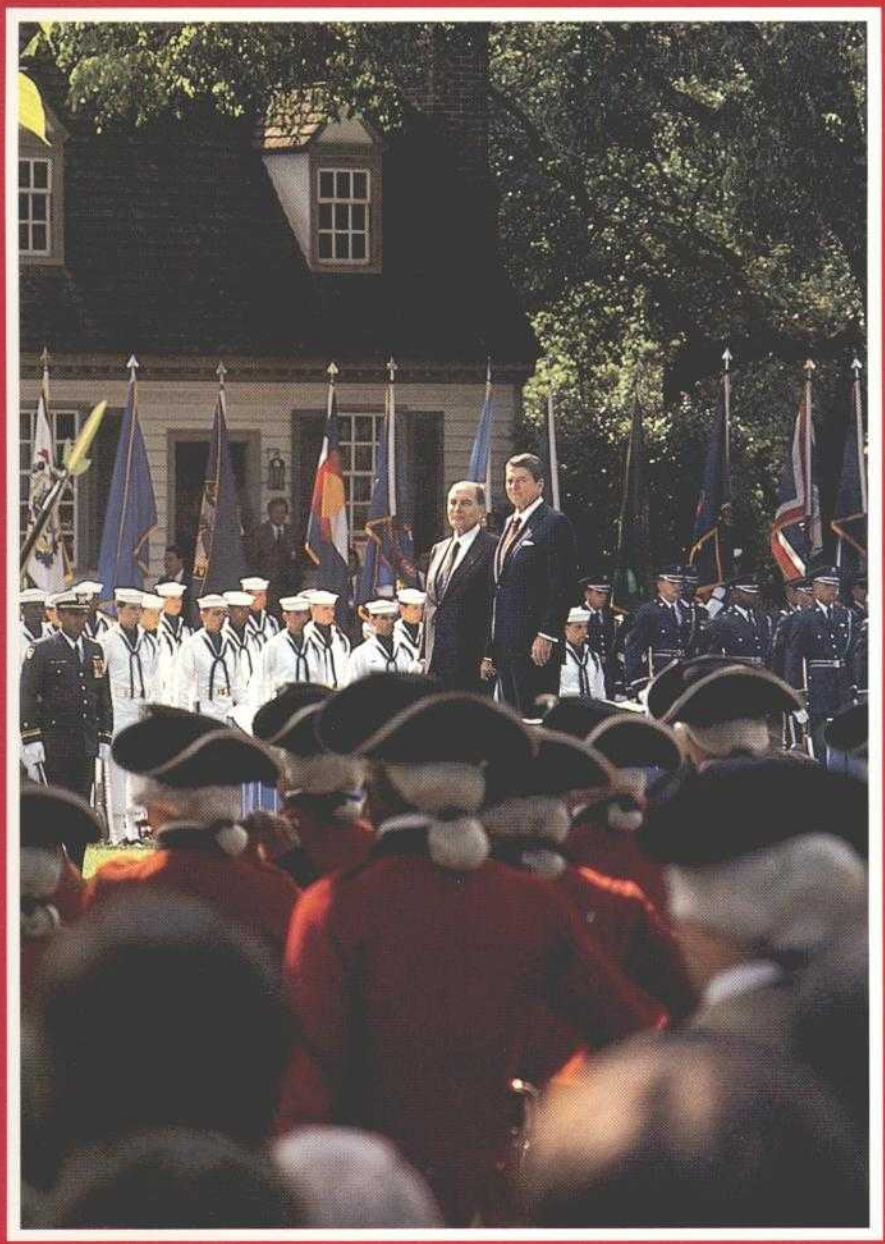
COMSAT®

COMMUNICATIONS SATELLITE CORPORATION MAGAZINE

1983



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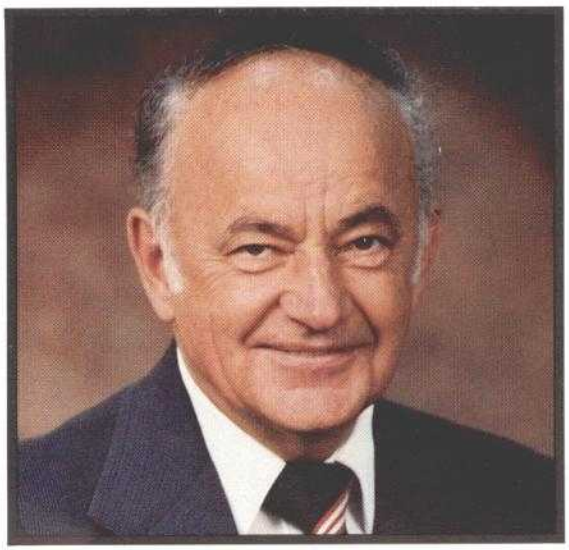
VIEWPOINT



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

Our first home when Comsat came into being in 1963 was an estate in northwest Washington called Tregaron that came complete with a main house, carriage house, greenhouse, farm house and Russian dacha set on a wooded hill. Built in 1912 and named the Causeway, the estate was owned and lived in from 1940 until his death in 1958 by Joseph Davies, the first U.S. ambassador to the U.S.S.R. It was Davies who changed the name of the estate to Tregaron after the place in Wales where his mother was born.

Set off from the frenetic pace of Washington's government and business scenes, Tregaron struck the Comsat Incorporators who selected it as befitting an organization that was expected to do a number of things that had no precedent. Those of us who came to work in the place faced a number of practical problems from the start, however, not least of which was a lack of space for all the people we would need to fulfill our mandate to start the world's first global satellite-based telecommunications system. But though space was limited and became progressively more cramped, I don't think any of us spent much time regretting such an unconventional choice for a first home.

What I do remember from our Tregaron days was the camaraderie and the good spirit that prevailed among the growing staff. Most of all, I remember the spirit of adventure that suffused our every activity. This positive spirit stayed with us as we moved first to a second temporary location in downtown Washington and from there to our own building in L'Enfant Plaza. Along the way, that spirit was buoyed by the excellent reception for our initial stock offering, the achievement of being able to get representatives from several diverse nations to agree to work together to manage a global communications system, and a string of predominantly successful launches beginning with Early Bird in 1965. Early Bird not only did everything we said it would, but it actually exceeded our expectations by operating three times longer than predicted.

As we paused from time to time to reflect upon where we were going and what we were achieving, we had the pleasure of knowing that we had succeeded in doing something extremely bold and, what is more, that we were vigorously working to extend the technology.

Now, from the vantage point of 20 years of successful leadership in satellite communications, what gives me special pleasure is the knowledge that the sense of adventure continues to live at Comsat. We face a challenging future hardly free of risk, but we are facing it having taken several bold steps that I believe will ensure our ability to bring new programs into being and to see to their fruition. At Comsat, the adventure has a long way to go.

COMSAT

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Cover: President Reagan with President of France Francois Mitterrand at opening ceremonies for 1983 Summit of Industrialized Nations, Williamsburg, Virginia. Comsat also was at the Summit in historic Williamsburg, receiving TV newscast transmissions by means of a transportable Ku-band earth station for distribution to the French and U.K. delegations. In its 20-year event-packed history, Comsat often has been where history was being made. Story on page 6. 20th Anniversary coverage begins on page 11. Photo by William J. Megna.

From the Editor

In the 20th Anniversary section of the current issue, we publish three photographs in color of the four currently active 20-year employees of **Comsat** including Dr. Joseph V. Charyk, Chairman and Chief Executive Officer. These photographs were taken this past spring at Tregaron, the estate in Northwest Washington that was **Comsat**'s first home, and we wish to thank the Washington International School, the present owner of the estate, for permitting us free access to the grounds and buildings. In all, we made five trips to the estate, and each time we found the staff of this leading private educational institution most gracious and accommodating.

The chart showing the major milestones in the history of **Comsat** in the center of the current issue required extensive, painstaking effort to put together. The person who deserves the credit for this demanding assignment is Patricia A. King, Comsat Magazine Editorial Assistant.

Finally, we wish to extend our thanks to our three guest authors in the current issue for agreeing to contribute to the collection of reminiscences that make up our 20th Anniversary section—Senator Edward M. Kennedy (D-Mass.), Retired Senator John O. Pastore, and Bruce G. Sundlun, the original Incorporator and Director on the Comsat Board of Directors.

Stephen A. Saft

N O T E S

Board elects senior officers

The Comsat Board of Directors has elected Joseph V. Charyk as Chairman and Chief Executive Officer and Irving Goldstein as President of the Corporation. In his new position, Dr. Charyk is responsible for the overall management of the Corporation and its businesses, and the Chairmanship of the Board of Directors. As President, Mr. Goldstein reports to Dr. Charyk and is responsible for the management of all of the Corporation's operating units, including Comsat World Systems Division, Satellite Television Corporation (**STC**), Comsat General Corporation, Comsat Technology Products (comprising **TeleSystems** and **Amplica**), Environmental Research & Technology (**ERT**), **CGIS**, and the Corporation's participation in Satellite Business Systems (**SBS**). (A photograph of Dr. Charyk and Mr. Goldstein taken at the 1983 Annual Meeting appears on Page 5.)

A. William Perigard is President of Comsat Technology Products, Inc.

Shareholders approve stock split at 1983 Annual Meeting

Comsat shareholders approved the two-for-one stock split that was proposed earlier this year at the 1983 Annual Meeting. The split up of Comsat stock, which had been approved by the Federal Communications Commission (FCC), became effective on June 6, 1983, the record date for shareholders.

The split up of Comsat stock took effect as a result of an amendment to the Corporation's Articles of Incorporation. It increased the number of outstanding shares to 18,000,028 from 9,000,014. The split also increased the number of treasury shares held by the Corporation to 2,000,000 from 1,000,000. In approving the amendment to the Corporation's Articles, Comsat shareholders also approved an increase in the number of shares that the Corporation is authorized to issue from its current level of 25,000,000 up to 40,000,000.

In other actions, the Corporation's shareholders reelected 11 members of the Board of Directors, including Joseph V. Charyk, Frederick B. Dent, Elliott M. Estes, Lewis W. Foy, William W. Hagerty, John D. Harper, Melvin R. Laird, Ellmore C. Patterson, Charles J. Pilliod, Jr., Bruce G. Sundlun, and William L. Zimmer, III. Filling a vacancy on the Board created by the retirement of Howard J. Morgens, the shareholders elected Irving Goldstein to the Comsat Board.

The shareholders also approved two amendments to the Corporation's Articles of Incorporation, in addition to the one previously described. One modifies the statement of purposes of the Corporation to include terms used by the FCC in an interpretation of the Satellite Act; and the other deletes the provision of the Articles that requires that shares be reserved for purchase by Series II Shareholders at the time of the stock offering. The shareholders approved the appointment of Deloitte Haskins & Sells as the Corporation's independent public accountants and approved an Employee Stock Purchase Plan.

News of Comsat officers

Promotions: A. William Perigard, formerly President of TeleSystems, becomes President of Comsat Technology Products. In his new post, Mr. Perigard is responsible for **Comsat**'s complete manufacturing operations consisting of **TeleSystems** of Fairfax, Virginia, and **Amplica** of Newbury Park, California. Joel R. Alper, formerly Vice President, Communications Services, World Systems Division, becomes Executive Vice President, World Systems Division.

Appointments: William Michael Karnes has been elected Treasurer of **Comsat**. He is responsible for the Corporation's treasury, financial analysis, budgetary, and trust fund administration activities.

Dr. John V. Evans has been elected Vice President and Director of Research at **Comsat Laboratories**. Dr. Evans was formerly with M.I.T.'s Lincoln Laboratories as Assistant Director of Advanced Technology and Director of the Haystack Observatory.

The following appointments took place at Satellite Television Corporation (**STC**): Richard M. Galkin becomes Senior Vice President, Programming, with overall responsibility for acquiring the programming for **STC**'s planned multichannel direct broadcast satellite (DBS) service. J. Ronald Castell becomes Senior Vice President, Marketing. Mr. Castell is responsible for developing and implementing the marketing strategies

N O T E S

for **STC**'s satellite-to-home pay television service to be introduced in the fall of 1984. Warren Y. Zeger, formerly Vice President, General Counsel, has been named Vice President, Planning and Business Development. John S. Hannon has been named Vice President and General Counsel. He was formerly Assistant General Counsel, Commercial Matters, at **Comsat**.

Mr. Carl A. Washenko has been appointed Vice President, Human Resources and Administration, of **TeleSystems**.

Awards: Les Besser of **CGIS** has received the Institute of Electrical and Electronics Engineers (IEEE) Microwave Applications Award "for the development and application of COMPACT, a computer program for microwave circuit design."

Agreement reached with GE on sale of a part of CGIS

Comsat and General Electric Company have reached agreement in principle on the purchase by GE of the digital electronics portion of **Comsat**'s computer-aided engineering software subsidiary, **CGIS**, for approximately $14 million in cash. The transaction would entail purchase of 100 percent of CGIS common stock and is subject to negotiation and agreement on a definitive contract, with a closing expected in the third quarter 1983.

Comsat would retain the microwave division of **CGIS**, which is located in Palo Alto, California, as a subsidiary under the name COMPACT Software, Inc. The digital electronics portion of **CGIS** to be acquired by GE is located in Austin, Texas, and would continue to be operated by its present management.

COMPACT Software, Inc., becomes a part of Comsat Technology Products, under the management of CTP President A. William Perigard. Other CTP businesses include **TeleSystems** and **Amplica**, manufacturers of advanced telecommunications equipment.

Governors choose Colino new Intelsat Director General

On June 17, in a unanimous decision, the Intelsat Board of Governors chose Richard Colino, the nominee of the United States, to be the next Director General of **Intelsat**.

Mr. Colino has had a long association with **Comsat** and with **Intelsat**. He joined **Comsat** in 1965 and rose to the rank of Vice President and General Manager, International Operations Division, now known as the World Systems Division. His long association with **Intelsat** began in 1962 when he was an attorney with the U.S. Government and spokesman on U.S. delegations which negotiated the Interim Agreements establishing **Intelsat**.

Mr. Colino was Chairman of the Working Committee which concluded the negotiation of the predecessor to the Intelsat Operating Agreement in June 1964, the Special Agreement. He served as alternate U.S. representative to the Intelsat Interim Communications Satellite Committee, which preceded the Board of Governors, and in 1973 became the U.S. Governor to the Board, remaining in that position until he left **Comsat** in 1979.

Since 1979, Mr. Colino has served as a chief executive in the establishment and operation of subscription television businesses, as the president of a private consulting firm specializing in telecommunications and broadcasting, and as a practicing communications attorney.

Mr. Colino's appointment will now be submitted to the Intelsat Assembly of Parties—representing the government of **Intelsat**'s 109 member countries—for confirmation at its next meeting in October. He is expected to take up the duties of his new post at the end of this year, upon the retirement of the present Director General, Mr. Santiago Astrain.

Richard Colino has been chosen by the Intelsat Board of Governors to be the new Director General of Intelsat, replacing Santiago Astrain, who will retire at the end of the year.

Second quarter income up, Quarterly dividend increased

Comsat's Consolidated Net Income for the quarter ended June 30, 1983, was $16.1 million, an increase of 49 percent, or $5.3 million, over net income for the second quarter of 1982 and an increase of 28 percent, or $3.5 million, over the previous quarter. Earnings per share for the second quarter were 89 cents—on

approximately 18,000,000 shares—an increase of 22 cents over the amount reported for the second quarter last year—when about 16,000,000 shares were outstanding—and 19 cents over the amount for the previous quarter. Earnings per share amounts reflect the effect of the June 1983 two-for-one split of the Corporation's stock.

The Corporation also announced an increased quarterly dividend, to 30 cents per share, payable September 12, 1983, to shareholders of record on August 12, 1983. Prior to the two-for-one stock split, which took place in June, quarterly dividends of 57.5 cents a share have been paid since the second quarter of 1979. The latest dividend, a four percent increase over the previous quarter, is the 52nd consecutive quarterly dividend declared by the Corporation to its shareholders.

The increase in Net Income is primarily attributable to the sale of the Corporation's investment in common stock of Ungermann-Bass, Inc., which resulted in a nonrecurring increase in after tax income of approximately $4.8 million. Also contributing to the increase was increased income from the Corporation's international satellite services, partially offset by increased losses related to the Corporation's partnership interest in Satellite Business Systems (**SBS**). Absent the income resulting from the sale of Ungermann-Bass stock, second quarter Net Income was $11.3 million, or 63 cents per share.

After recognizing federal income tax benefits and investment tax credits, the Corporation's share of losses from its partnership interest in **SBS** increased to $5.8 million from $5.1 million for the second quarter of 1982. This increase is primarily attributable to higher operating losses sustained by **SBS** during the second three months of 1983 compared to those of the same period of 1982.

SBS revenues for the second quarter rose significantly, to $31.3 million, a fourfold increase over the $5.9 million reported for the same quarter of 1982.

The SBS Partners—Aetna Life & Casualty, IBM, and **Comsat**—have agreed to increase their funding of **SBS** to $711 million from $591 million, an increase of $120 million. All of the Partner funding is equity and is provided in equal shares by the three owners.

The Corporation's Operating Revenues for the second quarter of 1983 were $110.0 million, up $10.0 million from revenues reported for the second quarter of 1982. For the first six months of 1983, Operating Revenues increased $24.3 million to $218.4 million. This increase is principally a result of growth in revenues from the Corporation's international communications satellite services and from its equipment manufacturing business. For the first six months of 1983, Consolidated Net Income was $28.6 million, or $1.59 per share. This Net Income amount represents an increase of $7.5 million, or 27 cents per share, over the first six months of 1982. The increase is attributable primarily to the sale of Ungermann-Bass stock and higher revenues resulting from **Comsat**'s international satellite services, partially offset by increased losses related to the Corporation's partnership interest in **SBS**.

