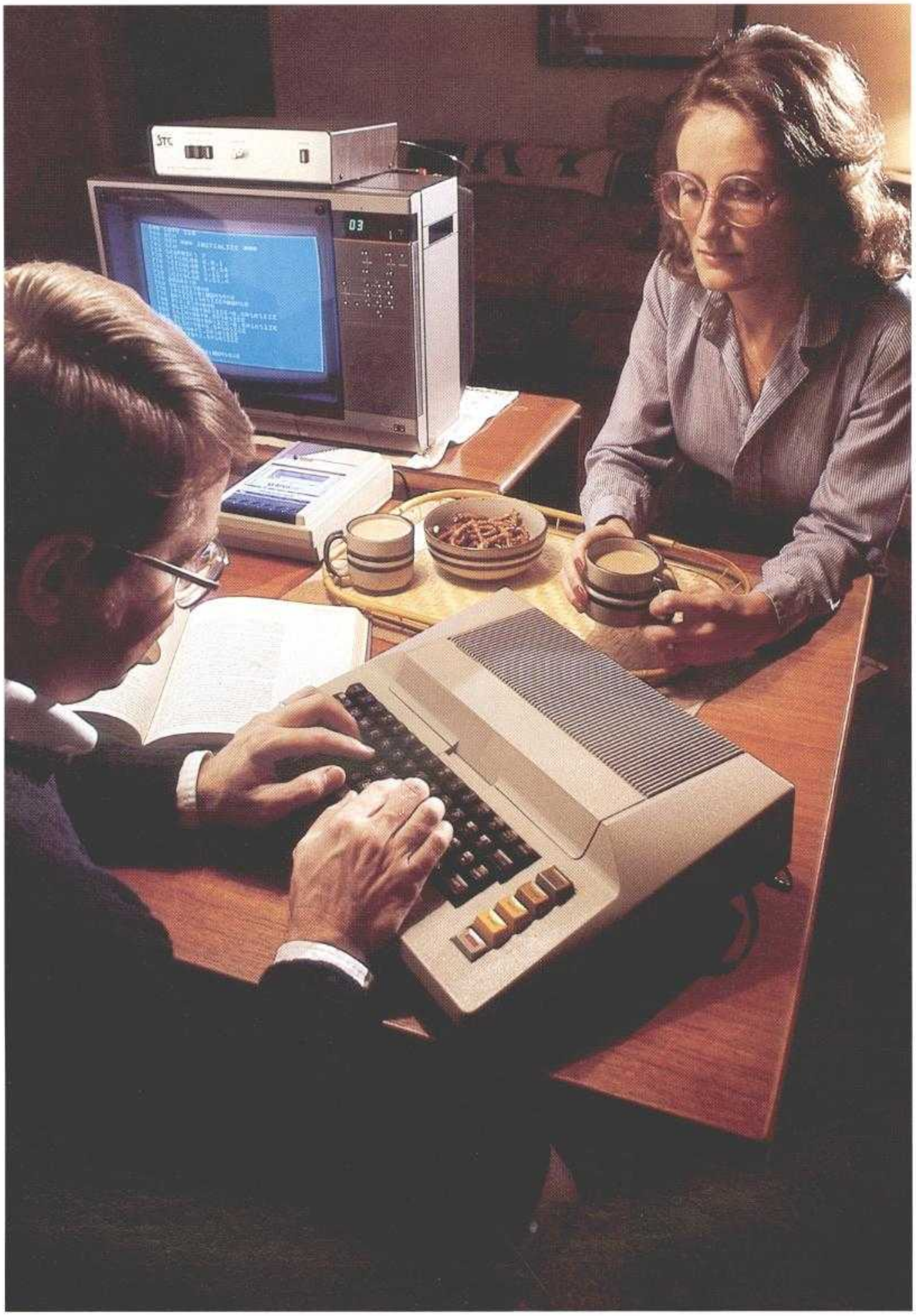
In addition, a dish two-and-a-half feet in diameter or smaller is lightweight, easy to maneuver, and can be installed by one person. Larger dishes may require two persons for installation, which adds even more to the subscribers' costs.

Meteorological conditions can also become a substantial consideration with dishes larger than those contemplated by **STC**. With larger rooftop antennas, strong gusts of wind could cause problems. At the very least, the wind could shift the larger dish, causing a reduction in signal quality. In a worst-case situation, a subscriber's home could be damaged.

Programming covering the range of interests and tastes of family members will be available from STC.

The high-powered DBS satellites afford consumers the advantages of smaller dishes and avoid the obstacles created by larger antenna systems. For reasons of aesthetics and cost effectiveness, the smaller the dish, the more attractive the product.

A second requirement in the specifications was that the equipment would function with a four-decibel noise figure (the lower the noise figure, the more sensitive the equipment and the higher the quality of the picture). At this stage, four



Not just entertainment but information and education will be brought to the home via STC's DBS system. Advent of the system will be a major step toward making it possible for large numbers of Americans to go to work in their own dens, studies or living rooms. Photo by **William J. Megna**.

decibels seem well within the state of the art for low-cost, mass-produced equipment.

Marketing considerations are also factored into the home equipment design. As **STC** examines consumer tastes and buying patterns, it becomes apparent that DBS viewers will desire equipment capable of receiving more than one DBS service. For this reason, it is necessary to design compatible home equipment. **STC** is working with the manufacturing community to promote and implement this concept.

With the development of compatible home equipment, a universal receiver could be produced. Such a receiver would be capable of accessing signals from all DBS satellites located at the same orbital position.

With the universal receiver, different types of services—both pay and nonsubscription-supported programming—can be sent to the subscriber's home. Subscription-supported and pay-per-view or pay-per-series programs could be received if the proper descrambling system were in place. Through this combination, a subscriber will have ready access to greater diversity in programming.

American consumers are becoming more and more dependent on television as a source of entertainment as well as information and related services. By 1990, many households will have a host of electronic signals streaming into their television sets through a variety of compatible delivery systems. DBS will not only be a part of this multitude of video services, it will be a driving force in furthering television technology.

With DBS, dramatic improvements in picture quality are possible. Images enhanced by technological innovations will grace the television set in the subscriber's home. As the video portion of the television picture is enhanced, consumers will demand comparable audio. DBS has the capability to deliver stereo sound that will greatly enhance the viewing experience.

With these improvements, the television set will become the focal point of a home communications center. Programming can be provided by DBS satellites, over-the-air stations, cable systems, VCRs and videodiscs. Information needs will be met by establishing an electronic library; by linking a home computer to the system, a wealth of data services can be at the subscriber's fingertips.

The foundation for the improvement of television viewing is being laid right now with a collaborative effort between STC and the manufacturing community. If DBS is to drive the technology further, home equipment must be produced at a cost that the consumer can afford. Every indication tells us that this goal can, and will, be met.

RARC'83

MAPPING THE FUTURE FOR DBS

by **Edward E. Reinhart**
Director, Spectrum Management
Satellite Television Corporation

Beginning in June, delegates to the 1983 Regional Administrative Radio Conference (RARC-83) of the United Nation's International Telecommunication Union (ITU) will convene in Geneva to develop a plan that will allot orbital positions and frequencies for the direct broadcast satellite (DBS) systems in ITU Region 2. The plan will attempt to accommodate the requirements specified for each of the 47 countries or territories in the region (essentially the Western Hemisphere, including Greenland) using a planning approach and reference system parameters agreed upon at the conference by the participating countries.

The specific allotments will depend primarily on conference decisions in three areas: 1) the national service requirements to be accommodated, 2) the planning methods to be used in constructing the plan, and 3) the reference system parameters adopted as a basis for planning. Much of the groundwork for decisions in all three of these areas was laid last summer. Well over half of the Western Hemisphere administrations submitted their service requirements to the ITU's International Frequency Registration Board (IFRB) by the June 1982 deadline, as specified by Resolution 701 of the International Radio Regulations. Concurrently, specific recommendations for both planning methods and reference system parameters were agreed upon at the Conference Preparatory Meeting, which was held in June and July 1982 in Geneva under the auspices of the International Radio Consultative Committee (CCIR) of the ITU. It included delegations from Japan, the USSR, and from a number of European Administrations with territories in Region 2, as well as representatives of the Region 2 countries. The results of preparatory efforts will be summarized for each of these areas in turn.

National Requirements

The DBS service requirements of each country are described in terms of the geographic boundaries of the service areas to be covered and the number of TV channels to be provided to each area. Also included is the preferred satellite

position, or range of positions. Based on public responses to a series of FCC Notices of Inquiry and on the recommendations of an FCC Industry Advisory Committee, the U.S. requirements submitted to the IFRB are for four time-zone-size service areas in the contiguous United States (CONUS), plus separate service areas for Alaska, Hawaii, Puerto Rico and the Virgin Islands. Fifty channels were specified for each of the service areas in CONUS, Alaska and Hawaii, but the number of channels for Puerto Rico and the Virgin Islands was left open. A range of acceptable orbital positions was indicated for each of the CONUS service areas. Hawaii and Alaska are to be served from the satellite position or positions allotted to the Pacific time zone. Puerto Rico and the Virgin Islands are to be served from the Eastern time zone position or positions. (See the chart on page 24 for a listing of known national service requirements.)

Most of the countries not listed in the chart specified one service area, one orbital position and four channels. In considering all the requirements, however, it must be recognized that they are both incomplete and subject to change. For example, Mexico, Bolivia, Surinam, Venezula, and most of the Central American and Caribbean countries have not yet specified their requirements. Moreover, any country can modify its specifications up to and during the RARC-83 Conference.

The team at STC charged with the responsibility of coordinating STC's own planning for RARC-83 are, from left, Dr. Robert Blau, James Whitworth, Ernesto Martin, Edward Reinhart, and Nicholas Marzella. Photo by **William J. Megna**

Planning Methods

In setting forth the technical bases for planning at RARC-83, delegates to the Conference Preparatory Meeting agreed on the desirable characteristics and features of a Region 2 planning approach, the characteristics to be determined in the plan, and the specific approaches to be used. The Conference Preparatory Meeting emphasized that the approach should be:

- sufficiently detailed to make clear the interference potential of, and the interference protection required by, the specific systems used in developing the plan;
- responsive to improvements in technology after the plan is completed;
- responsive to a wide range of programming requirements and transmission formats; and
- responsive to the high intrinsic orbital capacity available to Region 2.