TeleSystems will provide TDMA terminals to Siemens

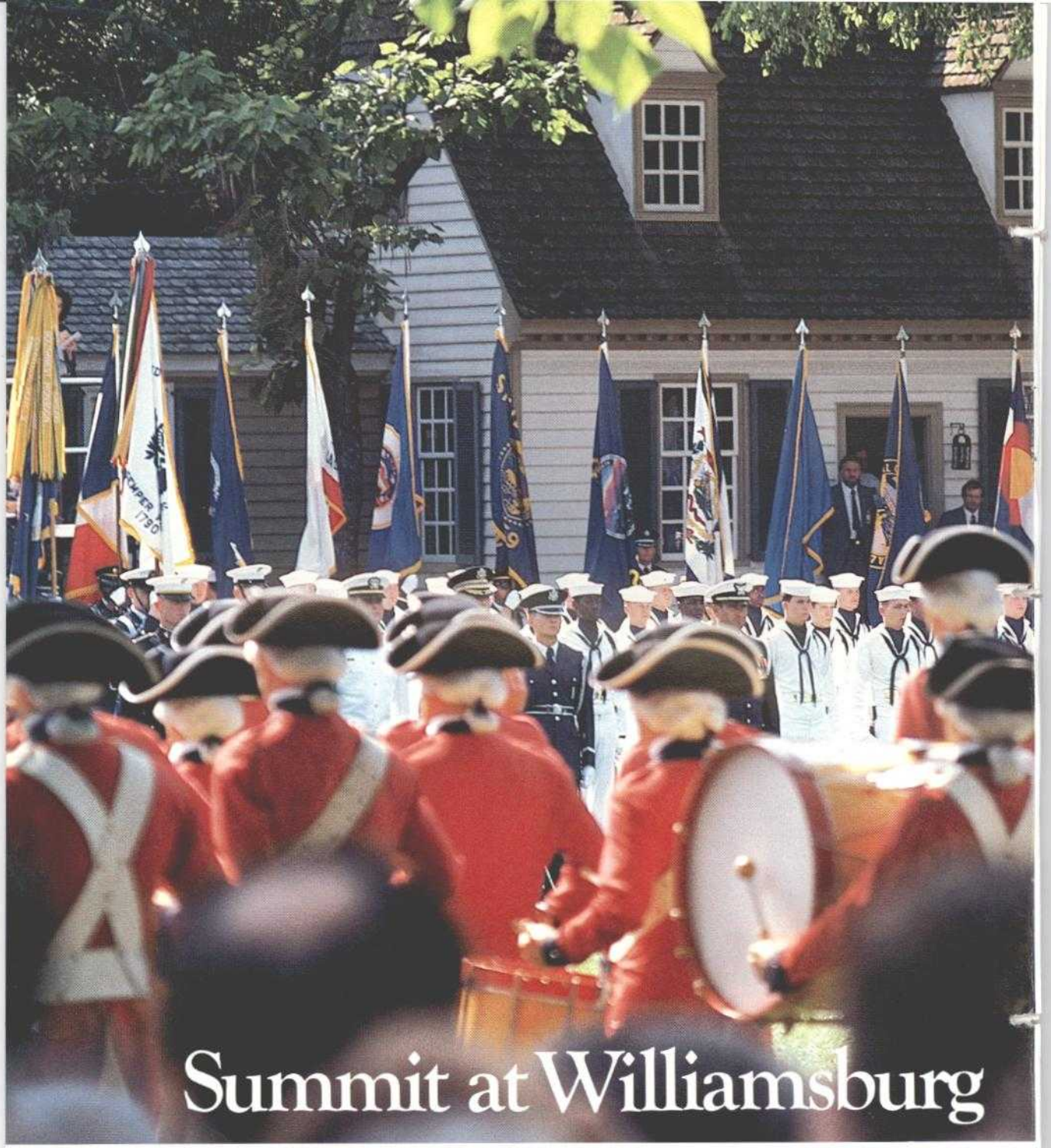
Comsat TeleSystems, Inc., has been selected to provide 32 Time-Division Multiple-Access (TDMA) terminals for the West German Telecommunications Satellite (DFS) Network. Under the terms of the three-year agreement, which is initially valued at $11 million, **TeleSystems** will provide two reference terminals and 30 traffic stations to Siemens AG of Munich, which is heading the consortium responsible for the coordination and construction of the DFS network. Included in the initial agreement is an order for TeleSystems digital echo cancellers.

The DFS network is being constructed primarily to augment telephone and data communication networks that are overseen by the Deutsche Bundespost. TDMA terminals were chosen for inclusion in the system to improve the efficiency and cost-effectiveness of network operations. **TeleSystems**' TDMA system will allow the German Bundespost to realize greater effective capacity from its satellite through the synchronized time-sharing of transponders. In addition, the terminals will provide voice, data and teleconferencing transmission capabilities. It is anticipated that the network will be operational in 1986, prior to the launch of the DFS satellite.

At the Top: Joseph V. Charyk & Irving Goldstein

In May, the Comsat Board of Directors elected Joseph V. Charyk Chairman and Chief Executive Officer and Irving Goldstein President. Dr. Charyk, above left, who as Chairman of the Board succeeds John Harper, became President shortly after Comsat's incorporation in 1963 and has had the title of President and Chief Executive Officer since January 1979.

Mr. Goldstein, above right, previously was Executive Vice President of the Corporation, a post he assumed in September of last year. Prior to that, he was President of Satellite Television Corporation (**STC**), a wholly owned subsidiary of **Comsat** that will introduce a satellite-to-home subscription television service in 1984. Mr. Goldstein's previous positions in a Comsat career going back to 1966 largely concerned the Corporation's jurisdictional **Intelsat** business.

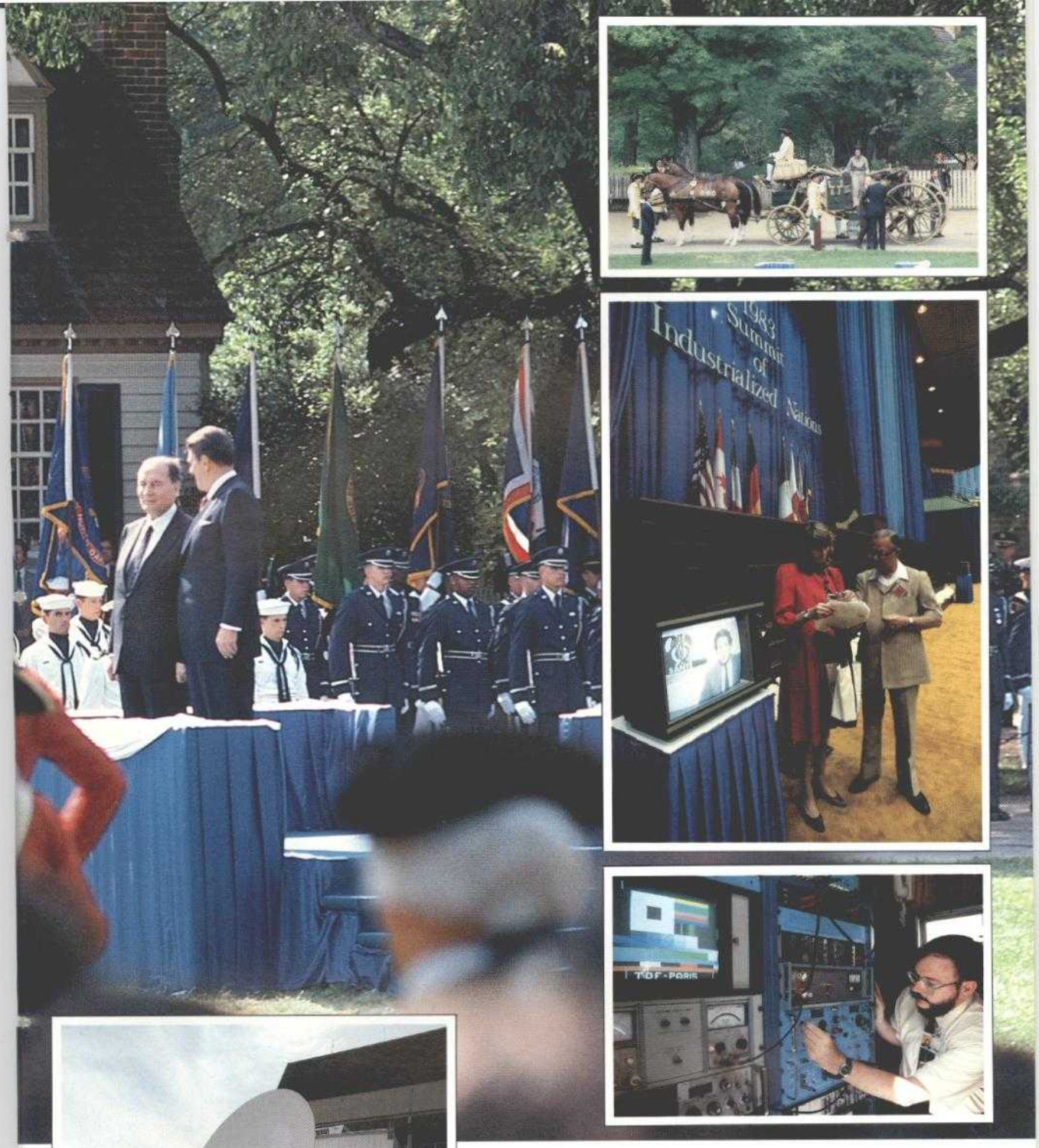


Summit at Williamsburg

History Is Made, and Comsat Is There

The 1983 Summit of Industrialized Nations, the ninth such economic summit, was held in Williamsburg in southern Virginia in late May, and for a while millions of eyes were focused on this living museum of American history.

Comsat also was at Williamsburg in order to provide television news feeds from their home countries to two of President Reagan's six principal guests —Prime Minister Margaret Thatcher of the U.K. and President Francois Mitterrand of France and their respective delegations. Using a transportable Ku-band earth station with 2.4-meter antenna, right, designed and built by **Comsat Laboratories**, the Comsat World Systems Division received the feeds via the 14/11 gigahertz system of the primary Intelsat V satellite over the Atlantic, then delivered them to the U.S. Information Agency (USIA), which han-



dled their recording and distribution.

Other photographs: Above Left, President Reagan and President Mitterrand at opening summit ceremonies. Above Right, President Reagan greets Prime Minister Pierre Trudeau of Canada. Above Middle, **Comsat**'s George Lawler describes television news feed system to French reporter. Below, Comsat Engineer Lester Veenstra fine tunes transmission from France.

Photography by ***William J. Megna***

The DOMESTIC/ INTERNATIONAL

New Universal Access Arrangements

by **Joel R. Alper**, *Executive Vice President, left, and* **George A. Lawler**, *Vice President, Comsat World Systems Division*

Building on its 20-year history of providing quality telecommunications services around the globe, **Comsat** with its earth station owner partners has recently developed an innovative approach known as the Universal Access Arrangements (UAA) to bring together domestic and international telecommunications facilities more effectively. Designed to meet the expanded interconnection requirements of the domestic U.S. communications industry, the UAA concept provides a comprehensive plan whereby authorized communications entities are able to locate their domestic satellite or terrestrial access facilities on or near the international earth station property of the Earth Station Ownership Consortium (ESOC), in which **Comsat** has a 50-percent stake, to link up with the international system.

The initial implementation phase for the Universal Access Arrangements calls for the development of 12 satellite antenna plats on ESOC property: four at Andover, two at Brewster, four at Etam, and two at Paumalu. Should a greater demand materialize, additional satellite plats will be developed at each site. Preparations will commence at each earth station as the first service request is received. Future plans call for development of UAA facilities at other U.S. ESOC international earth station locations and for terrestrial link accommodations as they develop.

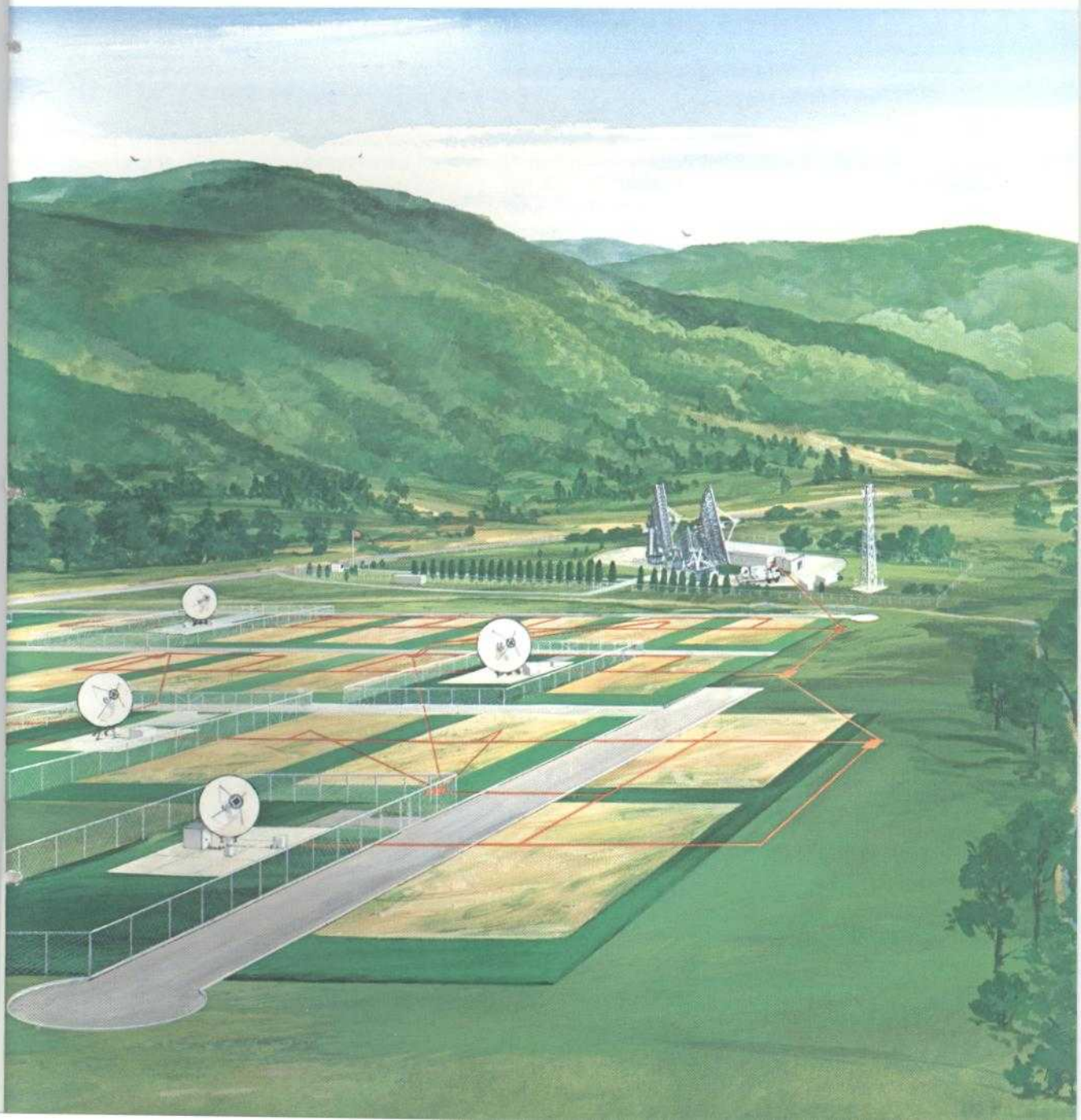
UAA arrangements are the culmination of a year of preparation, which began last March when the ESOC partners approved funding for a feasibility study by **Comsat**. The study examined areas of land at the U.S. international earth stations for domestic carriers to interconnect and extend their traffic to the international satellite system. The results

Rendering showing form Universal Access Arrangements would take at Etam, West Virginia, Earth Station. Existing Intelsat earth station is in rear, but a proposed transportable antenna has been drawn next to it. Facility in gray in left foreground also exists. Four dishes, foreground, and three microwave towers, left foreground, are all proposed.

LINK:

of the feasibility study demonstrated that land could be set aside at the Andover, Brewster, Etam, and Paumalu earth stations immediately for such purposes, without causing harmful interference to existing or future international satellite communication operations. The study also addressed frequency coordination and clearance procedures, although actual coordination procedures remain the responsibility of the entity requesting access. The study, however, did demonstrate that as long as proper consideration was given to frequency interference, a sufficient amount of land at the earth station could be cleared to accommodate all foreseeable users.

The UAA feasibility study was completed in January 1983, and on March 2, **Comsat**, on behalf of the Earth Station



Ownership Consortium, filed a letter with the Federal Communications Commission (FCC) detailing the proposed arrangements.

Considerable interest has already been expressed from various entities in utilizing UAA arrangements, and discussions are already under way with interested parties.

As indicated in the accompanying illustration, UAA customers are provided with a variety of options for locating their domestic communication facilities on ESOC property. For example, long-term service customers can meet their requirements through a five-year lease whereby a domestic satellite antenna facility would be constructed on the ESOC property; if users have short-term requirements for locating a transportable domestic antenna at the international earth station, lease arrangements are available for 30 days, with extensions in 30-day increments up to 90 days. If users desire, they can also locate domestic facilities near ESOC property. The user is then responsible for all the arrangements with nearby landowners and must enter into a right-of-way agreement with ESOC for connection from the nearby facility to the ESOC property. Additional options exist for users to locate terrestrial communications facilities either on or off the ESOC property. ESOC also will make available space in the international control building for linking amplification equipment for those users requiring it.

Etam, West Virginia, Earth Station as it basically looks today. Universal Access Arrangements facilities would be built on land behind the existing earth station.

The lease options provide access to ESOC property on a "nondiscriminatory, diverse, and flexible basis," as required by the Federal Communications Commission in August 1982. Steps have been taken to insure that the arrangements permit any qualified entity with domestic facilities desiring interconnection with international facilities to lease land on a first come, first served basis. In addition, all the domestic satellite system antenna plats have maximum visibility to the portion of the geostationary satellite arc used for U.S. domestic communications. Each specific mode of access is accommodated at a similar price, and terms and conditions of access are applied equally to all users. Diversity is achieved through the accommodation of all forms of access, and flexibility is provided through offering both full-time and short-term arrangements.

Typical charges for full-time satellite antenna plats are $14,000 per year plus a one-time charge of $20,000, with the user arranging separately for electric power services. For short-term users the sole charge will be a monthly fee of $2,725 plus power. The proposed charge for the terrestrial microwave facility and right-of-way leases is $6,000 per year. Space required in the international control building for additional equipment will be leased at an annual rate of $1,600 for specified floor space used for equipment, power and equipment maintenance. There is also a one-time charge of $3,000 for connection expenses.

The benefits of broadening the available interconnection arrangements at U.S. international earth stations are numerous, including greater flexibility in the provision of communications services to all authorized users. The attractiveness of the international satellite system also will be significantly enhanced by virtue of its ability to better accommodate users' desires and needs at lower costs. The location of domestic satellite and microwave facilities on or adjacent to ESOC property will reduce terrestrial interconnection costs to the international earth station facilities and meet the growing need for greater interconnection flexibility.

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20 Years of History, 20 Years of Accomplishments

Anniversaries are a time when looking backward is appropriate, even called for. Reviewing our past, we gain a richer appreciation of where we are today, why we are there and where we are going. Reviewing our past—casting attention on our rich legacy of accomplishments—we renew our confidence that we can indeed meet and best the large challenges ahead.

In the pages that follow, we look back upon **Comsat**'s past through the reminiscences of 11 people with strong connections to that past. Several of them are long-time employees of the Corporation, 20-year veterans who, excited by the promise of a fledgling organization with the boldest of missions, abandoned previous positions to take up residence at an estate called Tregaron in northwest Washington, D.C. Senator Edward M. Kennedy reminds us that it was his brother, President John F. Kennedy, who pushed for a commercially viable mechanism that would bring the benefits of satellite communications technology to the peoples of the world and who then happily signed the Communications Satellite Act of 1962, the offspring of that effort. Senator John O. Pastore, now retired, reminds us that it was he who managed the Act in its critical passage through the Senate. Bruce G. Sundlun, an original Incorporator and a member of the Board of Directors since the Board was first organized, gives us insight into how several key decisions were made that would shape the course of the infant organization.

All these reminiscences pertain to **Comsat**'s earliest days. In the center of the magazine, in one bold graphic foldout, we come to grips not just with the early events but the whole impressive array of milestones that are our first 20 years. Here all the launches, all the openings of earth stations, our numerous research and development achievements, our acquisitions and new business starts are set forth in context with major world events.

"What is past is prologue," Shakespeare has one of his charaters say in *The Tempest*. If all that we have already accomplished is merely the prologue for what lies ahead, then perhaps it will be understood if while trying to contemplate that future we fill for a moment with awe and wonder.

Stephen A. Saft

Comsat at 20

'Comsat, Model for International Understanding'

A statement by Senator Edward M. Kennedy

Twenty years ago, President Kennedy signed the Communications Satellite Act into law. It was a bill-signing ceremony he particularly enjoyed, because both he and then Attorney General Robert Kennedy had given their vigorous support to the legislation. I know that they would be pleased with how much has been accomplished and how much we have learned from the **Comsat** experience.

We have learned four important lessons from the example of **Comsat**, **Intelsat**, and **Inmarsat**. When the legislation was first proposed, **Comsat** was seen as an opportunity for the "joint efforts of private individuals and concerns, and agencies of the Federal government." The value of such public/private cooperation has become evident each time a satellite transmission brings television signals from across the globe into our homes, each time a ship at sea needs high quality communications. The device of the federally mandated private corporation utilizing a combination of public authority and technology along with private capital and expertise allowed a crucial synergism to emerge.

Second, through **Comsat**, we have learned anew the fundamental truth of the interdependence of the modern world. Information and technology transcend national borders and provide important building blocks for peace. **Comsat** through the **Intelsat** and **Inmarsat** experiences has been a model for international cooperation and understanding. It is a foundation for the future.

The example of **Comsat** also reminds us of the power of technology and the fundamental choice that humanity must make. Do we, as John Kennedy hoped, "advance the peaceful and productive use of space to accelerate the march of civilization"? Or, do we make space an arena for the arms race and accelerate the march to destruction?

Finally, **Comsat** reinforces the importance of daring and vision. When the Satellite Communications Act was signed, the law was still an untested dream. Today, there are 109 member countries in **Intelsat** and the market and demand for services is expanding. Satellites in the newest **Intelsat** V series, as well as some of the earlier series, are circling the earth providing the kind of instant communications once mentioned only in science fiction. We know now that when we reach boldly into the future, we can accomplish important things. All those who have been a part of this magnificent endeavor can take pride in their participation. "Together," President Kennedy said, "let us explore the stars and invoke the wonders of science instead of its terrors." **Comsat** has met the challenge of that last great frontier.

President John F. Kennedy signs the Communications Satellite Act of 1962 in a ceremony attended by sponsors and supporters. Senator John O. Pastore is in the foreground, third from right.

President Lyndon Johnson inaugurates commercial service via Early Bird by placing transatlantic telephone calls to leaders in London and Bonn.

'Milestone in The Field of Communications'

A statement by Retired Senator John O. Pastore

The creation of the Communications Satellite Corporation was a milestone in the field of communications.

As Chairman of the Sub-committee of the Senate on Communications, it was my responsibility and, indeed, my honor to chair the public hearings and later on to marshal the enactment of the legislation on the floor of the Senate.

For me, this was a labor of love since understanding through communications between peoples in this nuclear era is the only sure way to peace.

Peace is the yearning of all mankind regardless of language or culture, and I am proud on this 20th Anniversary to congratulate you on your success and to wish you a happy birthday.

'Fireworks' At First Incorporators Meeting

As remembered by Bruce G. Sundlun

Bruce G. Sundlun was appointed by President John F. Kennedy as one of the 13 original Incorporators of **Comsat**, *and he is today the senior Director on the Board of Directors. Mr. Sundlun is President and Chief Executive Officer of Outlet Company, a group broadcaster operating television and radio stations, which recently announced its proposed merger with Rockefeller Center, Inc. He also is Chairman of the Board of Executive Jet Aviation, Inc., and a director of Questech, Inc., and Worthington Industries, Inc.*

The first meeting of the Incorporators of the Communications Satellite Corporation (no one had thought of "**Comsat**" in those days) was held in Washington on October 22, 1962 in the American Red Cross building, because the new company had no offices, no employees, no money—nothing except an act of Congress and 13 Incorporators appointed by President John F. Kennedy.

When the Incorporators assembled, there were instant fireworks. Sidney Weinberg, the Senior Partner of Goldman Sachs & Co.—and a man who probably sat on more boards of directors than any other executive in the country—saw a stenotypist present and asked Phil Graham of the Washington Post and Chairman of the Incorporators, "What's he doing here?"

Phil replied, "Well, I thought we would like to have a record of the Board's deliberations."

Sidney said, "A stenotypist will inhibit the Board's deliberations or cause people to posture for the record. Either he goes or I do."

The stenotypist left.

Then Graham proposed the creation of an Executive Committee, but was shot down before he could even announce names on the ground that all Incorporators were appointed with equal authority and status and an Executive Committee would reduce some to "second-class status." A precedent was set, and ever since **Comsat** has not had an Executive Committee (although the Finance Committee was probably created as a substitute).

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Another precedent was set when James Dingman, Vice Chairman of AT&T, was asked directly whether the telephone company was going to support **Comsat**, pay it lip-service, or try to squelch it. Dingman replied strongly that the Bell companies would support **Comsat** in every way possible. History shows that AT&T was greatly responsible for getting **Comsat** started successfully. When the Europeans with vested

"Dingman replied strongly that the Bell companies would support Comsat in every way possible."

interests in cable hesitated to support the new satellite venture, Dingman and Frederick Kappel, AT&T Chairman, went to Karlsruhe, Germany, with Leo Welch, **Comsat**'s first Chairman, and told the Europeans bluntly that if they did not join **Intelsat**, **Comsat** had the resources to go it alone, and they would be left out. The Europeans came in.

The early days were hectic. At Senate confirmation, I testified for the Incorporators and really upset the Senators by saying **Comsat** might involve itself in businesses other than its jurisdictional charter. With today's plethora of ventures, I clearly underestimated the possibilities.

We needed money, so overnight David Kennedy of Continental Bank, an Incorporator, raised $5 million, and Byrne

'Leo did a great job at what he did know, negotiating with other countries for the Intelsat agreement. . ."

Litschgi and I, the two youngest present, were pointedly asked to sign the note.

Leo Welch, our first Chairman, had just retired as Chairman of Standard Oil when he was asked to take the Comsat job. He knew nothing about telecommunications or Washington and was asked why he was interested. An austere man, he glared and said, "Because I have a young wife, and she's not ready to retire yet." Leo did a great job at what he did know, negotiating with other countries for the Intelsat agreement and floating the company's first stock issue.

Later, after Jim McCormack retired as Chairman, Leo wanted to come back, but George Meany, President of the AFL-CIO, headed that off by arranging to speak first and so strongly in favor of Joe McConnell that there was no opportunity for any other nomination. Meany and Fred Donner, Chairman of General Motors, used to arrive at board meetings early so they could confer about their joint nemesis, Walter Reuther of the UAW.

The Comsat Board in over 20 years has had only two sharply divided votes. Merrill Lynch, Pierce, Fenner & Smith was chosen as lead underwriter of the first stock issue by only one vote, because the statute required "widest possible distribution" of the stock, and Merrill Lynch was the biggest retail house. Continental Bank was chosen as the first transfer agent despite being located in Chicago, because David Kennedy, the Bank's Chairman and an Incorporator, had raised the first $5 million overnight.

Probably the most important decision the Board ever made was to raise $200 million, all that was needed for the first Intelsat system, instead of just $10 million as some Incorporators advised. The company was overcapitalized, but that extra cash has helped ever since.

Starting Intelsat, The First Negotiations

As remembered by John A. Johnson

In the article that follows, John A. Johnson describes the leading role that **Comsat** *played in the formation of* **Intelsat**, *the 109-member-nation organization that manages the global satellite communications system which now consists of almost 500 antennas at more than 400 earth stations in more than 150 countries and territories. The article is derived from a tape-recorded conversation that Mr. Johnson had with Stephen A. Saft, Editor of* **Comsat Magazine**, *in April and covers in some depth his first year as a Comsat employee, the period 1963-1964, during which he personally played a role in negotiating with the representatives of scores of nations the Interim Agreements that would result in establishment of the international organization that would become known as* **Intelsat**. *During his long career with* **Comsat**, *a career that ended officially with his retirement in 1981, Mr. Johnson served in a number of key capacities, including as Chairman and Chief Executive Officer of Comsat General Corporation and as Chairman of Satellite Television Corporation. For several years, he was a member of the Comsat Board of Directors. Throughout the 1960s, he served either as Chairman or Vice Chairman of the Interim Communications Satellite Committee (ICSC), the temporary governing body for* **Intelsat** *that ceased operation in 1971 upon ratification of the organization's Definitive Arrangements.*

The Definitive Arrangements for Intelsat are signed on August 20, 1971, by Comsat's Dr. Joseph V. Charyk, left, and Secretary of State William P. Rogers.

I came to **Comsat** early in December of 1963 from NASA where I had been General Counsel since its organization in October 1958. Previously, I had been General Counsel of the Department of the Air Force. After being with **Comsat** some four months or so—I think in April of 1964—I became Vice President, International.

My job, as I saw it, was to help create the international organizational mechanism which would enable **Comsat** to carry out its statutory mission to be the U.S. participant in the establishment and operation of a global commercial communications satellite system. Of course, that necessarily involved multilateral arrangements with a great number of foreign telecommunications entities. Because of the nature of the obligations involved, and also because of the fact that most foreign telecommunications entities are government agencies or government-owned corporations, rather than private companies, it was necessary to deal with the political arms of those governments as well as with the telecommunications organizations themselves. In many cases, the foreign ministries and the ministries concerned with science and technology were very sensitive about anything related to space technology.

In 1963 and 1964 the greatest skepticism about **Comsat**'s prospects related to the international environment. By that time, there was reasonable confidence in the technology that was proposed, although we still had to make some key technical decisions such as the choice between putting satellites in geosynchronous orbit or in lower orbit.

As for the international organizational requirements of what **Comsat** was mandated to do, nothing of the kind had ever

Meeting of the Interim Communications Satellite Committee (ICSC) of Intelsat on September 29, 1964. John A. Johnson is man in the center, seated.

been attempted before, and there were a lot of doubts and worries as to whether it could be accomplished, or whether it could be done in time, and whether the resulting arrangements would be so burdensome or so unwieldy that **Comsat** could not function effectively.

A lot of the skepticism arose out of a perception of the number of unique problems and challenges that would have to be overcome to bring the Intelsat concept into being. In the first place, **Comsat** was a private company established with private capital and in every sense a private entity, even though its creation was due to an Act of Congress, whereas in most cases the entities abroad with whom we would be trying to reach agreement were of a governmental nature.

Fortunately, there was at least some precedent for what we were trying to do in the case of the transoceanic cables where U.S. private companies—AT&T, ITT, RCA, and Western Union International—had concluded international agreements with foreign telecommunication entities for the joint ownership and operation of international transmission facilities. Satellites, however, had a political aspect to them at that time, which cables had never had. It was 1963, only some six years since the first Sputnik had been launched. The Europeans were hoping rather desperately to do something significant in space, but they hadn't done it yet. To many, the technology appeared to be the focus of a great power rivalry between the United States and the Soviet Union. Also, in establishing a global satellite system, it would be necessary to have many more countries involved than had been the case in any cable arrangement. In addition, the less developed countries, for whom satellites showed so much promise, had not been involved in cable arrangements. The Intelsat negotiations would be the first opportunity for them to become involved in multilateral arrangements for the joint ownership and operation of an advanced technological means of transmission.

From the standpoint of my own experience, the first significant international meeting took place in Karlsruhe, Germany in December 1963, very shortly after I came to the company. It was a meeting of what was called the European C.E.P.T., the European Conference of Post and Telecommunications Administrations. This was the organization that endeavored to coordinate and develop cooperative arrangements among the telecommunications administrations of the member countries of Europe.

Before this meeting, the European attitude had been very cautious and rather negative toward the U.S. desire to move rapidly in the establishment of a global communications satellite system. Nevertheless, they were intensely interested in what **Comsat** proposed to do, and they invited us, AT&T and the Canadians to the meeting in Karlsruhe to discuss the subject.

In the course of that meeting, we were able to make it very clear to the Europeans that we were going ahead with the construction of the first commercial communications satellite—Early Bird, which was to become Intelsat I—and that we were doing this without awaiting any further progress in the actual conclusion of international agreements. A forthright and unequivocal statement by the AT&T representative at the meeting, James E. Dingman, who was AT&T's Vice Chairman at the time, of AT&T's support of our venture and their intention to make use of satellite communications was very significant in conveying a sense of seriousness and urgency to all the PTT administrations of Europe.

In response to the meeting in Karlsruhe, the Europeans organized a series of conferences, most of which were held in Europe at their invitation over a period of several months beginning in February 1964.

The next important meeting that I regard as critical in bringing **Intelsat** into being took place in Tokyo early in 1964.

That meeting was at the invitation of the Japanese, who also invited the Australians to be present. We went to Japan knowing that serious negotiations with the Europeans would shortly ensue. Japan and Australia were at this point the only two countries having major interests in cable ownership that had not been represented at the meeting in Europe. (The Canadians, who had been present, had already expressed their basic agreement with what we had in mind.) There were three of us from the United States at that first meeting in Japan—Gilbert Carter, who represented the State Department, Edward Istvan, who was then a member of the Comsat technical staff, and myself. In addition, we had strong support from the U.S. Embassy in Japan.

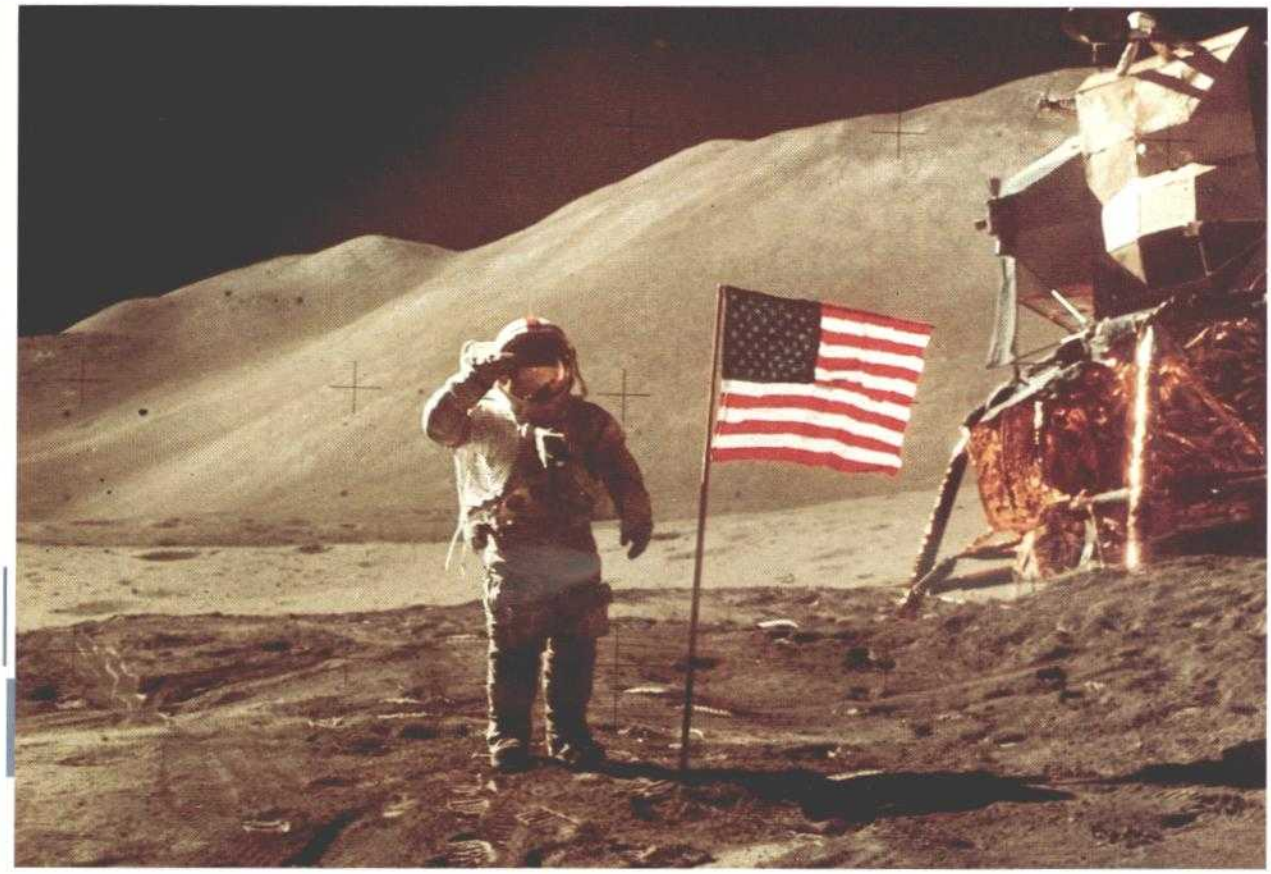
It proved to be a very interesting week. Every morning we spent three or four hours with the Japanese, and this was not only with representatives of KDD, the international telecommunications company, which eventually became our counterpart in **Intelsat** from Japan, but also with representatives from various government ministries such as the Ministry of Communications and the Foreign Ministry.

Every afternoon we spent with the Australians, often well into the evenings. They were very full days.