The characteristics to be determined in the plan include the following for each of the service areas specified in the national requirements:

- the satellite position, or positions;
- the channel frequencies;
- the shape, size and orientation in space of the satellite antenna beam used to cover the service area.

And possibly also:

- the polarization; and
- the equivalent isotropically radiated power (e.i.r.p.) of the satellite.

Two planning approaches were found to provide the desired features and characteristics. These were the "flexible detailed orbital position and channel assignment" approach, proposed by Canada, and the "detailed orbital position and block-frequency allotment" approach, proposed by the United States.

The Canadian approach would specify all five of the characteristics cited previously in a comprehensive plan to accommodate national requirements, but it would not require that actual systems adhere to the assigned values. The U.S. approach would, as its name suggests, assign frequencies in blocks rather than as individual channels. In addition, the proposal suggested by the United States would not assign specific polarization. Specific channel and polarization assignments would be made at the discretion of the individual administrations, either during RARC-83 or at the time they are ready to implement systems.

To gain the desired flexibility in using the plan, the delegates to the Conference Preparatory Meeting decided that the administrative regulations associated with the plan must include both a procedure for making permanent modifications to the plan as needed and the means by which a system with different technical parameters, different modulation methods, different coverage areas, etc., could be implemented without modification of the plan.

Reference System Parameters

As previously noted, the details of the plan to be developed at RARC-83 depend not only on the national service requirements to be met and the planning methods to be used, but also on the parameters assumed for DBS system performance and hardware. U.S. proposals at the conference preparatory

Major Non-U.S. Western Hemisphere DBS Requirements as of September 1982

	Service Areas	Channels Per Service Area	Orbital Positions
Argentina	3	3, 12, 9	1
Brazil	5	18	5
British West Indies	5	4	3
Canada	6	32	6
Chile	1	5	1
Cuba	1	6	1
Ecuador	2	1, 7	—
Guyana	2	2, 4	2
Jamaica	1	5	1
Paraguay	1	18	1
Uruguay	1	18	1

meeting in this area were based largely on the recommendations of the FCC Industry Advisory Committee. These recommendations were similar to those used for DBS planning by ITU Regions 1 and 3 in 1977, except in areas where significant technological progress has occurred such as in antenna sidelobe patterns.

For some of the parameters, the Conference Preparatory Meeting recommended a range of acceptable values in which the value proposed by the United States formed one limit and the value proposed by Canada the other limit. In particular, the U.S. values corresponded to higher satellite e.i.r.p. (equivalent isotropically radiated power) and smaller home receiving terminal antennas than those proposed by Canada.

With one major exception, the service requirements so far submitted by Region 2 countries appear to pose no serious planning problems for RARC-83. Either the flexible channel assignment planning method favored by Canada or the block frequency allotment method proposed by the United States could lead to a plan that accommodates all the requirements. The exception that may lead to difficulties is that Canada requires a 500 megahertz-wide allotment for each of six service areas from separate positions in the orbital arc 75°-170°W longitude, and the U.S. requirement implies a full 500 megahertz allotment for each of four service areas from a total of eight slots in the orbital arc 99°-170°W longitude. Allowing for requirements yet to be specified by Mexico, no combination of planning elements recommended at the Conference Preparatory Meeting appears able to meet the combined U.S. and Canadian requirements. Unless the United States and Canada are willing to reduce their total channel requirements or to enlarge their range of acceptable orbital positions (or both), it appears likely that planning element values outside the ranges proposed at the Conference Preparatory Meeting will have to be agreed upon before or during RARC-83.

In recognition of this, the FCC reconvened the Industry Advisory Committee to review its technical parameter recommendations and possible planning scenarios. The U.S. Government will also continue its bilateral meetings with Canada and with other Region 2 countries. Finally, the State Department has chosen former FCC Commissioner Abbott Washburn to head the United States Delegation to RARC-83 and has chosen nominees from both the government and private sector for the U.S. Delegation and for a technical and policy support staff. It is expected that these groups will meet periodically over the coming months to complete U.S. preparations for the conference.

COMSAT

WORLD SYSTEMS DIVISION

COMSAT, through its World Systems Division, gives businesses and individuals a means to solve their international communications problems.

COMSAT World Systems Division provides the link between earth stations and satellites that enables people to communicate internationally:

- ☐ Via telephone or telex;
- ☐ Through electronic data transfer;
- ☐ By transmitting exact copies of documents electronically; and
- ☐ By broadcasting television programming or holding business meetings through teleconferencing.

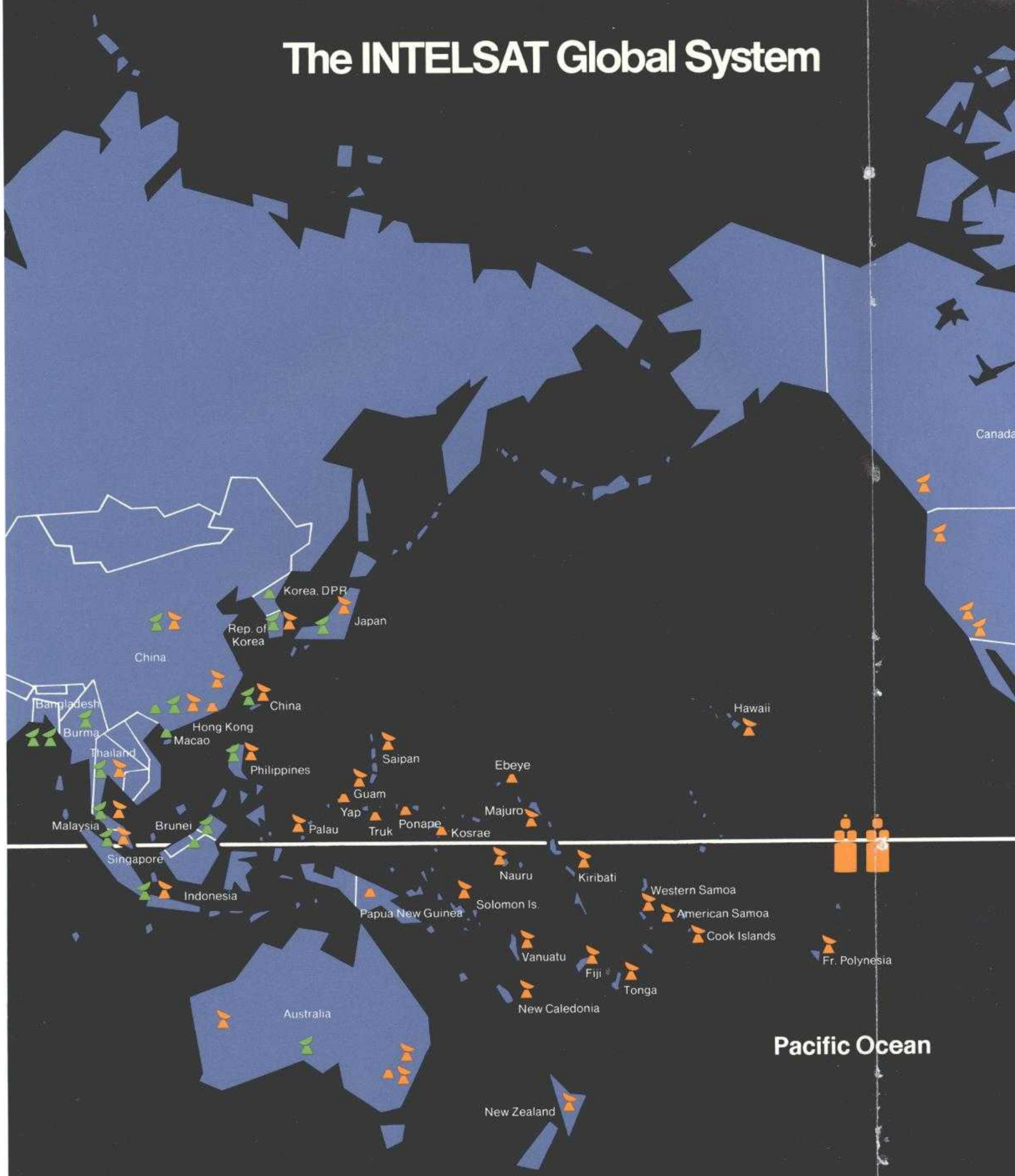
COMSAT furnishes telecommunications services through satellites of the 108-nation **INTELSAT** organization and the nine earth stations which it operates. As the U.S. representative to **INTELSAT, COMSAT** holds an ownership interest of about 24 percent in that organization.

No other communications system in the world allows its users to communicate with more international locations in as many different ways. More than 150 countries and territories use **INTELSAT** system services full time.

For more information on international communications services available through **COMSAT** World Systems Division, contact:

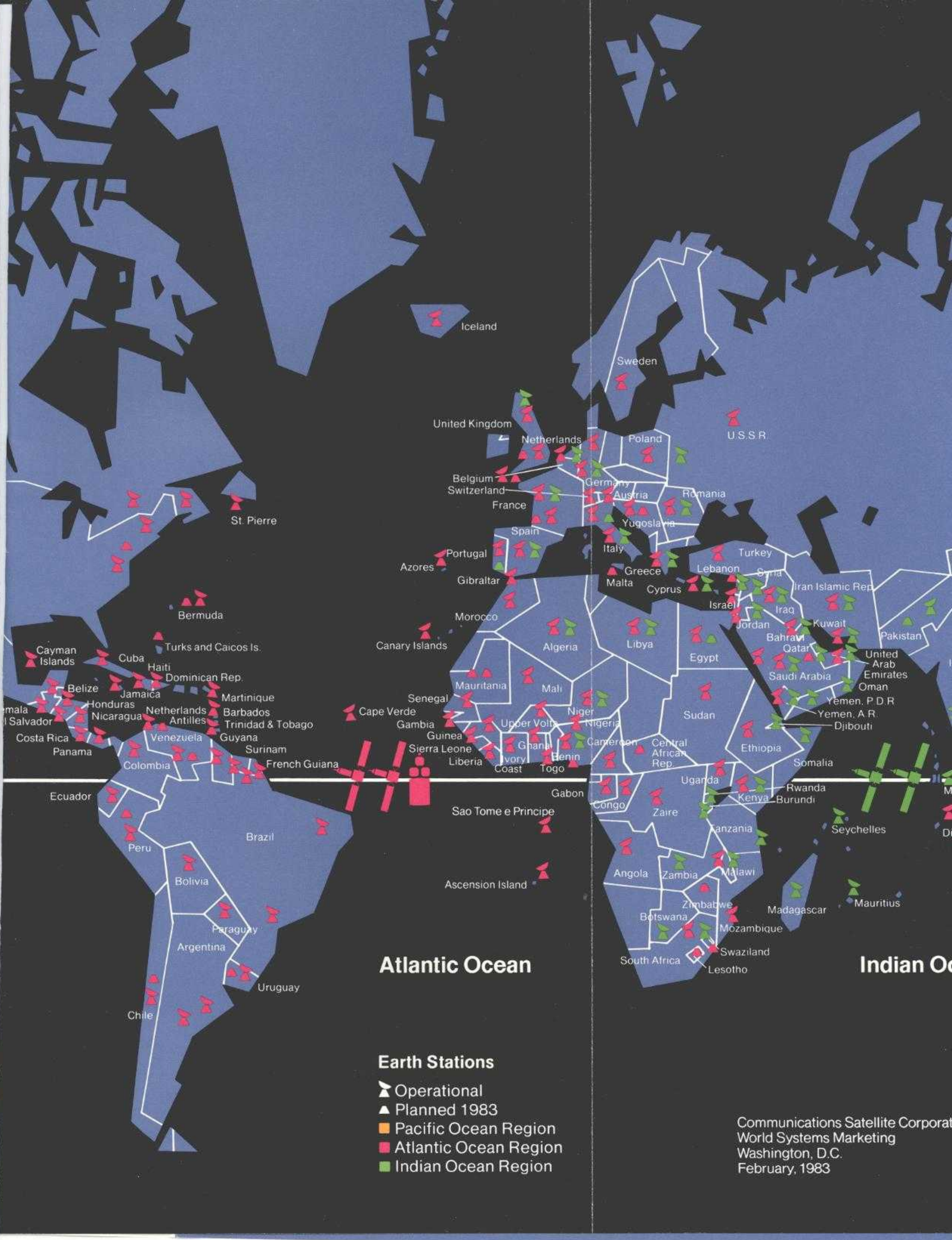
COMSAT
World Systems Division Marketing
950 L'Enfant Plaza, S.W.
Washington, D.C. 20024

The INTELSAT Global System



COMSAT

Providing Circuits for VOICE, DATA, FACSIMILE and VIDEO Ser



Communications Satellite Corporat
World Systems Marketing
Washington, D.C.
February, 1983

INTELSAT Earth Stations in International Service

Earth stations listed below were operating as of February, 1983. Figures in parenthesis following the listing of an earth station indicate the number of antennas at that site which provide service through the regional satellites.

ATLANTIC OCEAN REGION

Algeria: Lakhdaria
Angola: Cacuaco (2)
Argentina: Balcarce (2), Bosque Alegre
Ascension Island: See United Kingdom
Austria: Aflenz
Azores: See Portugal
Bahrain: Ras Abu Jarjur
Barbados: Barbados
Belgium: Lessive
Belize: Belmopan
Bermuda: See United Kingdom
Bolivia: Tiwanacu
Brazil: Natal, Tangua (2)
Cameroon: Zamengoe
Canada: Des Laurentides, Mill Village (2)
Canary Islands: See Spain
Cape Verde: Varzea
Cayman Islands: Grand Cayman
Chile: Longovilo (2)
Colombia: Choconta (2)
Congo: Mougouni
Costa Rica: Tarbaca
Cuba: Caribe
Cyprus: Makarios
Diego Garcia: See United Kingdom
Dominican Rep.: Cambita
Ecuador: Quito
Egypt: Maadi
El Salvador: Izalco
Ethiopia: Sululta
France: Bercenay-En-Othe (2)
Pleumeur-Bodou (2)
French Guiana: Trou-Biran
Martinique: Trois Ilets
St. Pierre: Pain de Sucre
French Guiana: See France
Gabon: N'koltang (2)
Gambia: Banjul
Germany, Fed. Rep. of: Raisting (3), Usingen
Ghana: Nkutunse
Gibraltar: See United Kingdom
Greece: Thermopylae (2)
Guatemala: Quetzal
Guinea: Wonkifong
Guyana: Georgetown
Haiti: J-C Duvalier
Honduras: Lempira
Iceland: Skyggnir
Iran, Islamic Rep. of: Shahid Dr. Ghandy
Iraq: Dujail
Israel: Emeq-Ha'ela (2)
Italy: Fucino (2), Lario
Ivory Coast: Abidjan (2)
Jamaica: Prospect Pen
Jordan: Baqa
Kenya: Longonot
Kuwait: Umm-Al-Aish (2)
Liberia: Sinkor
Libya: Tripoli (2)
Malawi: Kanjedza
Mali: Sullymanbougou (2)
Martinique: See France
Mexico: Tulancingo (2)
Morocco: Sehouls
Mozambique: Boane
Netherlands: Burum
Netherlands Antilles: Vredenberg
Netherlands Antilles: See Netherlands
Nicaragua: Managua
Niger: Karma
Nigeria: Lanlate, Kujama
Panama: Utibe (2)
Paraguay: Aregua
Peru: Lurin
Poland: Psary
Portugal: Sintra
Azores: Ponta Delgada
Romania: Cheia
St. Pierre: See France
Sao Tome e Principe: Sao Marcal
Saudi Arabia: Riyadh, Taif
Senegal: Gandoul
Sierra Leone: Wilberforce
South Africa: Pretoria (2)
Spain: Buitrago (2)
Canary Islands: Aguimes
Sudan: Umm Haraz
Surinam: Partes, Santo Boma
Sweden: Tanum (2)
Switzerland: Leuk (2)
Togo: Cacavelli
Trinidad & Tobago: Matura Point
Turkey: Ankara
Uganda: Mpoma
U.S.S.R.: Dubna
United Arab Emirates: Abu Dhabi
United Kingdom: Goonhilly (2), Madley
Ascension Island: Ascension (2)
Bermuda: Devonshire
Diego Garcia: Diego Garcia
Gibraltar: Gibraltar
U.S.A.: Andover (2), Etam (3)
Upper Volta: Somgande
Uruguay: Manga
Venezuela: Camatagua (2)
Yemen, A.R.: Sanaa
Yugoslavia: Jugoslavija
Zaire: N'sele

INDIAN OCEAN REGION

Algeria: Lakhdaria
Australia: Ceduna
Bahrain: Ras Abu Jarjur
Bangladesh: Betbunia, Talibabad
Botswana: Kgale
Brunei: Telisai
Burma: Rangoon
Burundi: Bujumbura
China: Peking
China: Taipei
Cyprus: Makarios
Djibouti: Ambouli
France: Pleumeur-Bodou
Germany, Fed. Rep. of: Raisting
Greece: Thermopylae
Hong Kong: See United Kingdom
India: Ahmed, Vikram
Indonesia: Djatiluhur
Iran, Islamic Rep. of: Shahid Dr. Ghandy
Iraq: Dujail
Italy: Fucino
Japan: Yamaguchi
Jordan: Baqa
Kenya: Longonot
Korea, Rep. of: Kum San
Kuwait: Umm Al-Aish
Lebanon: Arbaniyeh
Libya: Tripoli
Madagascar: Philibert Tsiranana
Malawi: Kanjedza
Malaysia: Melaka
Maldives: Maldives
Mauritius: Cassis
Nepal: Sagarmatha
Netherlands: Burum
Niger: Goudel
Nigeria: Lanlate
Oman: Al Hajar, Masirah
Pakistan: Deh Mandro
Philippines: Pinugay
Qatar: Doha
Romania: Cheia
Rwanda: Kicukiro
Saudi Arabia: Riyadh
Seychelles: Bon Espoir
Singapore: Sentosa
Somalia: Kaaraan
South Africa: Pretoria
Spain: Buitrago
Sri Lanka: Padukka
Syria: Sednaya
Tanzania: Mwenge
Thailand: Si Racha
United Arab Emirates: Dubai
U.S.S.R.: Lvov
United Kingdom: Madley
Hong Kong: Hong Kong
Yemen, A. R.: Sanaa
Yemen, P.D.R.: Ras Boradli
Zambia: Mwembeshi

PACIFIC OCEAN REGION

American Samoa: See U.S.A.
Australia: Moree, Carnarvon
Canada: Lake Cowichan
China: Peking, Shanghai
China: Taipei
Cook Islands: Avarua
Fiji: Suva
France:
New Caledonia: L'ile Nou
Fr. Polynesia: Papenoo
Fr. Polynesia: See France
Guam: See U.S.A.
Hong Kong: See United Kingdom
Indonesia: Djatiluhur
Japan: Ibaraki
Kiribati: Christmas Island
Korea, Rep. of: Kum San
Malaysia: Kuantan
Marshall Islands, Rep. of: See U.S.A.
Nauru: Nauru
New Caledonia: See France
New Zealand
Palau, Rep. o
Philippines: P
Saipan: See U
Singapore: S
Solomon Is.:
Thailand: Si R
Tonga: Nuku
United Kingd
Hong Ko
U.S.A.: Brews
Paula
America
Guam: P
Hawaii: F
Marshall
Palau, Re
Saipan: S
Vanuatu: Port
Western Sam

PLANNED IN ANTENNA

ATLANTIC O

Belgium: Les
Benin
Bermuda
Central Afric
Chile: Longo
France: Berc
Lebanon: Arb
Lesotho: Ha S
Malta
Mauritania: N
Netherlands
Netherla
Netherlands
Peru: Miguel
Qatar: Doha
Swaziland: E
Turks and Ca
United Kingd
U.S.A.: Roari
Uruguay
Venezuela: C
Yugoslavia: J
Zimbabwe

INDIAN OCE

Brunei
Egypt: Maadi
Hong Kong:
Italy: Lario
Korea, Dem.
Macao
Pakistan: Isla
Portugal: Sin

PACIFIC OC

Fed. States o
Hong Kong:
Marshall Isla
Papua New
U.S.A.:
Fed. State
Kosrae,
Marshall Isla

Mexico: Tulancingo (2)
Morocco: Sehouls
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Qatar: Doha
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Saudi Arabia: Riyadh
Seychelles: Bon Espoir
Singapore: Sentosa
Somalia: Kaaraan
South Africa: Pretoria
Spain: Buitrago
Sri Lanka: Padukka
Syria: Sednaya
Tanzania: Mwenge
Thailand: Si Racha
United Arab Emirates: Dubai
U.S.S.R.: Lvov
United Kingdom: Madley
  Hong Kong: Hong Kong
Yemen, A. R.: Sanaa
Yemen, P.D.R.: Ras Boradli
Zambia: Mwembeshi