At the end of that week both Japan and Australia indicated that they would like to participate actively in the negotiations. My recollection is that when we came back to Washington we had to insist rather firmly to the Europeans that we felt that the presence of the Australians and Japanese was indispensable. The Europeans then proceeded to extend an invitation to both countries along with Canada to participate in the conferences.

To us that was very important. The Europeans had decided to caucus among themselves on every issue and to negotiate

Map shows the approximate positions of Early Bird and the seven earth stations located in the United States, Canada, the United Kingdom, France, West Germany, Italy and Spain that, on a rotational basis, worked with the satellite.



Television coverage of the Apollo 11 mission to the moon was seen throughout the world "live via satellite."

on the basis of a single position, at least so far as their formal statements were concerned. That was difficult for us to contend with. We knew there were differences within the group, but they had numerous spokesmen who would reiterate their positions in the course of the negotiations. Ambassador Ortona, later the Italian Ambassador to the United States—at that time a senior official in the Italian Foreign Ministry—was the Chairman of the European Delegation from beginning to end and was their principal spokesman, but they had many other spokesmen along with him.

Fortunately, because of certain natural interests in common and also because of the groundwork that had been prudently established ahead of time, we were able to reach wide areas of agreement at the very outset with the Japanese, the Australians, and the Canadians. Hence, while we were outnumbered by the Europeans, we were not without allies, and very important allies. That was very significant because on many issues we had some very serious differences of opinion with Europe.

The common ground we found with the Canadians, Japanese and Australians for our positions during the 1964 negotiations provided a pattern for the relationship we were soon to enjoy with many of the less developed nations as they became involved in **Intelsat** soon after the signing of the Interim Agreements. On every significant and really tough confrontational issue with Western Europe—and that's where all the confrontation was in those days and right on through to the Definitive Arrangements negotiations in 1969 and 1970—we had the overwhelming support of the developing countries.

During the course of our negotiations in Europe, it was deemed desirable to make a serious effort to invite the Soviet Union to join the discussions. Several invitations had previously been extended, but there had been no affirmative response. In the spring of 1964, we were authorized by all the other participants in the negotiations to invite the Soviet Union to have bilateral discussions with us. They accepted, and we agreed to meet in Geneva in April or May of that year. Leo Welch, then the Chairman of **Comsat**, Mr. Istvan, and I represented **Comsat**. We had with us Mr. Henry, then the Chairman

of the Federal Communications Commission, and, I believe, Mr. Chayes, the Legal Advisor of the State Department, and members of their staffs. The Soviet delegation was headed by Dr. Blagonravov who held a high position in the scientific community in the Soviet Union. He was then a man in his 70s and had been the principal representative in some of the bilateral negotiations with NASA on U.S./Soviet cooperative agreements on space activities which had occurred during the period when I had been with NASA. With him were two or three assistants, primarily technical experts.

For two or three days, we briefed the Russians in detail on the Early Bird satellite program and on all the features of the international arrangements as they appeared to be emerging from our negotiations in Europe. The Russians were not at all forthcoming. They didn't give us any useful information about what they intended to do or about any significant aspect of their own program. At the end of the session, Dr. Blagonravov, who was a very courtly gentleman, read a harsh statement which had obviously been produced in Moscow and which had little relevance to our presentations. In summary, he said that the whole effort was premature, the implication being that the technology was not yet ready for application to a global system. In addition, he blasted our plans as being a means of extending a capitalistic imperialism and monopoly around the world. Then he put aside the document from which he was reading and, changing his tone entirely, he expressed in very gracious words his appreciation for all they had heard and said he hoped that at some future time we could renew the experience.

One of the things that I remember very clearly was Mr. Welch's response. Mr. Welch had been the Chairman of what was then Standard Oil of New Jersey, now Exxon Corporation, and had, therefore, a background that you might say would mark him in Soviet eyes as a rather exceptional person. Mr. Welch in his reply began with these words: "Dr. Blagonravov," he said, "I see that you and I approach this subject from somewhat different backgrounds." The contrast needed no further emphasis.

We came back and reported what had transpired to the Europeans, and they then accepted the fact that it was not useful to pursue the possibility of Russian participation any further. We went on then toward conclusion of the negotiations.

Originally the U.S. investment quota, held by **Comsat**, was 61 percent, and the quotas of all of the original European participants totalled 30½ percent, exactly half of ours. That arrangement emerged from prolonged discussions, but finally was wrapped up in a meeting in Mr. Welch's suite in the Westbury Hotel in London. It ended at one or two o'clock in the morning toward the end of the last conference in Europe, and a group of the most senior members of the European delegations participated.

The accord left a quota of 8½ percent remaining for Canada, Japan, and Australia. The Europeans met among themselves to divide their total of 30½ percent quota among 15 participants, and Canada, Australia and Japan reached an agreement among themselves as to how to divide the 8½ percent. That was the last major issue to be settled.

The Interim Agreements creating **Intelsat** were signed in Washington on August 20, 1964. They were then opened to other countries for accession.

Only a few weeks elapsed when Israel informed us that they wished to accede to the agreements. The State Department put out a press release announcing that Israel had signed the agreements, and within 24 hours I had a call from the Washington office of the League of Arab States. They wanted to know what this new organization was all about. And so we had some very interesting meetings with representatives of that office and a number of Arab nations with the result that the entire group of Arab states very quickly came into **Intelsat**, bringing its members to over 30.

We're now talking about the early fall of 1964 and the very earliest day of **Intelsat's** existence. At that time, we at **Comsat** had

made a decision jointly with the Department of State to make our initial effort toward the global expansion of **Intelsat** among the countries of Latin America. This was a natural choice as Latin America had the most far reaching and long established telecommunications ties with the United States. There were even plans at that time by certain companies to loop cables along the east and west coasts of South America linking one country to another, a project which never came to fruition thanks to satellite communications. ITT, RCA, Western Union International and Tropical Radio were all active in Latin America and were providing international service by means of high-frequency radio circuits. In those pre-satellite days, many calls from one Latin American nation to another had to be relayed through the United States.

Fortunately, we came away from the very first country in the region we visited —Brazil—with a letter from the governmental authorities expressing their intention to accede to the Intelsat Agreement and requesting an initial investment quota large enough to assure Brazil a seat on the Interim Communications Satellite Committee (ICSC), the governing body of **Intelsat**.

We went from Rio de Janeiro, where the meetings with the Brazilians had been held, down to Buenos Aires. For the first two or three days of those meetings, we didn't seem to be getting anywhere. Finally, after we revealed to the Argentinians that we were carrying to Washington a letter from Brazil, things moved very rapidly.

When we came back to the United States after that trip, we had in our possession letters from the two largest countries in South America expressing their intention to join **Intelsat** and requesting quotas. Support for **Intelsat** developed rapidly throughout Latin America from that point onward. We continue to have a close, cooperative relationship with all of the countries in that region.

From such beginnings as those I have described, **Intelsat** has gone on to become a huge success on every score—financial, political, and technical. The organization has met and is continuing to meet its goal of improving the ability of diverse peoples to communicate regardless of distance and terrestrial barriers. In doing so, it is contributing mightily to the interdependence of the world's peoples and thus is enhancing the prospects of world order and world peace.

Starting Intelsat, The Financial Perspective

As remembered by Carl J. Reber

Senior Vice President
Communications Satellite Corporation

When word came to Tregaron that the Interim Communications Satellite Agreements had been initialed and would be opened for signature, planning for **Comsat**'s role as manager of the international system's financial activities went into high gear. In July 1964, Lew Meyer, who was in charge of **Comsat**'s financial functions, asked me to work on procedures for allocating space segment costs, billing partners, and setting up other financial arrangements required by the Agreements.

There were no precedents for financing a partnership of this magnitude and complexity. Not only would continual payments be necessary from each Signatory to enable partnership obligations to be met as they became due, but also the number of signatories and their ownership percentages were expected to change frequently with new accessions.

The first task was to identify the costs accumulated during the previous year and a half which could be allocated to the space segment. I worked with Fred Meade and Bill Callaway to identify direct costs, and then Lew and I made judgments with respect to allocation of the joint staff and support costs between the space and earth segments.

Another early task was to develop procedures for monthly billing and payments and for adjusting ownership shares with each new accession. In order not to penalize the current signatories, the calculation for each new signatory had to be retroactive to the beginning and include a share of earlier losses as well as interest due to the other partners.

Even a simple matter like establishing the date a payment was made proved to be troublesome. Some signatories felt that payment was made on the date they instructed their banks to transfer funds. But administrative procedures in some banking

systems were very slow, and we received some of the transfers weeks later. After several months of trying to make that work, we gave up tracing individual payments and went to the normal commercial practice of using the date on which we or our banks received usable funds.

A big job that first summer involved working with Bill Berman and Marty Votaw on the NASA contract for launch of Early Bird. It was NASA's first contract under which they provided a commercial launch. The negotiations were lengthy because there was much adaptation required on both sides.

A very difficult early problem was establishment of the management fee to be paid by **Intelsat** to **Comsat**. The Operating Agreement provided for appropriate compensation to **Comsat** for its services as manager. Since direct and allocated indirect costs were being reimbursed, there was some argument whether there should be a separate management fee. On the grounds that **Comsat** had certain costs as a publicly owned Corporation that were not being shared, as well as costs and liabilities associated with building an expanded staff and facilities, a fee of $150,000 per year was established by the Interim Committee.

Early in 1965, establishment of the utilization charge for Early Bird became a very active subject. Essential factors such as future program assumptions, projections of circuit leases, provision for launch failures, depreciation periods, treatment of spare satellites, rate of return, and the period over which costs would be averaged were discussed at length by the Comsat Finance staff and the Advisory Subcommittee on Finance. With heavy reliance on advice from the Technical staff, the financial parameters were finally worked out and the Interim Committee made the decision—$32,000 per half circuit per year. (The charge per half circuit today is only $4,680.)

Every day there were new challenges and new aspects to consider in establishing this unique business. It is difficult now to describe the excitement engendered in everyone concerned with the venture. The Manager's (**Comsat**'s) financial staff made recommendations which were then reviewed and, in some cases, modified by the Interim Committee's Advisory Subcommittee on Finance. That group, chaired by Reg Westlake from the United Kingdom, included key financial managers from the major telecommunications entities around the world. Because financial practices varied significantly from country to country, there were lengthy discussions and a lot of accommodation. It was hard work, but it was

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The signers of the agreement creating the International Telecommunications Satellite Organization (Intelsat). Comsat's Leo D. Welch is fifth from right.

2/20/62 John H. Glenn, Jr. first American to orbit earth.

7/26/63 First successful synchronous communications satellite launched (Syncom II).

11/22/63 President John F. Kennedy fatally wounded by an assassin in Dallas, Texas.

6/29 Civil Rights Bill banning discrimination in voting, jobs, public accommodations, etc., passed.

8/7 U.S. Congress passes Tonkin Resolution authorizing Presidential action in Vietnam.

3/23 First U.S. 2-man Flight (Grissom & Young).

11/9 & 11/10 Massive electric power failure in northeastern U.S.

3/16 First docking of 2 orbiting spacecraft—Gemini 8 with Agena target rocket.

6/23 President Johnson and Soviet Premier Aleksei Kosygin meet at Glassboro State College in N.J.

December Protests mounting against Vietnam War.

4/4 Martin Luther King, Jr. is assassinated.

6/5 Assassination of Sen. Robert F. Kennedy.

1/20 Inauguration of Richard M. Nixon as President of U.S.

7/20 Neil Armstrong becomes first man to set foot on moon.

5/4 Four Kent State University students killed during Vietnam War protest.

8/12 Independent U.S. Postal Service created.

Comsat at 20

Two decades of Accomplishments

1962

8/31 Communications Satellite Act of 1962 signed by President John F. Kennedy.

10/22 Board of Incorporators, nominated by President Kennedy, holds first meeting.

1963

2/1 Comsat incorporated in the District of Columbia.

2/15 Comsat leases Tregaron—first headquarters.

2/28 $5 million line of credit approved by FCC.

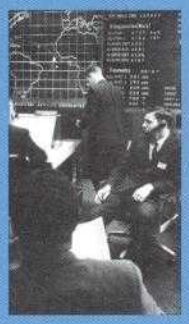
3/10 Leo D. Welch elected Chairman and Chief Executive Officer; Dr. Joseph V. Charyk elected President.

4/16 First "Early Bird" or Intelsat I hardware contract awarded to Hughes Aircraft Company.

6/2 Initial stock offering of 10 million shares oversubscribed first day.

8/20 Intelsat is created, and Comsat is designated Manager.

9/8 Comsat (CQ) listed on New York, Midwest, Pacific Coast Stock Exchanges.



9/17 First annual meeting of shareholders.

9/29 First meeting of Intelsat's Interim Communications Satellite Committee (ICSC) held, 15 countries represented.

10/10 Comsat coordinates arrangements for televising the 1964 Olympic Games from Tokyo.

11/18 Headquarters moved to office building at 1900 L Street, N.W., technical staff and satellite control center located in office building at 2100 L Street, N.W.

4/6 World's first commercial communications satellite, "Early Bird," is launched.

5/2 Early Bird transmits inaugural two-way telecast between United States and Europe, introducing the phrase "Live via Satellite."

5/12 FCC awards Comsat full ownership of 3 U.S. earth stations (Andover, Maine; Paumalu, Hawaii; Brewster, Washington).

6/18 Early Bird is used for first time to restore service during a transatlantic submarine cable outage.

6/27 Comsat establishes first tariff.

6/28 Early Bird begins operation. Andover earth station enters commerical service in Atlantic.

11/14 Ground broken for the Brewster earth station.

11/15 Hughes Aircraft receives contract for Intelsat II satellites.

12/1 James McCormack succeeds Leo D. Welch as Chairman and Chief Executive Officer.

12/27 Ground broken for Paumalu earth station.

6/23 FCC issues "authorized user" ruling.

6/23 TRW Systems, Inc., receives contract for six Intelsat III satellites.

8/1 Comsat proposes satellites and earth stations for domestic U.S. service.

8/3 First successful demonstration of Time-Divison Multiple-Access (TDMA) through Early Bird.

10/26 First Intelsat II satellite is launched but fails to achieve synchronous orbit.

12/3 Paumalu Tracking, Telemetry and Command (TT&C) station enters service.

12/7 FCC authorizes Comsat to build, operate 3 additional U.S. earth stations (Etam, Cayey and Jamesburg). Comsat ownership interest in U.S. earth stations reduced to 50 percent.

12/8 Paumalu and Brewster earth stations enter commercial service.

1/11 2nd Intelsat II satellite is successfully launched, providing first full-time service over Pacific.

1/26 Commercial satellite service is inaugurated in Pacific area linking United States and Japan, followed by Thailand and the Philippines.

3/22 3rd Intelsat II is successfully launched.

3/23 Earth Station Ownership Committee (ESOC) is formed.

4/4 Corporation registers "COMSAT" as its service mark with U.S. Patent Office.

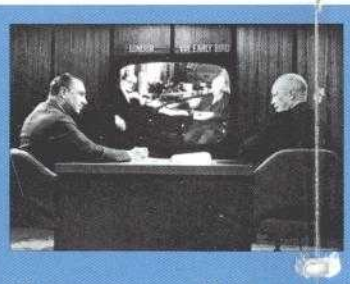
4/4 Comsat reduces transatlantic telephone and television rates.

9/20 Construction contract for new earth station at Cayey, Puerto Rico, followed by contracts for stations at Etam, W.Va., and Jamesburg, Calif., awarded.

9/27 4th Intelsat II is successfully launched.

12/18 Construction contract signed for Comsat Laboratories in Clarksburg, Maryland.

12/31 Comsat realizes net operating profit for first time.



6/3 Headquarters moved to 950 L'Enfant Plaza, S.W., Washington, D.C.

9/18 First of Intelsat III series destroyed in launch failure.

9/27 Etam earth station is dedicated.

10/18 Contract is awarded on behalf of Intelsat to Hughes Aircraft for 4 Intelsat IV satellites.

12/1 Jamesburg earth station enters commercial service.

12/1 Completion of a second large (97-foot diameter) antenna at the Paumalu, Hawaii, station makes Paumalu the largest earth station in the world.

12/18 2nd Intelsat III is successfully launched.

1/6 Etam earth station enters commercial operation.

1/25 Cayey earth station is dedicated and enters commercial service.

2/5 3rd Intelsat III is successfully launched.

4/25 Jamesburg earth station is dedicated.

5/21 4th Intelsat III is successfully launched.

7/1 Full global coverage is established when an Intelsat III satellite over the Indian Ocean begins commercial service.

7/25 5th Intelsat III is launched but fails to achieve orbit.

9/8 Comsat Laboratories opened in Clarksburg.

11/2 Pulantat, Guam, earth station enters commercial operation.

1/14 6th Intelsat III is successfully launched.

4/14 John A. Johnson is elected Chairman of the Interim Communications Satellite Committee of Intelsat.

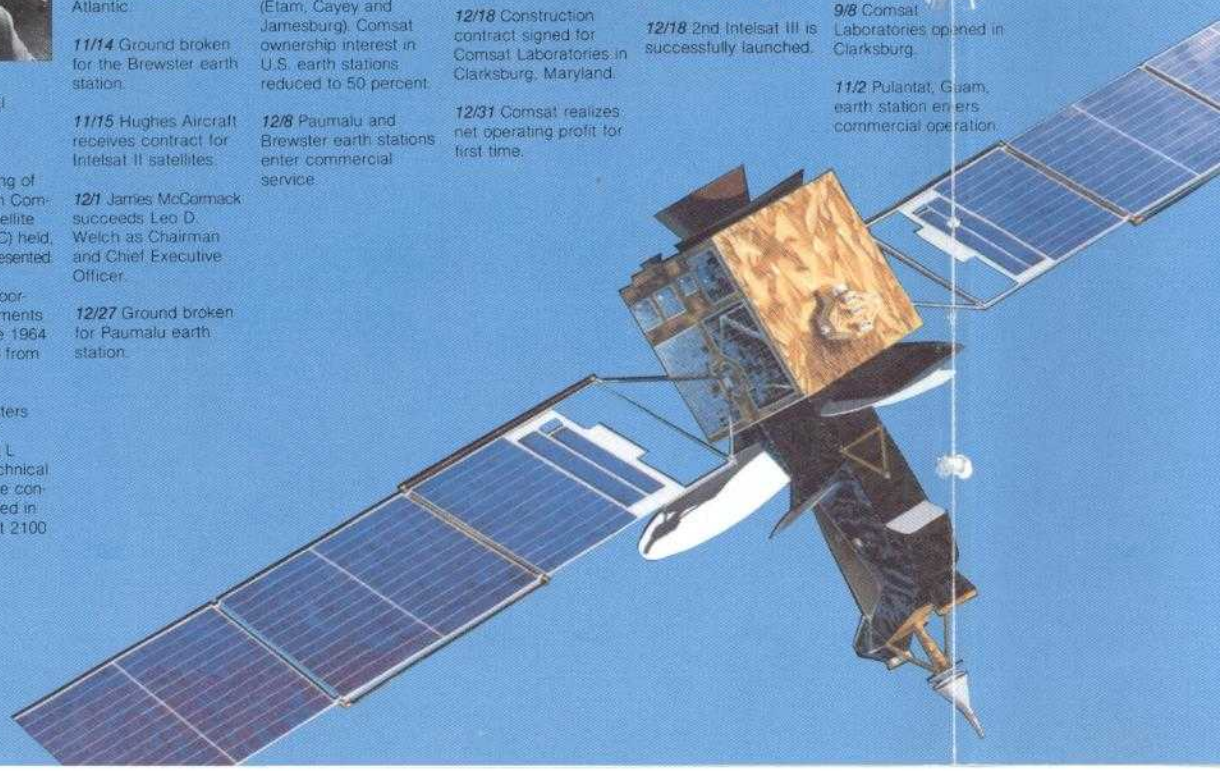
4/22 7th Intelsat III is successfully launched.

5/12 Joseph H. McConnell succeeds James McCormack as Chairman.

7/1 Bartlett earth station at Talkeetna, Alaska, enters commercial service, working with the Pacific Intelsat satellites.

7/23 8th Intelsat III is launched but fails to achieve orbit.

10/16 Board of Directors declares first dividend of 12-1/2 cents per share.



1969 1970 1971 1972 1973 1974 1975 1976

Luther King, assinated.

sination of t F. Kennedy.

1/20 Inauguration of Richard M. Nixon as President of U.S.

7/20 Neil Armstrong becomes first man to set foot on moon.

5/4 Four Kent State University students killed during Vietnam War protest.

8/12 Independent U.S. Postal Service created.

6/17 U.S., Japan sign treaty for return of Okinawa to Japan.

6/30 States ratify lowering the voting age to 18.

2/20 President Nixon first U.S. President to visit China; on May 22, first to visit Russia.

5/15 Alabama Governor George C. Wallace is seriously wounded at Laurel, Maryland.

1/22 Lyndon B. Johnson dies.

10/12 V.P. Agnew resigns and Gerald R. Ford is nominated by President Nixon to replace him.

10/19 Oil Embargo

5/9 Impeachment hearings against Nixon are opened.

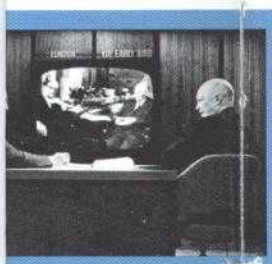
8/9 President Nixon resigns and Gerald R. Ford becomes President.

1/1 Nixon's top aides found guilty of Watergate cover up.

7/15 Apollo-Soyuz mission.

7/4 200th Annive of U.S. celebrate

7/21 Legionnaire disease kills 29 i Philadelphia.



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Intelsat III is lly launched.

1/6 Etam earth station enters commercial operation.

1/25 Cayey earth station is dedicated and enters commercial service.

2/5 3rd Intelsat III is successfully launched.

4/25 Jamesburg earth station is dedicated.

5/21 4th Intelsat III is successfully launched.

7/1 Full global coverage is established when an Intelsat III satellite over the Indian Ocean begins commercial service.

7/25 5th Intelsat III is launched but fails to achieve orbit.

9/8 Comsat Laboratories opened in Clarksburg.

11/2 Pulantat, Guam, earth station enters commercial operation.

1/14 6th Intelsat III is successfully launched.

4/14 John A. Johnson is elected Chairman of the Interim Communications Satellite Committee of Intelsat.

4/22 7th Intelsat III is successfully launched.

5/12 Joseph H. McConnell succeeds James McCormack as Chairman.

7/1 Bartlett earth station at Talkeetna, Alaska, enters commercial service, working with the Pacific Intelsat satellites.

7/23 8th Intelsat III is launched but fails to achieve orbit.

10/16 Board of Directors declares first dividend of 12-1/2 cents per share.

1/25 First satellite of the Intelsat IV series is successfully launched for service over the Atlantic Ocean.

4/8 First satellite message to go directly from Hawaii to the East Coast of the United States is received by a 10-foot experimental antenna at the Comsat Labs.

8/6 Comsat and Government of Nicaragua form Nicatelsat as joint venture.

8/20 Intelsat Definitive Arrangements are opened for signature in Washington, D.C.

12/3 During inauguration of the Tanum, Sweden, earth station, first picture telephone communications via satellite takes place.

12/19 2nd Intelsat IV is successfully launched.

1/8 A small, unmanned Comsat earth station at McMurdo Sound, Antarctica, begins transmission of geophysical data to the United States via Pacific Intelsat satellite.

1/15 New standard antenna goes into service at Andover replacing radome-covered horn antenna.

1/22 3rd Intelsat IV is successfully launched.

5/15 Comsat and the Cunard Line complete two-month experiment which successfully demonstrates satellite communications between ship and shore.

6/13 4th Intelsat IV is successfully launched.

12/22 FCC approves Comsat's proposed domestic systems. Three years later Satellite Business Systems (SBS) is born.

1/9 Comsat General Corp. is established as wholly owned subsidiary of Comsat headed by John A. Johnson as President.

2/1 Comsat Laboratories installs antenna aboard the hospital ship S.S. Hope, to exchange diagnostic data via satellite in port at Brazil with NIH in Bethesda, Maryland.

2/12 Definitive Arrangements for Intelsat enter into force superseding the Interim Arrangements of 1964 which established Intelsat as consortium of countries.

4/27 Contract awarded to Hughes Aircraft for Intelsat IV-A's.

5/15 John D. Harper is elected to Comsat Board of Directors, succeeding James McCormack.

8/23 5th Intelsat IV is successfully launched.

9/14 Comsat General awards contract to Hughes Aircraft for 4 Comstars.

11/28 Comsat General awards a contract to Philco-Ford Corporation for construction of earth stations at Southbury, Connecticut, and Santa Paula, California.

12/19 Bartlett earth station in Alaska sold to RCA Alaska Communications, Inc.

1/21 SPADE, the first international digital voice communications service, is introduced.

5/30 Comsat General awards contract to Scientific Atlanta, Inc., for four-foot diameter antennas to equip ships for Marisat service.

9/5 Comsat General selected to participate with ESA and the Government of Canada in providing the space segment for the Aerosat Program.

10/10 Comsat General acquires 40 percent ownership interest in Panama's Intercomsa.

11/21 6th Intelsat IV is successfully launched.

12/24 Intelsat Direct Communications Link (satellite "Hot Line") between Moscow and Washington, D.C. is activated.

2/20 7th Intelsat IV is launched but fails to achieve orbit.

5/22 8th and final Intelsat IV is successfully launched.

9/25 First of Intelsat IV-A satellites is successfully launched.

12/12 2nd antenna placed in operation at Etam and Andover.

12/15 SBS is formed as partnership by Comsat General, IBM and Aetna Life & Casualty.

1/29 2nd Intelsa is successfully la

2/19 First Marisa successfully au and stationed ov Atlantic Ocean.

5/13 First of 4 C satellites is laun

6/9 2nd Marisat cessfully launch stationed over P Ocean.

7/4 Small portab antenna erected Labs in Yellows Natl. Park for bi nial telecast.

7/22 2nd Comst launched.

9/3 Two interna agreements for tion of Inmarsat opened for sign

9/21 Contrac to Ford Aerospa Communication Intelsat V's.

10/14 3rd Maris successfully au and stationed o Indian Ocean.

12/9 Front page Washington Pos transmitted in fa form via satelli Rome, Italy.

COMSAT®

COMMUNICATIONS SATELLITE CORPORATION MAGAZINE

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1976

7/4 200th Anniversary of U.S. celebrated.

7/21 Legionnaire's disease kills 29 in Philadelphia.

1977

1/20 Inauguration of President James E. (Jimmy) Carter.

8/4 U.S. Energy Department created.

1978

1/13 Sen. Hubert H. Humphrey dies.

4/18 U.S. Senate votes to turn over the Panama Canal to Panama in 1999.

1979

3/28 Major accident, Three Mile Island nuclear power plant.

11/3 American hostages held at American Embassy in Iran.

1980

5/18 Mt. St. Helens erupts.

11/4 Ronald W. Reagan elected 40th President of U.S.

1981

3/30 Attempted assassination of President Reagan.

4/12 1st flight of Space Shuttle Columbia—2nd flight 11/12.

5/13 Pope John Paul II wounded.

10/6 Egyptian President Anwar El-Sadat fatally shot.

1982

1/11 AT&T agrees to divest all local operating companies.

3/22 Space shuttle Columbia makes 3rd trip.

Intelsat IV is
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BS is formed
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7/22 2nd Comstar is launched.

9/3 Two international agreements for formation of Inmarsat opened for signature.

9/21 Contract awarded to Ford Aerospace and Communications for 7 Intelsat V's.

10/14 3rd Marisat is successfully launched and stationed over Indian Ocean.

12/9 Front page of Washington Post transmitted in facsimile form via satellite to Rome, Italy.

1/29 2nd Intelsat IV-A is successfully launched.

2/19 First Marisat is successfully launched and stationed over Atlantic Ocean.

5/13 First of 4 Comstar satellites is launched.

6/9 2nd Marisat is successfully launched and stationed over Pacific Ocean.

7/4 Small portable antenna erected by Labs in Yellowstone Natl. Park for bicentennial telecast.

7/22 2nd Comstar is launched.

9/3 Two international agreements for formation of Inmarsat opened for signature.

9/21 Contract awarded to Ford Aerospace and Communications for 7 Intelsat V's.

10/14 3rd Marisat is successfully launched and stationed over Indian Ocean.

12/9 Front page of Washington Post transmitted in facsimile form via satellite to Rome, Italy.

1/1 Marisat joint venture begins providing service for first time on global basis.

1/1 First Director General of Intelsat, Santiago Astrain, assumes office.

1/19 First overseas 56 kilobit-per-second satellite data circuit starts service between U.S. and Spain.

2/8 FCC authorizes SBS to build, operate facilities for its proposed domestic satellite services.

5/26 3rd Intelsat IV-A is successfully launched.

7/24 Laboratories airlifts small (4 ft.) transportable earth station for emergency service during Johnstown, Pa., flood disaster.

8/1 Marisat joint venture agreement with Kokusai Denshin Denwa Co., Ltd. (KDD) makes commercial maritime satellite communications available worldwide for first time.

9/29 4th Intelsat IV-A is launched but fails to achieve orbit.

1/6 5th Intelsat IV-A is successfully launched.

1/6 SBS awards contract to Hughes Aircraft for 3 spin-stabilized satellites.

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9/29 4th Intelsat IV-A is launched but fails to achieve orbit.

1/6 5th Intelsat IV-A is successfully launched.

1/6 SBS awards contract to Hughes Aircraft for 3 spin-stabilized satellites.

2/9 Comsat Labs develops echo canceller.

3/31 6th and final Intelsat IV-A is successfully launched.

4/18 Contract awarded for Telemetry, Tracking and Control services from Intelsat.

6/26 Agreement signed with Government of American Samoa to establish an earth station in American Samoa.

6/29 3rd Comstar is launched.

11/1 President Carter signs International Maritime Satellite Telecommunications Act, which authorizes Comsat to represent U.S. in Inmarsat.

11/19 Intelsat IV-A satellite begins operation with switch over from Intelsat IV.

1/11 Comsat calls for early establishment of Inmarsat and signs operating agreement.

1/19 Dr. Charyk elected President and CEO.

3/19 TeleSystems is established by Comsat General.

3/19 50 percent ownership interest is sold in the Cayey, P.R. international earth station.

5/14 ERT joins Comsat as a wholly owned subsidiary of Comsat General.

5/15 John D. Harper succeeds Joseph H. McConnell as Chairman.

5/16 Comsat reduces rates by 15 percent for international communications satellite channels.

6/7 Robert C. Hall is elected President of SBS.

7/16 Inmarsat officially begins operations.

10/27 American Samoa earth station is dedicated.

11/12 23.5 percent U.S. ownership interest in Inmarsat is granted.

2/1 Comsat reduces rates for second time in less than a year for Intelsat services.

5/16 Richard S. Bodman elected President and CEO of Comsat General.

June Satellite Television Corporation (STC) is formed as a wholly owned subsidiary of Comsat.

6/10 Earth station on the island of Saipan to serve Northern Mariana Islands is authorized by FCC.

7/14 Contract is signed with Multi-Visions, Ltd. of Alaska for first commercial application of Torus antenna.

9/23 Comsat's World Systems Division is established with Dr. John L. McLucas as President.

9/24 John A. Johnson retires as Chairman and CEO of Comsat General assuming the position of Chairman of STC. Richard S. Bodman becomes Comsat General President and CEO.

10/30 CGIS is incorporated.

11/2 Susupe, Saipan, Northern Mariana Islands earth station is dedicated.

11/15 SBS's first satellite is launched with the assistance of Comsat's new Launch Control Center.

11/17 Comsat General acquires Compact Engineering, Inc. for CGIS.

12/6 First Intelsat V is successfully launched.

12/11 First issue of Comsat Magazine is published.

12/18 Intelsat awards contract to Ford Aerospace and Communications for 3 Intelsat V-A's.

1/1 Comsat reduces rates by 11.8 percent for Intelsat services.

1/13 CGIS acquires Comprehensive Computing Systems and Services, Inc.

2/10 Radiation Systems, Inc. (RSI) receives right to manufacture and sell Torus antennas.

2/21 4th Comstar satellite is launched.

3/12 SBS inaugurates commercial service.

3/13 Comsat leases its 10,000th international circuit.

4/22 DBS endorsed by the FCC.

5/1 First 14/11 GHz antenna used with Intelsat system dedicated at Etam.

5/23 2nd Intelsat V is successfully launched.

7/27 Irving Goldstein assumes position of President of STC as John A. Johnson, STC's Chairman, retires.

9/24 SBS-2 is launched.

12/15 3rd Intelsat V is successfully launched.

12/20 Marecs-A satellite is launched.

12/22 CGIS acquires Applied Silicon Technology, Inc.

1/15 Comsat General acquires Amplica, Inc.

2/1 Inmarsat becomes operational on a worldwide basis.

2/4 William Perigard elected TeleSystems President.

3/4 4th Intelsat V is successfully launched.

3/30 Comsat General and Inter-Continental Hotels announce video teleconferencing partnership.

4/1 CGIS acquires Graphix Software, Inc.

4/7 Intelsat awards contract to Hughes Aircraft for 5 Intelsat VI's.

5/24 New Roaring Creek earth station near Bloomsburg, Pa. is approved by FCC.

9/17 STC President Irving Goldstein becomes Executive Vice President of Comsat. Richard S. Bodman elected STC President; Robert W. Kinzie elected President of Comsat General.

9/23 FCC approves STC's application for its DBS system.

9/28 First Intelsat satellite (Intelsat V) equipped for maritime communications is launched.

10/25 STC signs contract with RCA's Astro-Electronics Division for 2 satellites.

11/11 SBS-3 is launched via the Space Shuttle—Columbia—first commercial use of the Space Shuttle.

11/15 New Palau earth station is inaugurated by Comsat World Systems.

12/22 Comsat offers one million shares of stock.

12/23 Full-period TV service via satellite to Australia begins.

more than just a job. We were building something important—the financial framework for a vital communications network.

Although the present Intelsat financial system has been refined to reflect the more complex current business situation, the basic policies and practices developed then still endure. On reflection, the esprit and dedication of the Comsat Finance staff and the Finance Subcommittee really were worthwhile. Our shared experience established a framework which has worked smoothly and effectively for almost 19 years.

Memories of Discussions In 'The Garret'

As remembered by Robert D. Briskman

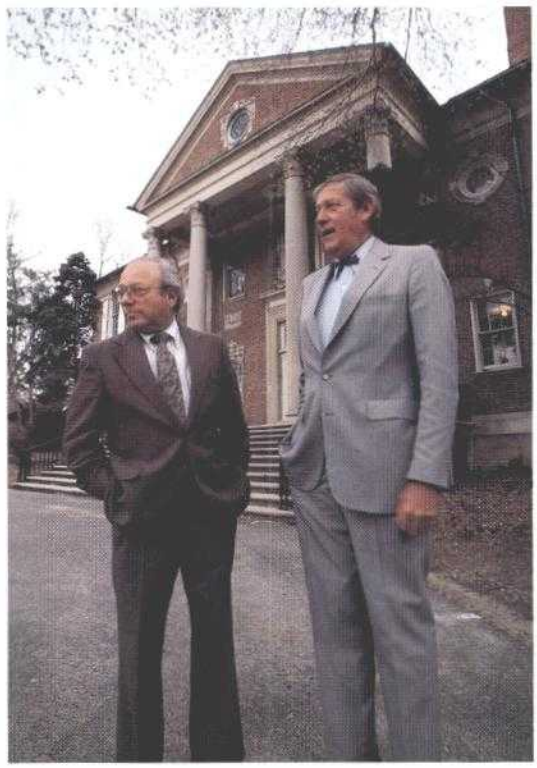
Vice President, Systems Implementation
Comsat General Corporation

Reminiscences of the early days of **Comsat**—our days occupying the estate of Joseph E. Davies, called Tregaron—immediately lead to fond memories of the original **Comsat** technical staff. We were housed mainly in the attic of the estate's main building. We called this place of gabled windows and narrow hallways "the garret." This original technical staff came from many diverse organizations and represented different technical skills. In my case, I was the only engineer who had come from the National Aeronautics and Space Administration (NASA) and who had actual experience in launch vehicle and satellite TT&C (tracking, telemetry and command).

The discussion of technical issues by these engineers, who had never before worked together, was stimulating. Leading these discussions, some of which might be better termed "arguments," would often be Sid Metzger, Sig Reiger, or Spence Spaulding, the three men generally acknowledged to be the infant Corporation's technical leaders. The main issue which preoccupied us the first two years was the type of communications satellite system which **Comsat** would implement. During this period, two types of medium altitude satellite systems and a geostationary altitude satellite system were under intensive comparative analysis. My recollection was that there was a preference initially for the medium altitude satellite system based on the then existing Relay and Telstar satellite technology. As time went on, the technical and economic analyses indicated that a geostationary system would be better. This and the performance of NASA's Syncom satellite project led to the decision of implementing the geostationary satellite system we know so well today.