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  Fr. Polynesia: Papenoo
Fr. Polynesia: See France
Guam: See U.S.A.
Hong Kong: See United Kingdom
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Japan: Ibaraki
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Malaysia: Kuantan
Marshall Islands, Rep. of: See U.S.A.
Nauru: Nauru
New Caledonia: See France
New Zealand: Warkworth
Palau, Rep. of: See U.S.A.
Philippines: Pinugay
Saipan: See U.S.A.
Singapore: Sentosa
Solomon Is.: Honiara
Thailand: Si Racha
Tonga: Nuku'Alofa
United Kingdom
  Hong Kong: Hong Kong
U.S.A.: Brewster, Jamesburg, Santa Paula
  American Samoa: Pago Pago
  Guam: Pulantat
  Hawaii: Paumalu
  Marshall Islands, Rep. of: Majuro
  Palau, Rep. of: Palau
  Saipan: Susupe
Vanuatu: Port Vila
Western Samoa: Afiamalu

PLANNED INTERNATIONAL ANTENNAS (1983)

ATLANTIC OCEAN REGION

Belgium: Lessive
Benin
Bermuda
Central African Rep.: M'poko
Chile: Longovilo
France: Bercenay-En-Othe
Lebanon: Arbaniyeh
Lesotho: Ha Sofonia
Malta
Mauritania: Nouadhibou, Nouakchott
Netherlands
  Netherlands Antilles: Serupela
Netherlands Antilles: See Netherlands
Peru: Miguel Colina
Qatar: Doha
Swaziland: Ezulwini
Turks and Caicos Is.: Grand Turk
United Kingdom: Goonhilly
U.S.A.: Roaring Creek
Uruguay
Venezuela: Camatagua
Yugoslavia: Jugoslavija
Zimbabwe

INDIAN OCEAN REGION

Brunei
Egypt: Maadi
Hong Kong: Hong Kong
Italy: Lario
Korea, Dem. Peoples Rep.
Macao
Pakistan: Islamabad
Portugal: Sintra

PACIFIC OCEAN REGION

Fed. States of Micronesia: See U.S.A.
Hong Kong: Hong Kong
Marshall Islands, Rep. of: See U.S.A.
Papua New Guinea: Port Moresby
U.S.A.:
  Fed. States of Micronesia: Kosrae, Ponape, Truk, Yap
Marshall Islands, Rep. of: Ebeye

LAUNCHING A SATELLITE SHUTTLE STYLE

PART 1 THE LAUNCH

Deployment of SBS-3 and Anik-C from Space Shuttle cargobay means a new era in the human uses of space

by Stephen A. Saft
Editor, Comsat Magazine

As a watcher of manned rocket launches, I'm a veteran, a veteran who can date his manned mission-watching back to Alan Shephard and the first U.S. suborbital ride in a sardine-can-size craft called Mercury. Peering intently at my own or someone else's television set, I've watched 20 years' worth of Mercury, Gemini and Apollo launches and then the first four of the Space Shuttle program, all of it brought to me courtesy of one of the three U.S. networks with considerable help by the National Aeronautics and Space Administration itself. Hence, when finally I got to see "the real thing"—to quote a much-played television commercial—the experience, though filled with a generous portion of awe and exhilaration, was also inevitably colored by comparisons with the view via the medium's enhancing and distorting lens.

For my first live manned launch, I had chosen what would become an historic occasion for the commercial satellite industry—the launch of the STS-5 mission of the Space Shuttle Columbia, the first delivery by a manned vehicle of a commercial satellite to space. Indeed, STS-5 was to make history by deploying two commercial satellites, SBS-3 of Satellite Business Systems and Anik-C of Telesat of Canada.

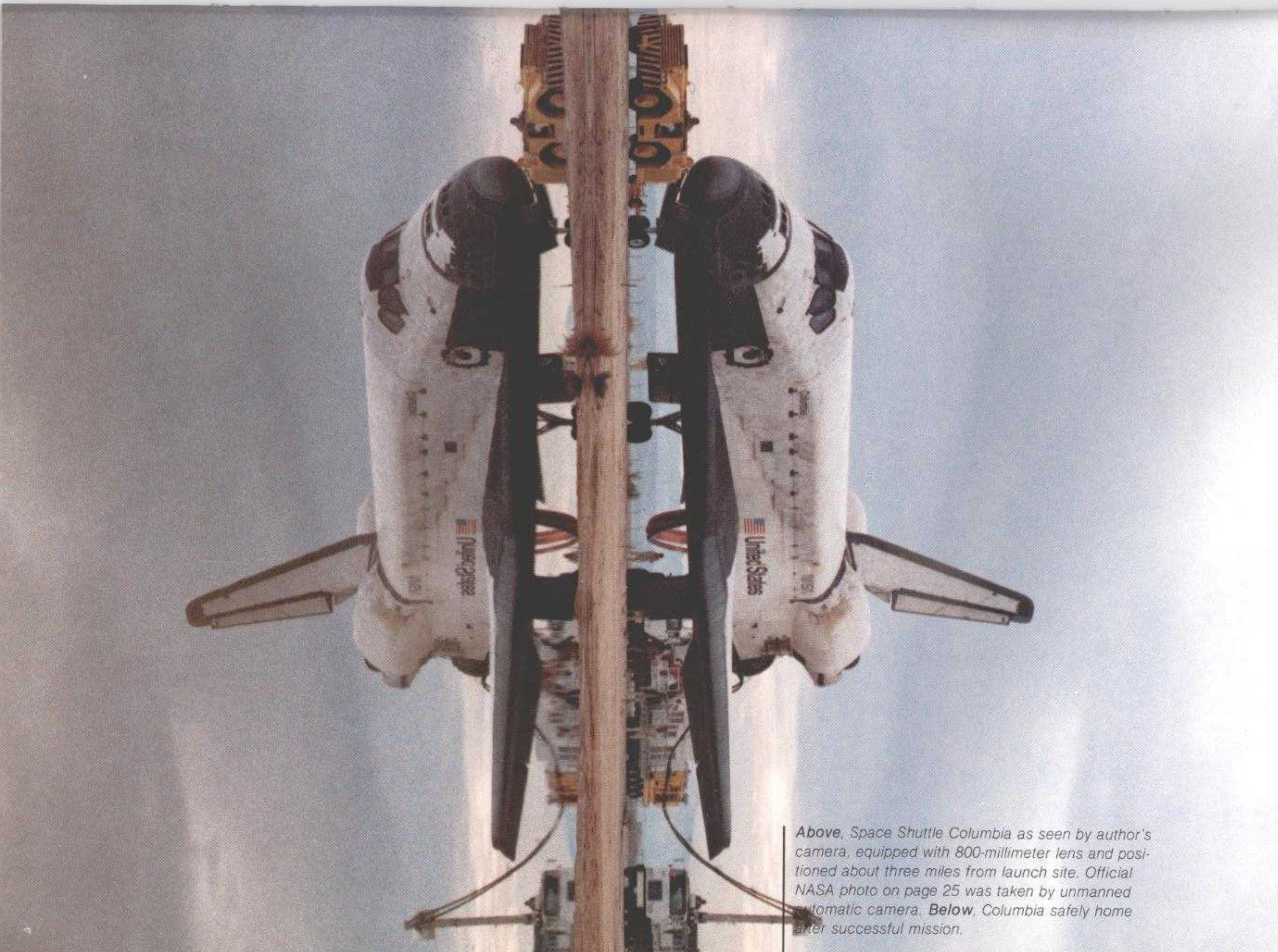
Early in the evening of November 10—about 12 hours before launch time—I boarded a bus at the Visitors Center of NASA's enormous Kennedy Space Center in Cape Canaveral, Florida, that would take me about a quarter of a mile from the launch site. As the filled bus approached the dusty parking area where it would be joined by perhaps a dozen others of its kind, I got my first taste of the reality of the Space Shuttle system.

Bathed by floodlights was a massive structure of towering girders, steel-plated platform and pipework. Initially I was struck by how industrial it all looked. I thought of the towering metal superstructure of a cement plant, a steel mill's massive smokestacks, the huge and intricate pipework punctuated by distillation-tower of an oil refinery or chemical plant.

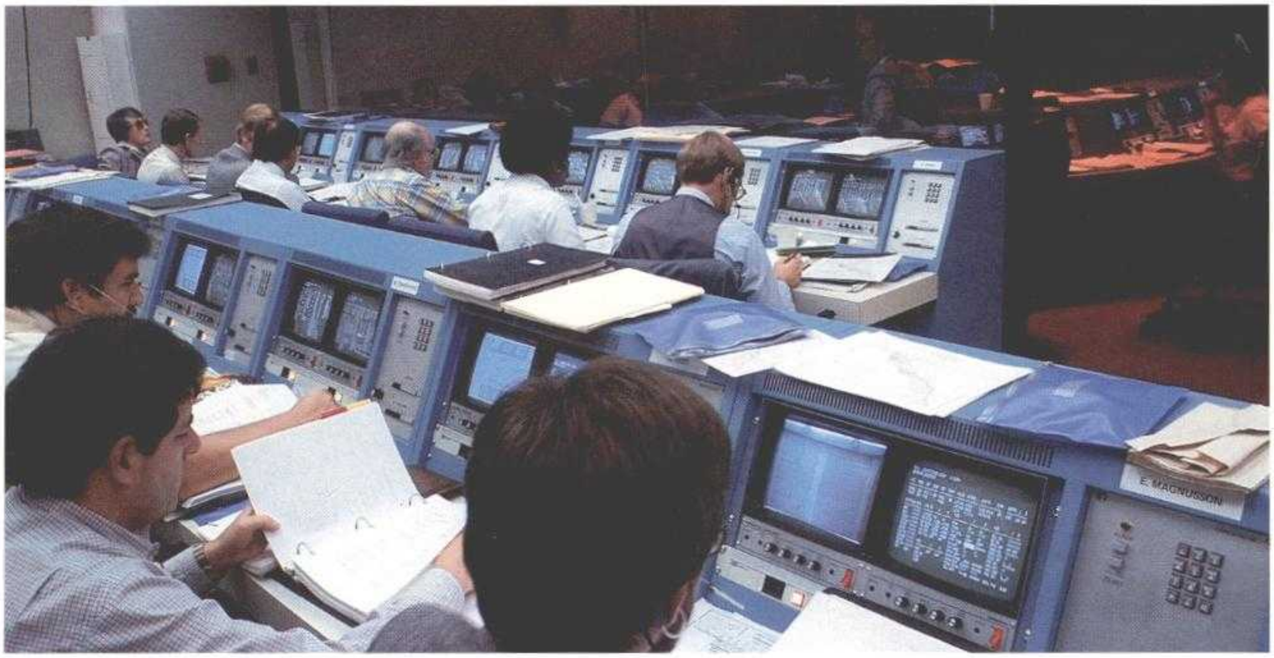
Only gradually did my mind's eye bring me to that moment of recognition where I could discriminate between what was Space Shuttle and what was launch support structure. It was as if I were seeing a movie star or a television personality in the flesh for the first time except this star in real life was far larger, far more majestic than the televised image that by now had become so familiar to me. There, under centerstage spotlights and now the riveting center of my attention, was the star of the show—Columbia, a huge white winged medallion hung on the back of an enormous rust-colored bullet called the expendable fuel tank and straddled by two great white legs, the solid rocket boosters. Majestic it was, but I experienced a touch of disappointment. What television had been etching into my mind for 20 years was an image of rocketry in motion, a special class of experience in which form and function lock, one indecipherable from the other. A rocket was a thing forever shooting fire out its aft end, forever thrusting higher, rising into the air. The reality of the Space Shuttle system that took hold of me that moment was composed of form alone, structure, solidity. A thing so massive, so imposing, so grandly stationary as this couldn't possibly move, let alone reach space, could it?

The next day my perspective was to change—literally. Having arisen at the cruel hour of 3:00 a.m., I set forth a short time later, now in a rented car, for the official press viewing site for the launch. Directed by prominent signs to a grassy area near the Kennedy complex's huge Vertical Assembly Building, I parked, then proceeded to wrest my burden for the morning from the car's trunk—an automatic camera equipped with an 800-millimeter lens and a tripod just a bit too flimsy for the heavy load it would be asked to bear. I would be attempting to play photographer that morning, a role that I might have felt more comfortable performing had I been more familiar with the borrowed equipment I was using.

In the pitch blackness of the moonless early morning, I stumbled with my burden forward across the rutted surface



Above, *Space Shuttle Columbia as seen by author's camera, equipped with 800-millimeter lens and positioned about three miles from launch site. Official NASA photo on page 25 was taken by unmanned automatic camera.* ***Below****, Columbia safely home after successful mission.*



of the parking area toward the illuminated grandstand perhaps a couple of hundred yards away. From the grandstand, already beginning to fill with reporters armed with typewriters or audio equipment, I headed back into blackness across an open expanse of grass. I wanted to get as close as I could to an illuminated object the length of my thumb about three miles off in the distance—the launch site. From this three-mile-distant vantage point, the gantry system obscured the true object of my attention. When I reached the natural forward boundary for the site, the river—just a black sheen in the darkness like a sheet of stretched black felt—I stopped. I was not alone.

As I struggled in the darkness with my clumsy rig, the air filled with the chatter of other photographers. Many seemed to know each other, were greeting each other like long lost friends. The happy chatter in the darkness—darkness interrupted only sparingly by the glow of the grandstand lights behind me—seemed out of keeping with the sense of increasing expectancy I felt. No, I finally decided, relax. We were all here for a fireworks show, a fireworks show in which the expected attraction would be the launch of a single piece.

Three miles away, under a halo of lights, was the launch site. That single firework, the shuttle itself, I imagined, must at that moment have been shining like a jewel.

Almost two hours after my arrival, the sun began to rise. I looked around me. David Hartman, host of ABC Television's "Good Morning, America," had taken up a position just in front of the grandstand and was talking to a television camera several feet away from him, into the back of which intently peered another man. Behind Hartman was the large digital countdown clock that often appears in networks' coverage of manned rocket launches. It showed about 10 minutes to go. I became aware of a row of small bungalows with large bay windows and decks out front to the right of the grandstand. Strange sight, but then I saw the signs they wore on their roofs. They were the special, launch-site studios of the television networks.

In the new light of morning, light interrupted by only the suggestion of haze, it was easy to imagine oneself at a convention of the Telephoto Lens Equipped Still Photographers of America. I was surrounded by these cameras with their ponderous yet impressive noses, in some cases as much as four feet in length. Indeed the nose on my own rig was not exactly modest in size. A photographer near me quipped, "If you put all the lenses of all the cameras that are here today end to end, they'd reach the shuttle." He may have been right.

It had taken me two hours of fumbling, but I had finally decided how I would use my own rig. Once the rocket began to move upward from its gantry, I would not attempt to track it with the camera. My tripod was too flimsy (and too short in relation to my size) to permit that, I decided. Instead, I would fix and focus the camera on a spot just at the top of the gantry. Once I detected upward movement, I would activate the automatic shutter and film advance mechanism and shoot away until all 36 frames had been exposed. I would not even look through the camera, but instead would stand straight up and take in the event directly.

With just minutes to go, I could no longer suppress my sense of anticipation. The beating of my heart sounded through me like the reverberations of a kettledrum.

At precisely 7:19 a.m., fire suddenly enveloped the base of the gantry system. For what seemed like eternity, there was only fire, no movement, no thrust. Now something was slowly moving upward. For an instant, only an instant, I could make out the thumbnail-size form. It was Columbia with her tank and boosters. She did work. She did fly. Then all I became conscious of was function—first a tail of blindingly brilliant fire, then after an eery delay, the addition of the sound, the latter an aria of huge crackles and hisses accompanied by an orchestra producing a continuous enormous roar and all causing a vibration in the air that rattled the change in my pockets.

The fire and the sound lasted perhaps 15 seconds, but the trail of the craft visible as a continuously-lengthening vertical white cloud, could be seen for several minutes. Indeed, the sky was so clear that I detected with the naked eye what I took to be one of the two solid rocket boosters, the size of a pinhead, separating from the system. A miles-long black line magically formed in the air. Extending diagonally down from the top of the vertical white cloud that was the shuttle's trail to the massive Vertical Assembly Building, once its home, the line appeared to be the trail's shadow, but why it hung in the air, unlike any other shadow I had ever experienced before, would require further investigation.

And so it was over—the launch of the Space Shuttle Columbia on its fifth mission and its first operational one. It was over, but it was just a beginning. Soon the astronauts would release from their cargohold the first commercial satellites ever brought to space by a manned space vehicle.

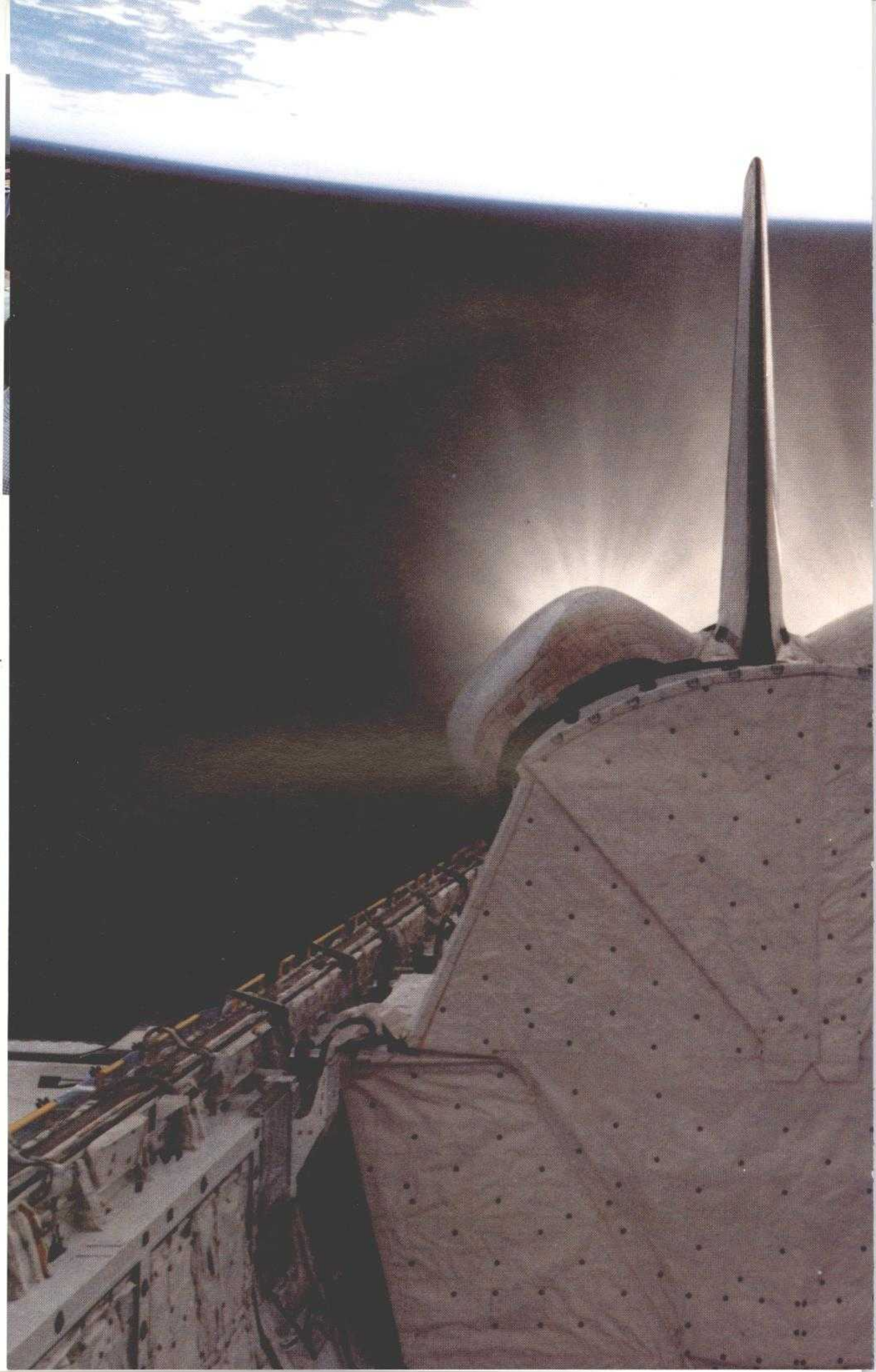
And now that some time has passed since my first live manned rocket mission, how do I respond to the questioner who asks me, "When it comes to manned rocket missions, is it better to see it in person or to watch it on television?"