The intense and long work days, coupled with everyone's close proximity, led both to the very effective team relationship through which technical activities were carried out in **Comsat** over the next several years and to personal relationships which still exist. Although only one member

Twenty-year employees Lewis C. Meyer, left, and James B. Potts, right, outside Tregaron, Comsat's first home. ***William J. Megna*** *photo.*



of that original technical team is employed in the **Comsat** family today, we all still see each other many times a year (with the sad exception of Sig Reiger who died in 1970).

It is especially gratifying for me to reflect back on the amount of early technical planning done in Tregaron that came to fruition. The best example was our identification of the need to create a laboratory. This was not actually formally proposed until some years later. The existence of the impressive **Comsat Laboratories** in Clarksburg, Maryland, is testament to our belief in those early days of the need for a first-class center devoted to satellite communications research and development.

Dr. Joseph V. Charyk, Chairman and Chief Executive Officer, in the room at Tregaron that was his office. Tregaron is now owned by the Washington International School, a private school. ***Below****, twenty-year employee William L. Callaway in room that was once the conservatory at Tregaron, but which since Comsat's day has been used for offices. Photos by* ***William J. Megna****.*

Geosynchronous Vs. Low Orbit, The First Big Technical Decision

As remembered by Sidney Metzger

Sidney Metzger participated in the making of several major technical and business decisions before retiring from Comsat in February 1982. His last position with the Corporation was Vice President and Chief Scientist.

In 1963, the most important technical decision to be made at **Comsat**—and one which would also have great economic and operational significance—was whether our first satellite system should be synchronous or low altitude. In the light of our later great success with synchronous satellites, it would seem that this question should have been trivial, but we're now speaking with benefit of hindsight. To those who recall the heated debates on this subject 20 years ago, it was a most difficult question. There were serious doubts as to the effect of the echoes occurring in a synchronous system, and the results of lab tests weren't very conclusive. There were questions as to the lifetime to be expected of thruster valves operating in the vacuum of space.

As of June 1963, when Sig Reiger and I came to work at **Comsat**, the Telstar I and Relay I satellites, although experiencing some problems, had clearly demonstrated that the low altitude system could relay wideband signals in a stable predictable manner without incurring the communications time delay of the synchronous satellites, and they did not require the thruster valves that would be needed on the latter. The experience with synchronous satellites was rather grim. Advent, a military synchronous satellite, was scrapped before it ever flew because of large financial overruns. Syncom I, a NASA synchronous satellite, failed to enter synchronous orbit. Syncom II was successfully launched and reached orbit in July 1963, but all the answers as regards its performance as a fully functioning communications satellite were not available at the time we had to make our big decision.

The reasoning which convinced me of the proper choice was the following: A low altitude system would require about two dozen satellites. The prudent approach, before building all two dozen satellites, would be to build and launch just one or two to prove out the design in actual flight. Only after the first one or two had proven satisfactory would the go-ahead be given to build the remaining satellites. Thus, the first one or two would be necessary for "proof testing," but they would have substantially

no operational value until their sister satellites had been built and launched. On the other hand, the successful launching of a single synchronous satellite would not only permit answering our questions, but if these were answered positively that satellite could immediately begin commercial operation.

Excited by this line of reasoning, I went to Dr. Charyk, our President, and made a presentation to him. He turned to Lew Meyer, then Treasurer, who at that moment was in the office with him, and said, "Do you hear that? Do you hear that?" in obvious delight at having found support from one who was considered an advocate of low altitude systems because of my previous work on the Relay satellite at RCA. Dr. Charyk had independently come to the same conclusion using the same line of reasoning. Soon after, the decision was made to proceed with the purchase of a relatively small synchronous satellite. It would become known as Early Bird. Its 85-pound weight would be as much as the Delta vehicle of that day could launch.

Since it couldn't be known whether the synchronous approach would work entirely to our satisfaction, despite our best reasoning and our best hopes, the decision was made to raise sufficient capital through our stock offering to pay for a low orbit system if Early Bird did not prove itself. As history made abundantly clear, the low orbit system was never necessary.

The 1964 Olympics, The First Commercial Venture

As remembered by William D. Young

Principal Engineer
Comsat World Systems Division

It is enticing to start the dating of **Comsat**'s many successes with the launch of the Early Bird satellite in 1965, but there was a preamble performance in 1964 that should not be overlooked. That year **Comsat**, the National Aeronautics and Space Administration (NASA), the Hughes Aircraft Corporation, and NHK of Japan (the Japan Broadcasting Company) collaborated to bring live television coverage of the 1964 Olympic Games to the United States from Japan.

Syncom III, the experimental geosynchronous satellite that Hughes built for NASA, was to be used to relay Japanese black and white television coverage to an 85-foot mesh-covered dish antenna at the end of an aircraft runway at the Point

Facing Page. *Early Bird or Intelsat I, world's first commercial satellite.* ***Left.*** *Scene from the 1964 Olympics as photographed on television screen. TV transmissions were sent via Syncom III.*

Mugu, California, Naval Air Station. It was very satisfying to witness and be part of the enthusiastic cooperation that existed from the beginning among the U.S. and Japanese participants in this project. Time was short and the hours long and inconvenient, but good spirit prevailed and the project was a success.

I had come to Washington, D.C., from California to join **Comsat** in August 1964. Within a very short time span I found myself back in California, at Point Mugu, serving as a kind of station manager for the Corporation. In effect, I was **Comsat**'s eyes and ears in the field to make sure the system worked.

Tons of equipment were flown in from Japan to process the television baseband and to change the line and frame standards to U.S. standards. Engineers from Hughes obtained a maser from Microwave Electronics Corporation of Palo Alto, California, installed it at the dish focus, tested the dish and radio equipment, and turned the signal over to the Japanese engineers.

It was a new experience for everyone, and there were some problems. One piece of Japanese processing equipment required a lot of work to adjust, but it was never used during the televising. The plan was to reduce the signal bandwidth and to improve picture quality by reducing the scan rate and interlacing frames. Unfortunately, moving subjects were distorted (horses in the equestrian events often had eight legs). Digital sound was tried and rejected because it tended to traumatize the listener's ears when picture sync was lost during camera changes, and a very loud buzz interrupted the peace.

Finally, when the start-up day arrived, everything worked. Pictures were sent throughout the United States and Canada. They were taped in Montreal and flown to Europe where they were seen with keen enthusiasm. Some of the joy was lost on subsequent days when NBC chose to use their color tapes recorded in Japan and flown, a day late, to the United States for distribution. The Canadians were able to see the transmissions in real time, and the Europeans saw them on the same calendar day. Hence, millions of people were given an opportunity to see the games in a way never before feasible.

Many people were involved in the Olympic TV project, but just a few names spring readily to mind: Dr. Spence Spaulding, **Comsat**'s Project Manager; Rick Gould, **Comsat**'s Field Representative; Hal Rosen, Hughes Aircraft's project chief; Bob Scrafford, the Hughes Field Engineer; and Tsutomu Kimura, NHK Deputy Director and representative at Point Mugu. For these people and all the other workers on the project—and perhaps even for some of the viewers—October 1964 will long be remembered as **Comsat**'s first commercial venture.

Sig Reiger and Early Bird, the First Satellite Contract

As remembered by Martin Votaw

Martin J. Votaw retired in 1982 with the rank of Director, Technical and Operations Division, of ***Inmarsat*** *(the International Maritime Satellite Organization), based in London. His long career in satellite communications included a total of 15 years at* ***Comsat****, which he joined in 1963 and which he served at one time as Vice President, International Management Division. For two years he was Vice President, Technical Operations, at Satellite Business Systems (****SBS****).*

In September 1963, the Hughes Aircraft Company, who had built the geosynchronous Syncom satellites for the National Aeronautics and Space Administration (NASA), offered to build an improved ver-

sion for **Comsat**. The commercial satellite would have wider bandwidth, higher power and higher antenna gain than the experimental Syncom.

Comsat was interested, and Siegfried H. Reiger, whose title was then Director, Systems Analysis, but who would soon be promoted to Vice President, Technical, was asked to assemble a team to take a closer look at the Hughes proposal. Sig invited Sid Metzger, then Manager, Engineering; Rob Briskman, then Manager of Telemetry and Command; Emeric Podraczky, then Manager of Spacecraft Communication Engineering; and the writer, then Manager of Spacecraft Engineering, to make the trip with him to the Hughes plant at El Segundo, California.

The initial meeting with the Hughes staff was very interesting as the technical characteristics of all the different parts of the satellite were discussed in some detail.

After these discussions were concluded, Sig Reiger asked, "What specifications are you prepared to meet?"

One of the Hughes people responded. "No specifications. This is a straight commercial arrangement like a TV set. You don't expect specifications when you buy a TV set, do you?"

Reiger responded, "I had specifications on my swimming pool." Then Reiger left the room and after a well-placed phone call came back and said, "No specifications. No contract. If you want to continue the discussions tomorrow, we'll come back with a list of the parameters to be specified, and you can fill in the performance numbers that you are willing to meet."

After leaving the Hughes plant, the **Comsat** group went to Sig Reiger's home on a hillside overlooking Los Angeles and Santa Monica Bay. The group met in Sig's den and there developed the list of performance parameters that were to be written into the contract. Once the task was completed—between 10 and 12 parameters were defined—the group had a fine dinner that had been prepared by Sig's wife Irmgard.

The next day the list was provided to the Hughes negotiating team, and it was agreed that after they had developed the appropriate numbers contract discussions would continue.

Thus the patience and determination of Siegfried Reiger was effective in setting a precedent for performance specifications in all **Comsat** spacecraft contracts. The contract was then completed for the satellite, later to be known as "Early Bird" or Intelsat I. Since then, the same style of contracting has been used by **Comsat** and **Intelsat** to purchase satellites totalling more than a billion dollars in cost.

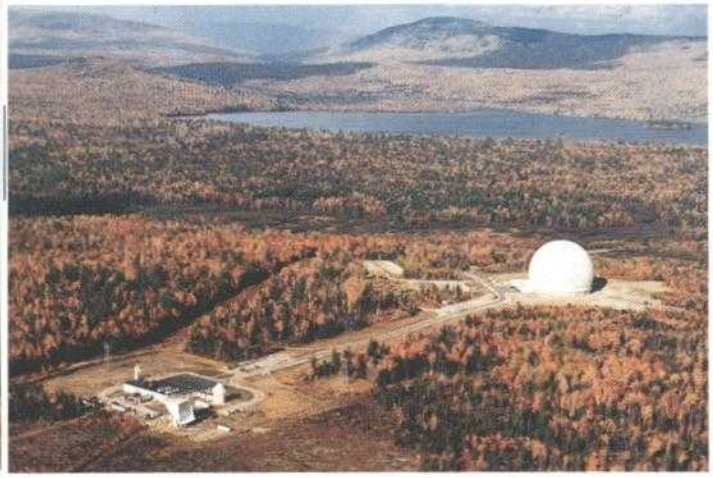
Above Left. *Siegfried H. Reiger played a key role in most of Comsat's technical activities during its early days.* ***Left.*** *Martin Votaw, right, and Charles Patrick Smith of NASA's Goddard Space Flight Center sign launch services agreement for Early Bird.*

Early Bird as Seen from Andover

As remembered by James B. Potts

Special Assistant and Chief Engineer
Comsat World Systems Division

The launch of Early Bird on April 6, 1965 was an obviously major step in positioning **Comsat** for the substantial growth and record of success that characterizes its history today. Corporate history was made that day, but those of us at Andover very likely didn't give much thought to it. We had a mission, perhaps not fully understood. **Intelsat** existed under the Interim Arrangements, but the construction of Early Bird was started prior to **Intelsat** formation by **Comsat** in consultation with four European countries and Canada. All of the group owned ground station facilities used with the Telstar and Relay programs, while **Comsat** obtained its entry by leasing Andover from AT&T. We contracted with Bell Labs for extensive modifications to the station so that it could perform the necessary telemetry, tracking and control (TT&C) functions compatible with Early Bird. Andover was to be a key part of the operation. It had to acquire the satellite on VHF, get the big horn antenna, which aimed the 14-foot command antenna, locked on the satellite, finally turning on the satellite's four-gigahertz transmitters. After completion of this task, the big horn would track at four-gigahertz giving the capability to produce orbital information of the required precision. The horn was also instrumented to determine the attitude of the spacecraft from polarization angle measurements. NASA's role ended with the achievement of transfer orbit. It was a big job the fledgling Corporation was taking on, and failure in any one of a number of critical operations could have had disastrous long-term effects.



Aerial view of Andover, Maine, Earth Station as it appeared around the time of the launch of Early Bird.

In our 20th year, 18 years after Early Bird, it is easy to look back and ponder the "what if's." Maybe we weren't smart enough to be scared, but even the traveling wave tube (TWT) transmitter's penchant for "crowbarring" and the failure of a bearing in one of the horn elevation wheels just about six days before launch didn't slow things too much. The transmitter had no spare, but we knew that from the beginning. The critical time would be the command to fire the apogee motor.

We would "see" (acquire) the satellite first at second apogee and measure orbit elements. The command to fire the apogee motor was to occur on the sixth apogee on April 10. If somehow we failed, then the next nominal apogee would be days later and there was a fear that the additional exposures of the solar cells to the Van Allen belt, as the satellite remained in transfer orbit, would seriously impact on their lifetime, which had been estimated as 18 months. Firing at an earlier apogee, on the other hand, would require the use of precious fuel to move the satellite to its planned station of 27.5°W. There weren't too many fallback options, but there was never really any doubt that things would work as planned.

On the evening of April 6, the time for

rehearsals had passed and everything was judged to be ready. At Andover, we pointed the big horn southward toward the Cape just above the horizon. The horn had been fitted with VHF couplers, and we wanted to see if we could monitor the lift-off since the satellite VHF would be on during launch. At 18:48 (6:48 p.m.) the lift-off occurred, and we picked up the VHF signals as the launch cleared the horizon. We knew the satellite had survived the launch. Now we could only wait. First apogee would occur over the Indian Ocean and we had to wait for second apogee on the morning of the 7th. NASA's tracking network would provide preliminary pointing data which would be used in Andover's acquisition. First acquisition was to be accomplished using a quad-helix tracker which provides rough pointing data to the big horn antenna. The horn was being used to point the 14-foot six-gigahertz command antenna with its beamwidth of about 0.8°, which meant the horn VHF tracking system had to be pretty good.

After acquisition and lock on by the horn, the spacecraft's four-gigahertz microwave beacons would be turned on. The horn beamwidth at four-gigahertz is only about 0.22°, and to insure the acquisition by the horn at four-gigahertz, a specially designed Precision Tracker (PT) employing a 10-foot dish was available if needed. The PT could provide pointing data to within 0.02°, which would be more than adequate.

The first really anxious moment occurred during this initial command sequence. Hughes Aircraft personnel operated the telemetry, tracking and control (TT&C) console, and the instructions stated that the command execute key be turned on for two seconds after the command had been entered. **Comsat** had built an Early Bird simulator which picked up the signals radiated from the command antenna and displayed the modulation on a cathode ray tube giving a positive indication of command transmission. On the first try by the command operator, there was no command execute verification from the spacecraft telemetry. It hadn't worked! Expectant silence turned to stunned silence. Did we

The date is April 6, 1965, and the hugely successful launch of Early Bird has just begun.

miss something in the procedure—had the transmitter failed? Worst of all, no one had watched the simulator display, and we didn't even have that much information. Before there was any panic—even before the full realization could sink in—one of the Hughes launch team who had come in from

Radome-covered horn antenna at Andover, Maine, Earth Station.

the Cape overnight volunteered that the command execute had not been actuated long enough. Assured that the key had been closed for the specified two seconds, he remained just as adamant that two seconds might not have been sufficient time. The procedure wasn't clear on that point. It was interpreted by the operator as two seconds—no more, no less, but the new input was that two seconds was the minimum. There was no maximum.

So it was tried again, and this time, success. We had microwave and the tracking could begin. The next crucial moment would be the firing of the apogee motor on the 9th, but there was still something we engineers could do: check the communications transponder.

Sid Metzger was the instigator. We had a small TV camera, something like you see in stores as a monitor to protect against shoplifting. We also had some pictures out of the press folder—one of a bird caricature and one of an artist's rendition of Early Bird itself. It didn't take long to set up a TV transmission to loop through the satellite and snap some Polaroid pictures of the return on the TV monitor. No problem, the microwave transponder was just fine. Even though not a true engineering test, the picture could not have been as good as it was if the system hadn't been operating close to normal.

This event was reported in the *Washington Post* as the unauthorized act of zealous engineers, but who could fault the engineers?

Now came Friday, the big day. While a relative calm prevailed, there was still a "what if" remaining. On Friday morning, the control building was jammed with people. Present were all the Western Electric station personnel, about a dozen Bell Labs engineers who had worked hard in modifying the station, the Hughes TT&C crew, some of the launch team from the Cape and, of course, **Comsat** people including Sid Metzger, myself, Bill Young, Al Coburn, Andy Werth and Laurie Gray. At 08:40:25, the big moment, firing the apogee motor. Success came. Then all was happiness. The satellite was in orbit. It worked. Everything worked.

In just a matter of minutes everyone except **Comsat** people began to disappear. Their part was done, and the rest was now up to us—preparing for operations. The control room was deserted except for the TT&C operator. The clamor of the crowded room became the solitary clacking of the teletype machine sending tracking data to the Control Center in Washington. This was the first of many successful Corporate steps, an achievement now all but forgotten except by a few for whom it is a very special memory.

Grease Pencils And Sliding Plexiglass

The First Control Center As remembered by Arnold W. Meyers

Manager, Operations
Comsat World Systems Division

One way to determine how far **Comsat** has come in its two-decade-long history is to compare its first Control Center with the existing control facilities that are its heirs, specifically the Comsat Launch Control Center and **Intelsat**'s Operations Center. The two modern facilities that are its outgrowth manage functions that were

handled within the single Control Center 18 years ago in much more primitive fashion.

In terms of appearance and operational speed, the contrast between our original center and the two sophisticated centers of today with their video monitors providing constantly updated readouts directly from a computer processing reams and reams of tracking, telemetry and operational data is like night and day. Constructed in 1964 at 2100 L Street, N.W., in the heart of Washington's downtown business district, the first Control Center was a "jack-of-all-trades" facility responsible for satellite command and control, the direction of day-to-day operations and maintenance of an international satellite network, and the provision of communications for external telegraphic communications. Specifically, it was put together with the limited Early Bird and Intelsat II satellites in mind.

Constructed in less than one year, the center was designed with the idea that the acquisition, handling and processing of information would have to be largely a manual rather than an electronic affair. Grease pencils and sliding plexiglass panels were the methods and materials of the day, and it was they that were used in directing the operation of an international network and following a satellite launch and orbit injection, not video displays. As for the staff, what experts there were among us came primarily from the military. In terms of environment and the system used, however, what we would be doing would be very different from our military experience. The expertise we obviously lacked in operating satellite systems was made up for by our enthusiasm over the opportunity to play a part in the making of history.

The new Control Center began playing a central role in ushering in international satellite service with the launch of Early Bird the evening of April 6, 1965. Staffed 12 hours per day, the center controlled a system that at first was able to work with only two earth stations at a time. The earth station we took over from AT&T in Andover, Maine, was a constant in the system. Andover, in turn, worked with one of several earth stations in Europe—in France, Italy, West Germany and the United Kingdom—selected on a rotational basis. (In October 1966, Canada through its earth station at Mill Village became a part of the system as well. One out of every eight days Mill Village handled North American traffic via Early Bird.) **Comsat** managed the entire system, and instructions were provided from the Control Center to activate the satellite system and establish international links by means of a single teletype channel shared among the five participating countries. Our total capacity was 240 circuits or a single television channel.

Simplicity of operations stands out in retrospect as the important aspect of Control Center operations. Grease pencils, easels and the backs of envelopes were truly necessary tools in those days, and long hours an essential part of the work routine. The teamwork of the staff was excellent, and amid the hectic pace there was no time for second guessing and worrying.

The Intelsat system has changed dramatically since those days 18 years ago when the first Control Center went into operation. As the system has become larger and more and more successful, the means to control it have of necessity grown in sophistication by leaps and bounds. What hasn't changed in all these years is the challenge of the technology. Satellite communications technology is as rewarding and enjoyable today as it was then.

Operations staff checks Early Bird telemetry at Control Center.

R&D

The Research & Development Perspective: Twenty Years of Achievement

by **Dr. Geoffrey Hyde**, *Senior Staff Scientist, left, and* **Dr. Pier Bargellini**, *The Senior Scientist, Office of the Director, Comsat Laboratories*

Comsat came into being during the latter part of a remarkable decade —1955-1965—that saw the birth of several key technologies upon which its own future would depend—rockets, synchronous satellites, low noise receivers, very high gain antennas, real time telemetry processing, to name just some. Through continued innovations in technology, services and systems, **Comsat** has consistently honed and advanced the cutting edge of satellite communications technology. In the account that follows, we will trace the advance of satellite communications as furthered by **Comsat** over the past two decades and will indicate how we perceive its future course over the next two decades.

In 1962, limited transoceanic communications were made possible by a few submarine cables providing less than 100 good quality high reliability telephone circuits and by high frequency (HF) radio telephony providing circuits of lesser quality and reliability. Clearly cables were then and will remain inflexible links between two fixed points. HF radio could and did link one point to several, that is, HF radio had more of the ability to provide communications among several points, that is, greater connectivity, than cables. However, continuity of service is limited as HF radio depends on ionospheric propagation with its many vagaries. Thus the ultimate in communications capacity, reliability and connectivity was yet to come. In 1962, low orbit active satellites, such as Telstar and Relay, were launched and proved the feasibility of transoceanic telephony and television via satellite. Passage in August 1962 of the Communications Satellite Act by the U.S. Congress with the intent to establish a commercial communications satellite system led in February 1963 to the birth of **Comsat**. Nineteen Hundred Sixty-Three also saw the successful launching of Syncom II, the first communications satellite to hover continuously over one spot on the earth's surface (the equator), that is, to orbit geosynchronously. In 1964, 11 nations led by the United States entered into the Intelsat agreements, with **Comsat** (the U.S. signatory and representative) designated as Manager. **Comsat** then made the momentous decision to develop a geosynchronous satellite communications system, correctly foreseeing that advancing technology would remove many of the problems of such a system while retaining its inherent advantages.

It is appropriate to recall that the decision to adopt the geosynchronous approach was taken at that time very much against the opinion of many telecommunications experts. The problems arising from launching satellites and maintaining them in geostationary orbit at much greater distances from earth stations were overcome. The inherent system simplicity and its potential global connectivity (the linking of one-third of the earth's surface through a single spacecraft) led to enormous savings and maximum cost effectiveness.

In this initial phase, **Comsat** not only established its own earth stations and, in rapid succession, oversaw the development and launch of the Intelsat I (Early Bird), Intelsat II, III, and IV communications satellites, it also actively supported the development of satellite earth stations around the world. In addition, at **Comsat**, unique communications system design, satellite launch and orbital maintenance and engineering support organizations were built to establish and maintain what had become by 1969 the world's first global communications network, the Intelsat III system. With satellites over the Atlantic, Indian and Pacific Oceans connecting all of the

Experimental optimized dual-polarized global coverage antenna in the anechoic chamber at Comsat Laboratories. Researcher holds one of the antenna feedhorns. All photos by ***William J. Megna.***

world that wished to be connected, the dream in 1945 of Arthur C. Clarke of a communications system based on satellites in geosynchronous orbit had become a reality.

1962 to 1982, Key Advances

The decision to use geosynchronous satellites proved to be most successful and set the pattern for the general acceptance of satellite systems and their fully satisfactory integration with land-based communications facilities. No compromise on system, service, quality and performance was accepted where advanced technology showed that there was room for improvement. In the decade following the congressional act, **Comsat** supervised the creation of four successive generations of satellites. Each generation more than doubled the communications capacity of its predecessor. **Comsat** established the

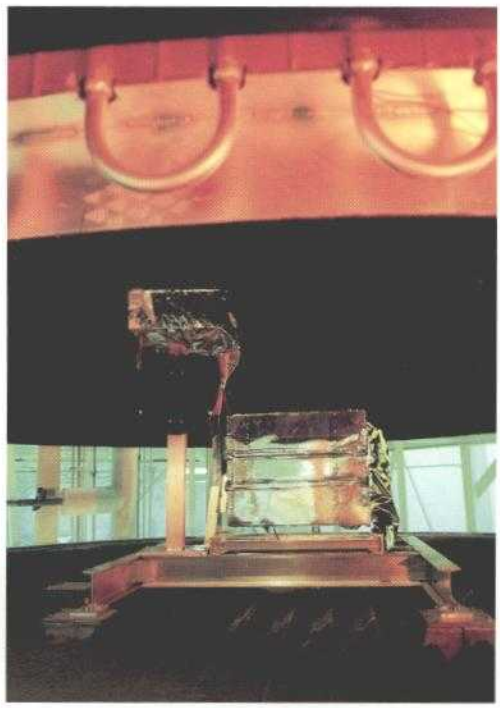
basic services—telephony, telegraphy and, uniquely to this day, transoceanic television. By exploiting the fundamental assets of geostationary satellites, global connectivity was attained by the use of preassigned frequencies, Frequency Division Multiplexing (FDM), Frequency Modulation (FM) and Frequency Division Multiple Access (FDMA) techniques.

In 1967 in order to focus efforts on further advancing satellite communications over a broad front, **Comsat Laboratories** was founded. Laboratories were established in the following five major areas of technologies: Physical Sciences, Spacecraft Engineering, Microwave Engineering, Signal Processing and Systems Engineering. **Comsat Labs** constitutes one of the few research centers in the world dedicated to the field of satellite communications.

Labs scientists and engineers have been responsible for the awarding, in whole or in part, of 226 U.S. patents since the Corporation's founding. The accomplishments of scientists and engineers at the Labs as well as at other branches of the Corporation are reported on by the twice-yearly *Comsat Technical Review*, now in its 13th year of publication and the first technical journal solely dedicated to space communications technology.

In cooperation with the communications industry, a succession of technology advances has been made by Labs scientists and engineers and incorporated into the Intelsat system. A major limitation on satellite capacity arose in the interaction of one signal with another inside the satellite. Microwave channel filters at the theoretical limits of their responses were designed and built, the concept successfully embodied in the Intelsat IV and subsequent communications satellites.

This channelizing approach facilitated the previously mentioned integration of the satellites into the ground-based communications network which was then largely based on analog transmission methods. As satellites at this time were power limited and depended entirely on solar cells and storage batteries for energy supply and storage, great strides were necessary and were accomplished in both areas. Solar cell efficiency was increased from about 9 percent in the days of Early Bird to 13 percent with the introduction of the **Comsat**-invented "violet" cell and about 16 percent for the



Spacecraft battery pack with experimental heat pipe assembly is positioned for testing in Comsat Laboratories' large thermal vacuum chamber.

latest solar cell on the Comsat Laboratory benches. Improvements were introduced in the nickel cadmium battery, and the nickel hydrogen battery was developed. The improvements in prime power generation and energy storage have been critical to the development of satellites with larger communications capacity (which require more power and energy storage). Long lifetime in orbit was also achieved through battery improvements.

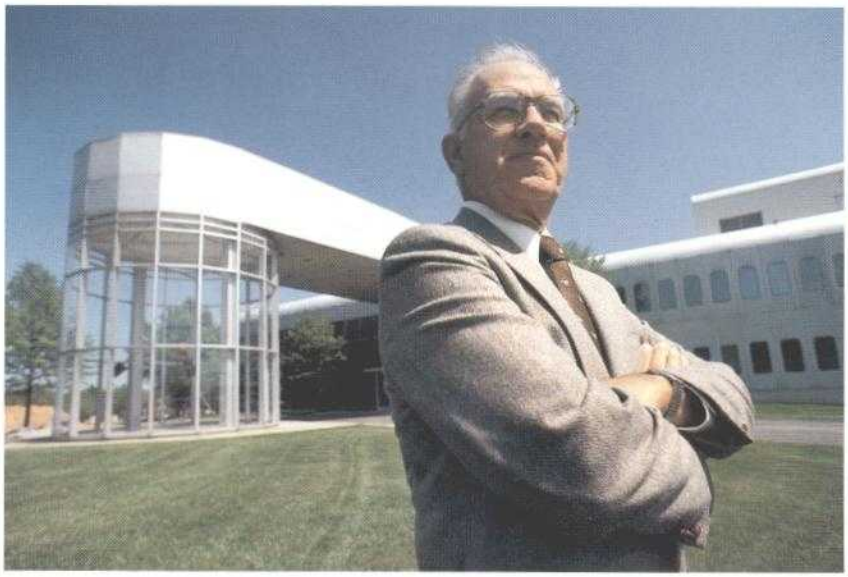
Considerable advances were also achieved in regard to station-keeping (the ability to hold satellite position in orbit) and attitude control (the ability to orient the satellite with respect to the earth). **Comsat** has worked closely with industry to provide this and more on-board fuel to control the larger satellites over longer lifetimes in orbit. The consequences of the longer life have been more time between generations of satellites and lower costs per satellite channel year. The improved station-keeping reduces the tracking requirements on the very narrow radio beam (0.1°/0.15°) of large earth station antennas and, along with the improved attitude control, reduces the allowance that has to be made for mispointing of satellite radio antenna beams. Ultimately, it also allows much narrower (higher gain) satellite antenna beams. The fact that a satellite will depart from its nominal geostationary orbit station, its "box," is one limit on the number of satellites that may be stationed on the geostationary arc. The more precise station-keeping improves the oppor-

tunities for utilization of the geostationary orbit, which is a scarce and precious resource.

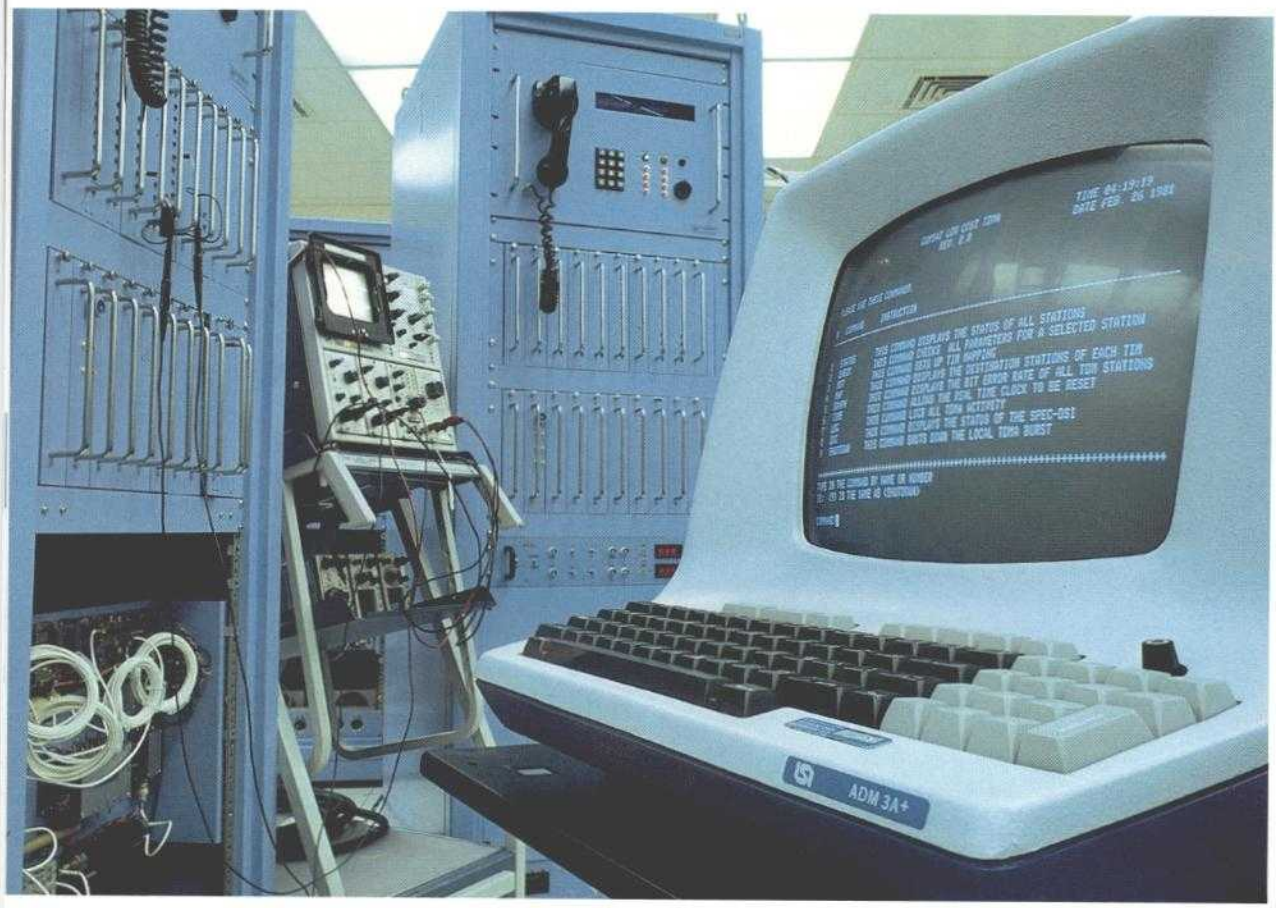
One problem with satellite communications systems is the delay that arises while signals traverse the paths (23,000 miles up and 23,000 miles down) from earth station to satellite to earth station. The total delay is about 0.25 seconds. This of itself is not bothersome to most people and can be compensated for in other applications (digital data communications, for example). However, whenever there is appreciable echo on the terrestrial line, the echo and the delay combine to become very troublesome. **Comsat** developed at **Comsat Labs** and produces and sells through its TeleSystems subsidiary a complex electronic device known as the echo canceller, which totally corrects for the echo problem.

As might be guessed, the radio signals in satellite communications, having to travel over great distances, can become rather weak, especially those received from orbit where power is hard to come by. Initially, the receivers needed at the earth stations were masers, laboratory-like instruments cooled with liquid helium in order to obtain low noise performance. These devices had been originally developed for radio astronomy. Use of masers was followed by use of simpler liquid helium and later liquid nitrogen cooled parametric amplifiers. More recently, the field effect transistor (FET) along with Peltier cooling (the effect whereby, for certain metal systems, passing a current through cools one end while heating the other) have made possible a multi-stage Peltier-cooled low noise (FET) amplifier, one of which is being built at **Comsat Labs** for deployment at the newest Comsat earth station at Roaring Creek, Pennsylvania, in its 11 gigahertz receive system. In part, this has been made possible by industry-developed improvements in earth station antennas. Part of this work has been electromagnetic; the efficiencies of these antennas have improved from about 55 to 75 percent. Another part of the work has been structural because antenna size has increased up to about 105 feet. The net result has been to increase antenna gain while holding antenna contributions to radio noise at about the same level as or better than all but a few of the early antennas. The improved antenna gain has in part been traded off with the low noise receiver requirements to make the latter less stringent.

The problem of connecting everyone is made more complicated by the fact that links between some countries, mainly North America, Western Europe and Japan, use many hundreds of satellite telephone channels, while links to and from developing nations use only a few. Systems with only a few channels per link (thin route systems) need special attention to coexist effectively and efficiently with the heavy links. **Comsat** developed and implemented in **Intelsat** the SPADE system where channels are assigned on demand. **Comsat** also implemented SCPC (single channel per carrier) with fixed assigned channels.These approaches provide thin route capability



Dr. John V. Harrington, Senior Vice President, Research and Development, for Comsat and Director, Comsat Laboratories, in front of Comsat Laboratories, located in Clarksburg, Maryland.



for the Intelsat system and yield greater amounts of communications capacity for a given combination of satellites and earth stations.

As these capabilities grew, traffic demand grew even faster. As the frequency bands allocated to fixed satellite services are limited by international agreements, it has been necessary to develop the concept of frequency band reuse. Its implementation is made possible by designing satellite antenna systems such that when the frequency bands (most usually the paired bands at 4/6 gigahertz and 11/14 gigahertz) are used for one antenna beam, they are invisible to (do not couple energy into) another antenna beam on the same satellite. Frequency reuse can be accomplished by use of orthogonally polarized radio beams, or by beams which do not illuminate the same part of the earth. In any event, there is a very heavy burden on the satellite antenna. In collaboration with the satellite industry the frontiers of dual-polarized and shaped and contoured beam antennas have been pushed to the point where four-fold frequency re-use is in orbit and six-fold foreseen for the next generation of Intelsat satellites.

The Intelsat system development required **Comsat** to produce from scratch the concepts and services that today constitute the international fixed satellite services. There are other forms of international services—for example, the mobile services. And here **Comsat Labs** shipboard experiments on the Queen Elizabeth II in 1973, the hospital ship, Hope, and experiments in locations ranging from Spitzbergen in the Arctic Circle to Manaus, Brazil, near the equator, led to the **Comsat**-developed Marisat system in 1976. Eventually, these concepts and services were incorporated in January 1981 into the Inmarsat system, which provides the world with maritime mobile satellite services.