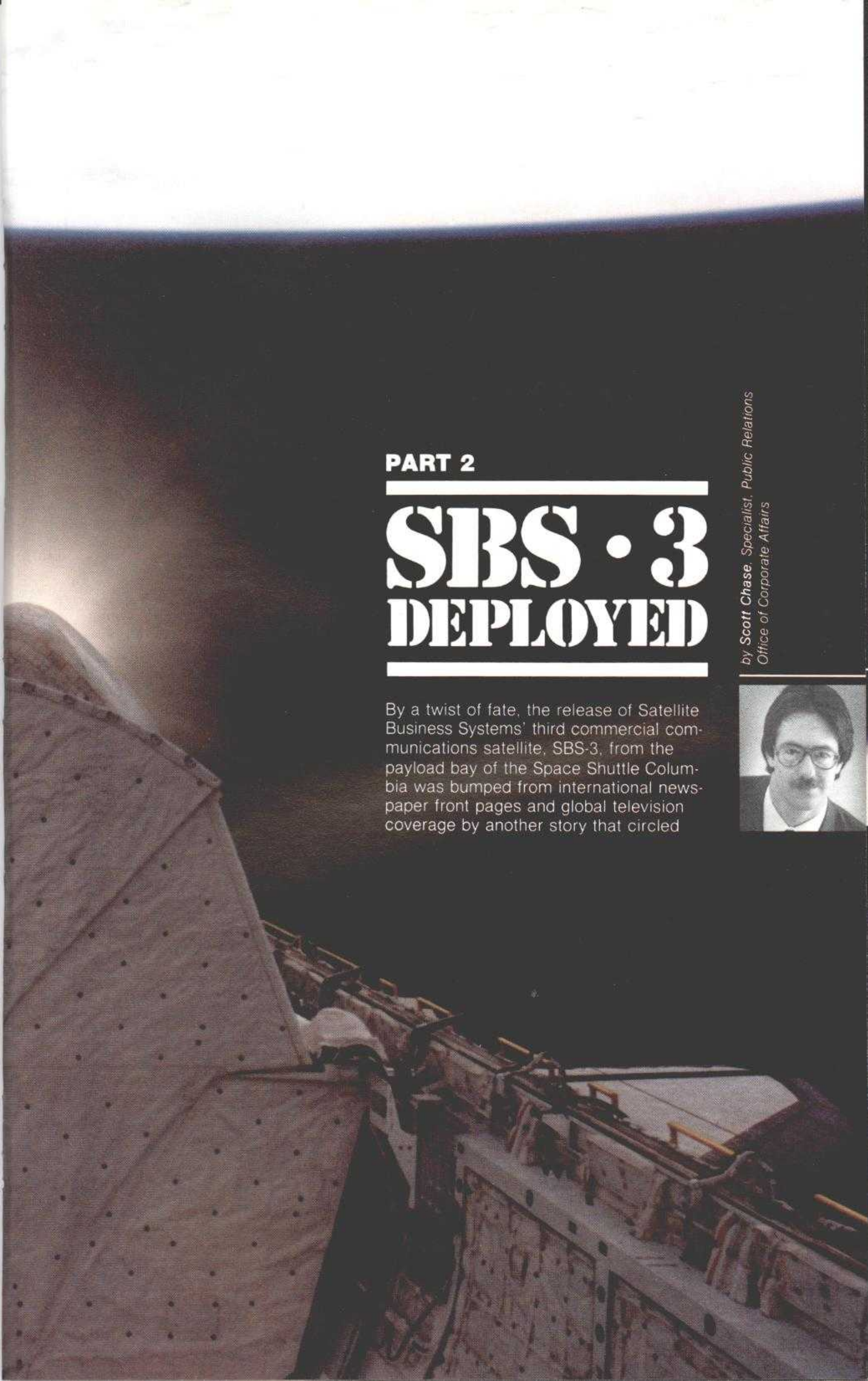
Thorny philosophical questions about the nature of reality cross my mind, but I dismiss them by telling myself, "Remember, there is no one single reality. What reality is is a matter of the perspective of the viewer, whether that perspective is created by electronic means or not." Then turning to the questioner, I adopt the diplomat's pose and answer "both."

The immensity, the majesty of the Space Shuttle system when witnessed up close at night cannot be duplicated on television, not given the present state of the art. Nor have the geniuses of the medium yet figured out how to capture the brilliance of the shuttle's fire and the loudness and the nuances of the sound—and certainly not the earthquake-like vibration. On the other hand, if you want to see the shuttle at reasonable size just before liftoff until several minutes after it has left the pad—and including solid rocket booster separation—watch the launch on television. Besides you won't have to get up at some cruel hour of the morning to do it.

Yes, "both" is the right answer.

Facing Page. *SBS, Comsat and contractor staff at work in Comsat's Launch Control Center during rehearsal for SBS-3 mission.* ***Below.*** *SBS data technician at work during rehearsal. Comsat Launch Control Center assumed control of SBS-3 once it left Shuttle cargobay. Photos by* **William J. Megna**



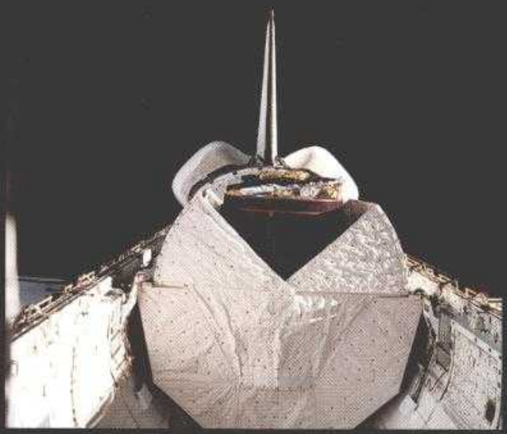


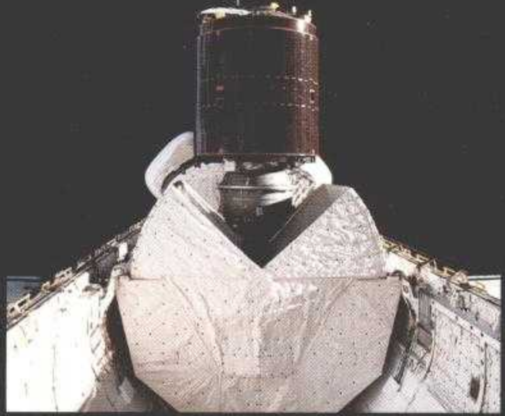
PART 2

SBS-3 DEPLOYED

by **Scott Chase**, *Specialist, Public Relations*
Office of Corporate Affairs

By a twist of fate, the release of Satellite Business Systems' third commercial communications satellite, SBS-3, from the payload bay of the Space Shuttle Columbia was bumped from international newspaper front pages and global television coverage by another story that circled





***Above**, left to right, astronaut's eye view of SBS-3 being deployed from Shuttle cargobay.* ***Opening Pages**, Firing of Shuttle's Orbital Maneuvering System (OMS) engines to bring about reentry of Columbia, as seen by an astronaut's camera. All photos used with this article, compliments of NASA.*

the world by satellite: the death of Leonid Brezhnev last November in Moscow.

The successful deployment of SBS-3 was a major space age milestone comparable to the first space walk and the first lunar orbiters. In fact, staffers from NASA counted off the "firsts" for the fifth space shuttle mission: First commercial launch, first launch with four men, first satellite deployment from the cargo bay, and first flight of mission specialists.

Those first mission specialists were Drs. William B. Lenoir and Joseph P. Allen. Like most of the three dozen people in NASA's mission specialist program, both men have a long history of involvement with space research, and both completed a year of intense "mission-specific training" required for them to perform their unique duties last winter.

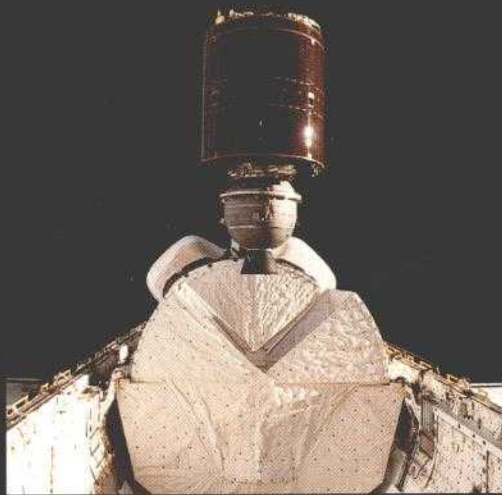
"We looked forward to STS-5," says Dr. Lenoir, of the scheduled November 11, 1982, lift-off, which went flawlessly. Lenoir, like his partner, had never "flown" before. Lenoir, a veteran of two decades in space research, applied to NASA as a scientist astronaut in 1967 and has been at Johnson Space Center in Houston ever since.

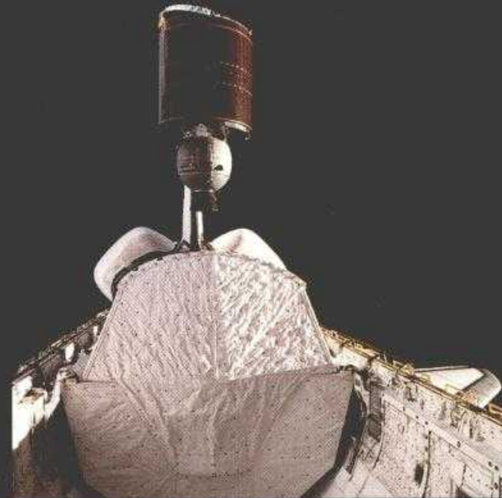
"The commander and pilot shared the primary responsibility of taking care of the orbiter," explains Lenoir. "As mission specialists, our focus was on successfully deploying two communications satellites." A Canadian telecommunications payload, Anik-C, shared Columbia's cargo bay with SBS-3 and was placed into a perfect transfer orbit about 24 hours after it.

According to the astronauts, their portion of the SBS mission was controlled by two on-board computers. "They (the computers) talked to one another," says Dr. Allen, "and we monitored the conversation to make sure it was progressing on schedule." The shuttle pilot and commander "supported deployment by positioning the spacecraft in precisely the right direction," Lenoir adds.

The SBS satellites, manufactured by Hughes Aircraft Company, consist of a telescoping cylindrical body covered with solar cells and an independently mounted communications platform hosting 10 transponders. Two 72-inch-diameter parabolic antennas and a feed-horn array operate over a bandwidth of 500 megahertz, with the up-link extending from 14.0 to 14.5 gigahertz and the down-link from 11.7 to 12.2 gigahertz. The Time-Division Multiple-Access (TDMA) technique is used to allocate bandwidth. SBS satellites are spin stabilized at 68 revolutions per minute (rpm).

SBS-3 was mounted inside Columbia on a "turntable" that Dr. Allen says "looks to all the world like a record





player." The satellite sat upright in the shuttle's cargo bay. About 30 minutes before deployment the mission specialists started the turntable spinning.

After the orbiter was correctly oriented," says Dr. Lenoir, "we prepared to release the bird. The satellite must be ejected at an exact point and moment, and that moment has to be within one second" of the appointed deployment time.

"Our computers," says Dr. Allen, "sent a signal to explosive bolts which secured the satellite. When the bolts blew, four spring-loaded pins gently lofted the satellite from its berth, at about two and a half feet per second. It slowly moved away and was already spinning at 50 rpm, an event captured in living color by the shuttle's own television cameras. The mission specialists observed SBS-3 at a close distance for several minutes after injection, taking photographs and technical measurements. Then the Space Shuttle moved about 20 miles away, the shuttle crew maintaining visual contact with the SBS satellite as long as possible.

"The moment SBS-3 left the cargo bay, its own clock began countdown for ignition of the transfer orbit motor," explains Dr. Lenoir. The satellite was released as the shuttle was moving south across the Equator over the Pacific Ocean. Just 45 minutes later, a solid fuel rocket motor boosted SBS-3 into transfer orbit over the Indian Ocean. The movement of SBS-3 into a specified geosynchronous orbit was controlled by specialists at the Comsat Launch Control Center and relied on the global tracking facilities of **Intelsat**. After the satellite achieved geosynchronous orbit, about 76 hours after lift-off, control of SBS-3 was assumed by Satellite Business Systems' tracking, telemetry and command facilities at Castle Rock, Colorado, and Clarksburg, Maryland. The two stations work in tandem to maintain the three SBS satellites within 0.03 degrees of their intended positions, using command operated thrusters that can be fired to correct orbital drift.

"Anik-C went exactly the same way about 24 hours later," Dr. Lenoir comments. After the two communications satellites were ejected, the mission specialists "tidied up" reusable equipment in the cargo bay.

"We're still very enthusiastic about the shuttle flight, and we were pleased to participate with **SBS**," states Dr. Lenoir. "We did a good job for them, if I say so myself."

Observes Dr. Allen, "SBS satellites had previously been on Delta Boosters. In a sense, **SBS** was an experimenter with us. Contracting a shuttle launch was a very unusual and interesting business decision on the part of the SBS directors. I'm confident that they now feel it was a good decision."

***Below Left**. Crew of "Ace Moving Company" congratulate each other on job well done; clockwise from bottom, Vance Brand, Commander; Bill Lenoir, Mission Specialist; Bob Overmyer, Pilot; and Bill Allen, Mission Specialist. **Below Right**. Satellite at a distance of half a mile.*

IWA

HAWAII'S UNWELCOME GUEST

Vicious hurricane teaches an important lesson: When it comes to telecommunications planning, the unthinkable has to be thought.

by ***Dr. Robert J. Oslund****, Director*
International Communications Liaison
Comsat World Systems Division
Photography by ***William J. Megna***

Traditionally, tropical storms[1] are named in advance by the international weather watchers of the World Meteorological Organization. A couple of years ago, however, it was agreed that East Pacific basin storms would be given Hawaiian names. Little did the meteorologists know then that Iwa would live up to its name literally and figuratively during a visit to Hawaii two days before Thanksgiving.

One Hawaiian dictionary provides two definitions for "Iwa:" The first is "ninth," and, indeed, Iwa was the ninth major Pacific storm of the year; the second is "man-o'-war bird," and, indeed, Iwa was not a dove.

Following a northeasterly track, the hurricane swept over Kauai (the Garden Isle) and lashed Oahu Tuesday night (November 23) and early Wednesday morning (November 24), snapping trees and utility poles, leveling sugarcane fields, ripping roofs off of houses and buildings, and disrupting the essential lifelines of electrical power and telecommunications. On the Saturday after Iwa, with damage estimates soaring over the $150 million mark, President Reagan declared the islands a Federal Disaster Area.

From the telecommunications perspective, Iwa was a grim reminder that telecommunications facilities planning is a multifaceted process whether it is carried out on the domestic or the international level. It entails delicately balancing future technologies and user demands, present operational capabilities, and past experience (the last hurricane to hit Hawaii was Dot in 1959) with assumptions based not upon the best—but upon the worst or near-worst—of all operational worlds, and, last but certainly not least, with consideration of the costs involved.

Thinking About The Unthinkable

Based upon available assessments and accounts of what happened to the telecommunications facilities during Iwa, here are examples of why the "unthinkable" sometimes has to be "thought" in facilities planning:

- Civil defense planners based plans for communicating with the state's population through KGU, the designated emergency broadcasting station in Honolulu, and with the islands' news media through the Honolulu bureaus of the Associated Press and United Press International. Yet, when KGU's commercial power source was interrupted during the storm, its backup power system proved problematical, and at other times there were information lags due to downed telephone lines which cut the station off from direct contact with local civil defense and police officials. The AP and UPI distribution conduits were also lost during the storm due to loss of commercial power.
- The Weather Service in Honolulu, which relies upon the electronic imagery of its weather satellite—GOES West—to track major Pacific storms, lost its eyesight as Iwa started bearing down on the islands when a 100-mile microwave system linking an earth station on Kauai with its Honolulu offices failed. Normal operations call for the Hawaiian weather forecasters to receive enhanced GOES imagery from the National Earth Satellite Service in Greenbelt, Maryland, via a domestic satellite link to the Kauai earth station. It is then transmitted to Honolulu over the microwave system. In this abnormal situation, GOES photos ended up being verbally interpreted by the Maryland office by telephone to Honolulu. By ironic coincidence, after having provided the Weather Bureau

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[1] Tropical storms in the Pacific Ocean Region are classified as "hurricanes" if they are east, and "typhoons" if they are west of the International Dateline when their sustained winds reach 74 miles per hour.

View of Waikiki from the top of Diamond Head, the sky still ominous several days after Iwa had wreaked her havoc. ***Facing Page.*** *Beached and ruined boats and torn-up road were part of the scene of devastation on the island of Kauai, which suffered the full brunt of Iwa.*

with critical early warning information on Iwa, the GOES satellite lost its photographic and infrared capabilities on Friday, after the hurricane had passed over the islands.

- Power outages at one point knocked out all Honolulu TV stations and radio stations save for KGU and a commercial religious broadcasting radio station.
- A 1,400-circuit trunking cable belonging to Hawaiian Telephone, which connects Honolulu with the windward side of the island of Oahu, was disabled through an unlikely chain of events. A high voltage powerline paralleling a highway snapped and fell on a guardrail, which, in turn, created an electrical path to the underground cable, melting the cable circuitry and disrupting this major traffic path. The situation was further aggravated as microwave towers and telephone poles were knocked out all over the island.
- An underwater slide off the west coast of Oahu affected four commercial submarine cables. It severed the southern portion of the 82-circuit COMPAC cable system, which links Canada with New Zealand and Australia, just off the cable landing site at Keawaula. It also affected three submarine cables near the Makaha cable landing station, two of which carry U.S. Mainland traffic to Hawaii and westward on to Guam and thence to Japan, Taiwan, Australia, Hong Kong, Singapore, the Philippines and Papua, New Guinea— all via other cables. Service on HAW 3, an 845-circuit cable between Califor-

__Below Left, Right,__ Beautiful Lihue Lutheran Church on the island of Kauai before and after Iwa's unwelcome visit. __Far Right,__ Surf crashing on reef on Waimea Bay on Oahu. Five days after Iwa had departed, the seas were still angry.

nia and Oahu, was disrupted, while service on the 840-circuit Transpac 2 was impaired due apparently to the cable's having been crushed. A 96-circuit Hawaii trunking cable which links Honolulu with the west end of Oahu on the south side of the island was also broken.

- Telephone, telex and television satellite services with the Mainland were also interrupted when wind gusts blew GTE's antenna "off" the Comstar satellite.

While operational problems such as these can be singly planned for in advance, their simultaneous occurrence confronts telecommunications planners and operators with the aforementioned "unthinkable" environment. Yet through contingency planning, careful coordination and operational flexibility, most eventualities can be—and were in fact—adapted to and overcome.

Planning As Best One Can

One of the few telecommunications facilities which remained operational was the Comsat-operated U.S. international earth station at Paumalu accessing the Intelsat IV-A satellite over the Pacific. The earth station stayed on-line throughout the hurricane, playing a pivotal role in restoring emergency communications during and after Iwa's visit.

In originally planning Pamaulu 17 years ago and subsequently adding to its capabilities, a number of assumptions have had to be made and have proven to be critically correct:

- It was assumed that the earth station

Facing Page, Top. Paumalu, Hawaii, Intelsat Earth Station is built on a plateau overlooking famous Sunset Beach, scene of televised surfing contests. *Facing Page, Bottom.* Among telecommunications facilities destroyed by Iwa was this microwave tower on Kauai.

would have to be capable of sustaining itself. During the hurricane, commercial power and water sources were interrupted, and for six days the earth station operated on its own power generators.

- The 30-meter dish had to be built to withstand high gusts of wind. During the hurricane, wind gusts peaked at 83 miles per hour, slightly in excess of the antenna's design parameters. Further, to ensure that an antenna failure would not render the earth station inoperable, a spare antenna had been constructed. Fortunately, the spare antenna was not needed, but nevertheless would have been available.
- With respect to overall operations considerations, contingency plans had to be developed to anticipate different kinds of abnormal situations.

One type of preventive contingency had to do with wind conditions. When wind gusts reached 50 mph late Tuesday afternoon, Bob Yamazaki, the Earth Station Director, made a decision to keep one antenna operational and to "stow" the spare antenna as a safety precaution so as to ensure restoration after the storm passed in the event the "on-line" antenna was damaged. ("Stowing" an antenna means raising the antenna to the 90° vertical or zenith position and inserting "stow pins" to lock the antenna into place.) This was in keeping with established procedures. The stowage was carried out after the commercial power had failed and the earth station had switched over to its own power source.

Another type of contingency involved developing plans for restoring failed submarine cable facilities. In mid-1968, a Pacific Restoration Group was established to develop complementary cable/satellite contingency plans. In late 1981, **Comsat** had participated in a meeting of this group in Singapore to develop cable restoral plans with the U.S. and foreign cable owners of HAW 3, Transpac 2 and COMPAC. As things evolved, two of the standing cable restoral plans were rendered inoperable due to simultaneous facility failures, but the cable service was restored nevertheless.

Iwa Hits Oahu

Iwa hit Oahu hard around dinnertime Tuesday night. The hurricane-related underwater slide on the westward side of the island severed HAW 3 and COMPAC and partially crushed Transpac 2 about 6:00 p.m. As wind gusts soared past 70 mph, microwave towers were manhandled and telephone poles were snapped off, virtually crippling Oahu's telephone system. Unable to use the Oahu telephone system to call the Mainland, Yamazaki contacted A. J. Stotler, Manager of the Comsat-operated U.S. international earth station in Jamesburg, California, via the Intelsat IV-A satellite. Stotler, in turn, called Washington to advise the Comsat Headquarters staff of the deteriorating conditions and of the decision not to stow the "on-line" antenna. Ironically, this decision was made at approximately the same time the underwater slide was disrupting the submarine cable communications on the other side of the island.

As Harry Gross, General Manager of the U.S. Intelsat Earth Stations, later recalled: "The decision not to stow was Bob's alone to make. The scenario of

"In the end, it's a judgment call."

Bob Yamazaki, who serves as Director of both Pacific Offshore Operations and the Paumalu Earth Station, has been with **Comsat** seven years. He assumed his present duties in January 1981.

Below are some of his observations on Iwa's "visit" to Hawaii:

". . . In anticipation of abnormal conditions, such as hurricanes, we have preparatory procedures which include inspecting facilities at the station to ensure that all are in working order. All external structures are inspected to identify any possible problems . . . Roofs were sandwhen to stow had been discussed earlier, but only he knew what the conditions actually were—and he had to call it as he saw it."

Iwa's gusts peaked at 83 mph about 7:00 p.m. Tuesday, at which time one operational antenna at the GTE earth station, located nearby the U.S. Intelsat earth station complex at Paumalu, was blown off, that is, out of alignment with, the Comstar satellite. (GTE had already stowed its second antenna as a precautionary measure.) Four hours later (4:00 a.m. Washington time), Yamazaki received a request from HAWTEL to restore HAW 3 services via the Intelsat space segment and the Jamesburg earth station. The cable restoration plan had originally called for HAW 3 restoration on Comstar, but, as mentioned previously, the GTE earth station antenna had been blown off the satellite. Using Stotler as a go-between, Yamazaki advised Arnold W. Meyers, Comsat's Restoration Liaison Officer (RLO), at Comsat Headquarters, of the requirement. Meyers promptly determined the availability of Intelsat space segment and began to develop an ad hoc cable restoral plan. The next step was to arrange with AT&T and Hawaiian Telephone Company representatives necessary rerouting of traffic to and from Jamesburg and Paumalu. Within an hour and a half, the Intelsat space segment between Paumalu and Jamesburg had been arranged and tested. However, due to the unavailability of interconnecting microwave facilities on Oahu, the restoration was not effected until 2:00 p.m. the next day, Wednesday. The HAW 3 restoration was subsequently transferred to Comstar.

While the HAW 3 ad hoc restoration plan was being readied, Yamazaki also hosted an ABC news team which used the Paumalu earth station operations center and transmission facilities to originate the first TV coverage of Iwa back to the U.S. Mainland at 3:00 a.m., again via **Intelsat**.

Thirty minutes after receiving the HAW 3 restoration advisory, Meyers,

bagged on some of our supporting buildings to protect them and prevent their being blown away . . .

". . . We augmented our normal operations crew with key staff members who remained throughout the storm to deal with unforeseen contingencies and inspect the station after the storm passed for any possible damage . . . Our shifts were staggered before and after the storm to ensure that our staff did not get involved in the predictable traffic jams and add to the confusion . . .

". . . I was shocked at what I saw when we were able to leave the facility and return to our residences. I had no idea of the magnitude of the storm's damage to the local communities . . .

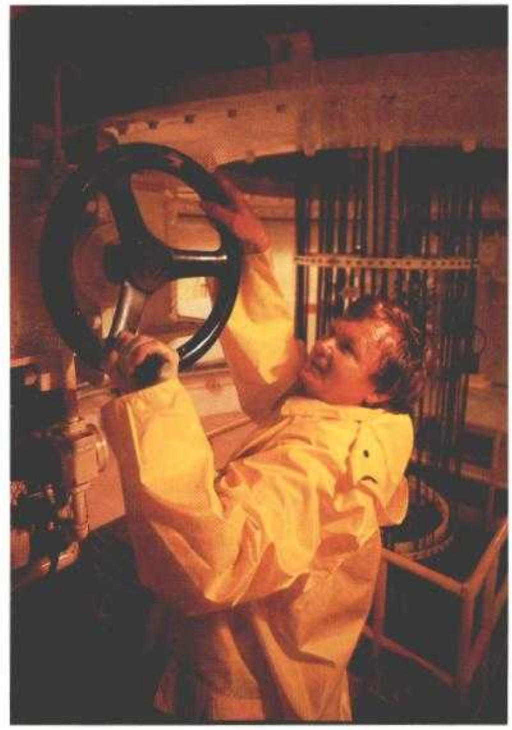
". . . We didn't want to subject our crew to unnecessary hazards. One of the reasons we chose the Paumalu 2 antenna to remain operational was because of its protective shrouding leading up to the electronics in the feed room of the antenna . . .

". . . We have core procedures which address general contingencies, but we look at each occurrence as an individual requirement. We cannot apply one set of procedures across the board. There are always exceptions to the general rule. In the end, it's a judgment call."

Comsat's RLO, received a second request for an ad hoc cable restoral, this one from the earth station in Hong Kong, one of the Far East points having lost Transpac 2 service. Normally Transpac 2 restoration would have been effected using U.S. international earth stations at Paumalu and Guam. But the loss of microwave facilities on Hawaii prevented hauling traffic from the cable landing station at Makaha to the Paumalu earth station. As a result, the U.S. Mainland-Far East traffic was routed to the Jamesburg earth station on the Mainland and transmitted to the U.S. international earth station in Guam where it interconnected with the Far East cables. Days later, another request was received to restore the remaining TPC 2 cable service on the Intelsat satellite, using yet another ad hoc plan to accommodate Hawaii traffic to Japan and Taipei.

Reviewing the situation, George Tellmann, Senior Director, International Systems Operations, observed: "It's a tribute to the network of restoration liaison officers that ad hoc restorations could be accomplished for four simultaneous facility failures."

Right. Iwa produced winds gusting to over 80 mph at earth station site. To ensure antenna-satellite alignment during height of storm, Comsat's Don Stribling manned antenna pointing control wheel. ***Below.*** *As storm raged, Comsat's Charles Ogata checked downlink spectrum analyzer for signs of wind related problems.*



The one cable restoration by satellite which was implemented as planned involved the break in the south segment of the COMPAC system. The service was restored by the earth stations in Vancouver, British Columbia, and New Zealand, also via **Intelsat**.

The Lessons of Iwa

Not only is Iwa a grim reminder of the need for comprehensive and coordinated telecommunications facilities planning. The hurricane also serves as a timely reminder that international telecommunications involves different technologies and operational complexities which sometimes appear to be deceptively simple because they work the way they have been planned and designed to work. When things do go wrong, it is too late to ask "what if." On the contrary, the time for second-guessing is before the fact, weighing what you have against what you need in order to do what you want to do and at what cost.

Photo Left. *Arnold W. Meyers, left, Comsat's Restoration Liaison Officer (RLO), was the man charged with overseeing restoral of lost telecommunications services. Working with Paumalu's Bob Yamazaki and with two senior Comsat staff members, Harry Gross, middle, and George Tellmann, Jr., Meyers effected restoral service. Harry Gross is General Manager, U.S. Intelsat Earth Stations, and George Tellman, Jr., is Senior Director, International Systems Operations and Planning, Comsat World Systems Division.*

INDEX TO SUBJECTS IN THE FIRST TEN ISSUES OF COMSAT MAGAZINE

Readers engaged in legitimate research projects who do not have a file of back issues of *Comsat Magazine* should write specifying the subject or subjects from the following Index they are interested in. We will respond by sending photocopies of appropriate passages as referenced in the Index. Address correspondence to Patricia A. King, Editorial Assistant, Comsat Magazine, Communications Satellite Corporation, 950 L'Enfant Plaza S.W., Washington, D.C. 20024. Please note that to keep page references from becoming ponderous, we refer only to the first mention of a subject in an article. Readers should read to the end of an article for subsequent references.
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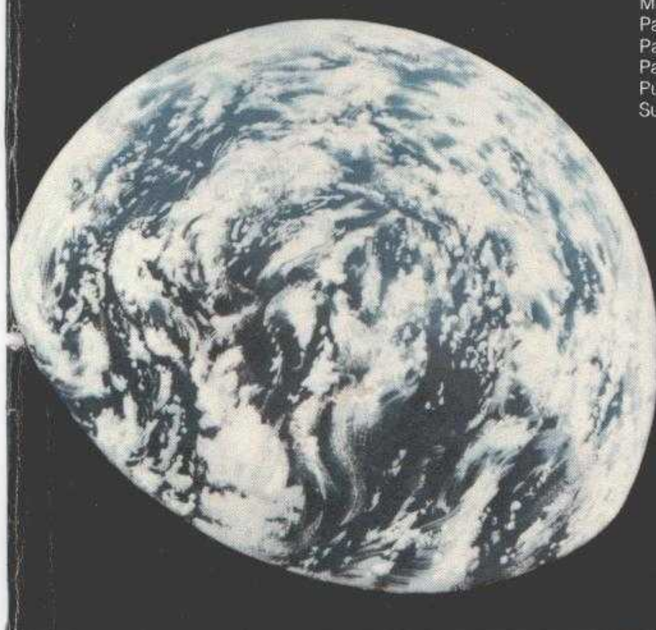

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