Interference and bandwidth today constitute the limits on satellite communications systems. The multiplicity of satellites using the same frequency allocations gives rise to interference, both intra-system (for example, there are three Intelsat satellites in use and in relatively close proximity over the Atlantic Ocean) and intersystem (there are

over a dozen national, regional and international systems in space or under construction). Further, frequency reuse (both by dual polarization and by antenna pattern) and channelization give rise to some intra-satellite interference. Finally, other services (for example, terrestrial) share many of the frequency allocations. Today and for the foreseeable future, the available frequency spectrum, the available allocated bands and the interference in these allocated bands restrict satellite communications significantly. The technologies that **Comsat** explored in the 1970s and has been implementing in the last few years include expansion of satellite services into Ku-band, Time-Division Multiple-Access methods, digital technology, digital modulation and coding and error correction techniques.

1982 to 1984, Key Technologies

The overall evolution of communications technology has brought digital techniques to the forefront. These lend themselves to a multiple access technique—Time-Division Multiple Access (TDMA)—in which slots are provided in time rather than in frequency. TDMA for commercial satellite communications has been developed over the past 15 years at **Comsat**, culminating in field trials using 60 million bits per second (Mbit/sec) TDMA and terminals developed by **Comsat Labs**, and the development of Intelsat standards for 120 Mbit/sec TDMA. It should be noted that Satellite Business Systems (**SBS**), founded by **Comsat** in partnership with IBM and later Aetna—whose satellite system was deployed in 1981 and 1982—was the first all-digital, all-TDMA (48 Mbit/sec) commercial satellite system.

Field trials using the Comsat Labs 120 Mbit/sec TDMA terminals are in the offing. These terminals incorporate **Comsat**-developed advanced digital speech interpolation (DSI) processing that, taken together with TDMA, will significantly increase satellite telephone channel capacity. Other forms of voice signal processes have reduced the requirements for speech of the requisite quality from 64 kilobits per second (kbps) to 32 kbps, and 16 kbps speech at the required quality level is foreseeable. Similarly, in television and image processing, **Comsat Labs** has developed the capability to reduce bit rate requirements while maintaining quality to demonstrate that first two and now three TV channels can be put through a single 36 megahertz bandwidth transponder. This work is proceeding to develop optimum quality capability in image/TV processing over the 1 to 20 Mbit/sec range.

One way out of the current difficulties arising from heavy use of the 4 and 6 gigahertz frequency bands is the use of the higher frequency band allocations. **Comsat**, through **Comsat Labs**, has worked closely with the National Aeronautics and Space Administration (NASA) on experiments on the ATS-3, ATS-6 and CTS satellites, and with Bell Laboratories on the Comstar beacons. On-board units were built for the ATS-6 (13-18 to 4 GHz transponder) and Comstar satellites (19.04 and 28.56 GHz beacons). A wealth of data collected, reduced and analyzed has permitted **Comsat** to find the limitations of satellite communications at frequencies above 10 gigahertz resulting from rainfall and other hydrometeors. Appropriate systems models have been developed.

Currently, there are several exciting new technology and service efforts under way in the Comsat family. Satellite broadcasting by the Satellite Television Corporation (**STC**) is in the offing, and there are critical technology problems being overcome now in developing low cost, reliable Ku band (12 gigahertz) home receivers and, jointly with industry, a high power radio frequency (r.f.) satellite transmitter. The advent of TDMA has brought nearer the idea of "the switchboard in the sky" concept, based on satellite-switched TDMA (SS-TDMA), to which end efforts on satellite switching, routing, signal regeneration and other forms of on-board signal processing are being pursued at **Comsat Labs**.

Earth stations have grown in complexity and sophistication. At the Etam, West Virginia, earth station, in order to overcome the absorption effects of rain at 11/14 gigahertz, a diversity site has been implemented at Lenox, some 35 km

Facing Page. *Advanced Time-Division Multiple-Access (TDMA) terminal developed at Comsat Laboratories.* ***Below.*** *In Semiconductor Fabrication Clean Room at Comsat Laboratories, silicon wafers enter diffusion/oxidation furnace as a part of fabrication process for semiconductor devices.*

away, based on studies and modeling done at **Comsat**. Improved and dual polarized 6/4 gigahertz earth station antenna feed systems have been developed and tested and are being implemented at several earth stations. The microwave channelizing concept mentioned previously has been extended recently to high power r.f. multiplexers (channel combiners) at 6 and 14 gigahertz for earth stations. Finally, the multiple beam earth station antenna concept developed in the early 1970s will bear fruit, it appears, in the universal access concept.

A recent service developed is Intelmet, a joint partnership of **Comsat General** and Inter-Continental Hotels to provide international teleconferencing services. The effectiveness of this and related data communications services has been shown in a number of demonstrations, the most general of which is the High-speed International Packet Switching (HIPS) experiment. The HIPS experiment was performed jointly with DFVLR of West Germany and has demonstrated that high throughput can be obtained in digital data services via satellite, if appropriate protocols are used.

Future

Much of the technology already discussed—that is, long-life satellite technology (including the development of a solid state power, amplifier successor to the satellite TWTA), TDMA technology, digital processing technology, satellite antenna technology and others—will undergo further development. The advance of microelectronics for microwave circuits (MMICs) and for digital circuits for large and very large scale integration (LSICs and VLSICs) and their hardening for space applications, and the advance of microprocessors, currently under way at **Comsat Labs**, will continue to radically change electronics in the satellites and at the earth stations. The impact of these devices in the construction of large quantities of home receivers for television reception from direct broadcast satellites is expected to be conspicuous. In the fixed satellite services, there will be much more processing on the satellite—both of the signals en route and of control signals—and there will be much more automation at the earth stations. The capability to reconfigure the satellite and the earth station communications capabilities may very well be brought into regular use. Programs studying all of these matters have been initiated. Participation in the Intelsat R&D programs continues as vigorously as in the past.

Comsat is very active in the exploration of use of the higher frequencies, including efforts in the area of optical fibers and optical communications systems. It is actively engaged in the NASA 30/20 GHz ACTS program in partnership with RCA and TRW.

In the area of new services, the integrated services digital network (ISDN) looms on the horizon. Here voice, computer data, facsimile, telegraphy, and teleconferencing would be offered through a properly organized integration of all means of communications from satellites to microwave terrestrial systems, coaxial and optical cables. It would appear that, if unwarranted rules discriminating against use of satellites can be kept out, the satellite systems are naturals for ISDNs. The Intelsat system intends to expand into international business satellite services and these will no doubt include ISDN. Their implementation and exploitation is a logical extension of the HIPS experimental demonstrations just past and to be conducted in 1985. It can be anticipated that there will be work to extend maritime mobile satellite services to include aeronautical and land mobile services.

Clearly, **Comsat** is working hard to keep itself on the cutting edge of satellite communications technology.

Microcircuit Technician Elizabeth R. McGee inspects microwave circuit of new design in Yellow Room, Microwave Integrated Circuit Photolithography Laboratory,Comsat Laboratories. Room's yellow light creates safe light conditions for performing photolithography.

FOR THE RECORD

Excerpts of Mr. Harper's and Dr. Charyk's Remarks at the 1983 Annual Meeting of Shareholders Washington, D.C., May 20, 1983

Remarks of John D. Harper, former Chairman of the Board of Directors, Communications Satellite Corporation.

We are delighted to announce two important developments concerning the strategic plans for our direct broadcasting by satellite business. In addition, we are pleased to be able to report on a contract we signed with the National Broadcasting Company to provide network program distribution to affiliate stations.

Our direct broadcast news is particularly exciting. We have concluded an agreement that will enable us to enter the direct broadcasting marketplace as early as 1984. Using satellite communications capacity leased from Satellite Business Systems (**SBS**), we plan to offer a satellite-to-home subscription television service to residents of the northeastern United States.

Our second direct broadcasting announcement relates to the time when we begin service on our own satellites in 1986. We now intend to serve both the Eastern and Central time zones of the United States and to provide double the number of channels over what we had originally proposed.

As we have reported to you, **Comsat** attained record revenues of nearly $410 million for fiscal year 1982. This marked the first time the Corporation surpassed the $400 million revenue milestone.

Net income for the year increased to a total of $43 million, up 53 percent over the level we reported for 1981 before including the effects of an accounting change. Earnings per share were $5.41, the highest level in recent years.

Our performance for the first quarter of 1983 continued this positive trend. Net income for the period rose 22 percent over the first quarter a year ago. Earnings per share were up 11 cents to $1.40, in spite of the addition late last year of one million shares outstanding....

Our favorable performance for 1982 and the first quarter of 1983 is primarily the result of continued steady growth in our international communications business. During 1982, the number of communications circuits leased by **Comsat** through **Intelsat** grew by 15 percent. And although the rate of growth has slackened somewhat in recent months, we expect that demand for international satellite connections will continue to hold strong....

We will continue to build the rate-regulated international communications businesses we handle through **Intelsat** and **Inmarsat** while pursuing other new telecommunications opportunities that promise favorable long-term results. We believe this strategy will make **Comsat** an attractive investment in the 1980s and 1990s.

We place highest importance on maintaining the strength of our international communications business, which furnishes us with a solid base. In order to keep our position as a leader in providing international communications services, we must anticipate and adapt to the changing environment. Thus, we are discussing with the appropriate policymakers significant adjustments in our role of supplying services at the international earth stations....

Our strategic plans will require significant levels of financing in the coming three-year period. Through 1985, we expect to require some $270 million from external sources to fund capital needs for our rate-regulated satellite services and the development of our direct broadcasting business. Our investment in the international earth stations and the Intelsat space segment will require almost half of this capital. As we near the initiation of our direct broadcasting by satellite service, a greater percentage of our capital spending will be directed to Satellite Television Corporation (**STC**).

We believe that our financing plan is prudent and is necessary if we are to re-

main strong in the future. To begin to meet our financing needs, **Comsat** entered the debt market for the first time in 1982 by establishing lines of credit to borrow up to $100 million. And we returned to the equity market for the first time since our initial stock offering in 1964 through the issuance of one million shares of Treasury stock.

In defining our capitalization plans, we have set stringent limitations on the amount of debt we will incur. These limitations are intended to ensure that our basic business is in no way jeopardized.

In summary, I can assure you that our Company is strong and growing. Our industry is a vital one, and we are well-positioned strategically. You can expect further rapid growth in the years ahead.

With the close of this meeting, I will be retiring as Chairman of the Board of Directors. I have appreciated the opportunity to serve **Comsat** in this capacity through a very important period in the Company's history, a period of transition that has paved the way for future success. The full cooperation of each member of the Board and the entire Comsat organization has made my experience rewarding and enjoyable. I am grateful to each of you for your dedicated support, and I look forward to continuing my relationship with **Comsat** as a member of the Board of Directors....

John D. Harper conducts his last Annual Meeting—the 1983 Annual Meeting held May 20—as Chairman of the Board of the Directors. Mr. Harper continues on the Board.

Remarks of Joseph V. Charyk, Chairman and Chief Executive Officer, Communications Satellite Corporation.

We are moving ahead rapidly with preparations for our direct broadcasting by satellite service. We plan to begin service next year. In so doing, we will maintain the lead we have already established in pioneering this increasingly competitive business. Our intention is to use the next satellite in the Satellite Business Systems series to provide this service beginning in the fall of 1984. Initially, we will target our service to the most populous portion of the nation—the northeastern corridor, an area bounded roughly by Norfolk, Virginia; Pittsburgh; and Burlington, Vermont. Our plans are to offer five channels of pay television.

One of our main goals in designing a direct broadcast system has been to enable consumers to use small, inexpensive, easy-to-install antennas to receive signals from the satellites. With modifications that we will make, the SBS satellite will be capable of producing signals that are sufficiently strong to be received by antennas that are as small as two feet in diameter. Other similar services will require antennas that are four to six feet in diameter, a size that we believe is not economical or suitable for home rooftops.

Introducing a service that permits smaller antennas will give us a strategic advantage later on as well when we begin service from our own high-powered direct broadcast satellites in 1986. Since customers will already be equipped with the smaller antennas, there will be no need for them to buy costly new equipment. Over the long term, we believe that high-powered satellites and small antennas will claim the market....

We continue to hold discussions with companies about possible joint-venture and contractual relationships. We are examining carefully all prospective arrangements to ensure that complementary financial resource and management skills are brought to the venture....

The agreement to handle program distribution via satellite for NBC is of special significance to us. Under the in-

terim two-year arrangement, we will establish a system to distribute programming principally from NBC network broadcast centers in New York and California to 24 network affiliates.

Initially, we will lease transponders from Satellite Business Systems (**SBS**) to provide the service. Local affiliates will be equipped with earth station antennas to receive the transmissions. Service is to begin next January....

In reaching this interim arrangement, we agreed with NBC to negotiate a contract for the provision of an expanded network television distribution system. If negotiations are successful, we would serve all NBC affiliates nationwide for a 10-year period. The potential value of such a contract would be several hundred million dollars.

The interim service will represent the first time that network television programming is distributed by satellite in the higher, Ku frequency band.

There have been a number of other operational highlights recently. Our SBS partnership put up its third satellite, the first commercial payload ever launched from NASA's Space Shuttle. The sixth Intelsat V satellite lifted off successfully, destined for service over the Atlantic. This is the second satellite in the series equipped with a special maritime communications package.

During the year, we began operations at several new wholly owned international earth stations in the Pacific Trust Territories, bringing the benefits of satellite communications to the peoples of those geographically isolated islands for the first time.

Thus far, most of the U.S. Government's efforts to promote competition in the telecommunications industry have focused on the domestic market. Now, attention is turning to the international arena as well.

We think the Government's attempts to stimulate added competition in the provision of a new international communications services could be beneficial to consumers. The Intelsat system is ideally suited to accommodate such innovations. However, we are against any measure that would lead to the establishment of international transmission facilities that are duplicative and unnecessary.

We strongly believe in the concept of a single global satellite system as embodied by the Intelsat network. A significant diversion of traffic away from the Intelsat system to other facilities could have serious consequences. Among them are potentially higher rates on some routes, unequal access to service, and decreased efficiency and reliability....

The policies that heretofore have defined **Comsat**'s role in providing services at the international earth stations also are coming under federal review. In anticipation of a changing market, we have developed a plan for major adjustments in our international business arrangements.

In brief, our plan calls for a period of transition during which our World Systems Division would become a competitive "wholesaler" of earth station services. We would sell services tailored to customer needs at rates reflecting the costs of the specific services provided. A tariff would be established to accommodate access to Intelsat satellites at earth stations where the World Systems Division has no ownership interest. In addition, retail services offered directly to the public by **Comsat** would be offered through an affiliate fully separate from our World Systems Division....

Another component of our Rate-Regulated Satellite Services business segment is the maritime communications service we provide as the U.S. representative to **Inmarsat**.

In February, **Inmarsat** completed its first year of operations, with the number of ships and offshore rigs using the Inmarsat network up substantially. We benefited from this success, showing a small profit for 1982 from our maritime services.

In our Satellite Systems and Services business segment, revenues and income increased for 1982. Over the years, our Comstar and Marisat programs have made consistently strong contributions to the Corporation's overall performance. As these satellites approach the ends of their design lives, the leases for Comstar and Marisat capacity will begin to expire, affecting the contributions to earnings from this segment.

continued

The agreement with NBC will certainly replace a portion of the revenues lost as the Comstar and Marisat programs come to an end. In addition, we are pursuing other opportunities that will allow us to take advantage of our satellite systems expertise. Through one such venture announced earlier this year, the capabilities of **Comsat** and the resources of Intercontinental Hotels Corporation are being combined to provide a new international videoconferencing service. From facilities at Inter-Continental Hotels in New York and London, business people can "meet" through video and audio satellite connections. Plans are to expand the network to other Inter-Continental Hotel cities.

You probably have read about the announcement by the Executive Branch of its intention to explore the privatization of the satellite systems providing civil weather and local remote-sensing data. Regrettably, many of these reports have been confused, incomplete and in some cases misleading. In any event, the Executive Branch has announced its intention to solicit and evaluate proposals from private industry as a basis for a final decision. Approval of such a plan would require Congressional action before implementation. Our Corporation believes that there are significant advantages to a privatization of certain of the collection system resources and will look forward to actions that may be taken in this regard.

Early in 1982, we bolstered our Telecommunications Equipment segment through the acquisition of Amplica, Inc. Largely due to the Amplica acquisition, revenues for this segment nearly tripled from the previous year. **Amplica** is a producer of low-noise and medium-power, solid-state microwave amplifiers and related systems for the defense, electronics and commercial satellite communications industries.

TeleSystems, the other company in this business segment, manufactures shipboard terminals, advanced echo cancellers and Time-Division Multiple-Access equipment for the satellite communications industry. The outlook for long-term profitability in the equipment market continues to be positive as demand for new communications services intensifies.

Revenues for our Information Services segment declined during 1982, primarily due to lower demand for the types of environmental services provided by our Environmental Research and Technology company (**ERT**). The depressed economy that led to the shutdown of many manufacturing facilities contributed to this fall off in demand....

Satellite Business Systems (**SBS**), in which we own a one-third partnership interest along with Aetna Life & Casualty and IBM, recorded good revenue gains in 1982. Revenues increased quarter-by-quarter, rising from $5.3 million in 1981 to $39.1 million in 1982. **Comsat**'s after-tax losses related to **SBS** declined by approximately $5 million from the previous year, largely due to a planned reduction in our share of ownership from 41.3 percent to 33.3 percent.

We continue to be optimistic about the long-term outlook for **SBS**. In recent weeks, **SBS** has negotiated the lease of several satellite transponders to customers on a full-time basis. As I mentioned earlier, **Comsat** is among those customers.

Also, **SBS** is providing a growing number of large corporate customers with private communications networks.... In addition, SBS Skyline, introduced in late 1982, places **SBS** in the rapidly growing discount long-distance telephone service market.

The strategic plans we have outlined for **Comsat**, coupled with a prudent plan for financing our capital expenditures, will point the way to our prosperity in the years ahead. Carrying out our strategy will require the optimum use of all of our resources—human, managerial, technical and financial. It will require constant re-examination of the markets in which we operate and re-adjustment of our strategies to meeting changing conditions.

Our investments in the future are aimed at enhanced profitability through maintaining our leadership position in satellite communications. By achieving this goal, we will best serve the interests of our shareholders, customers and employees.

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STC

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ERT

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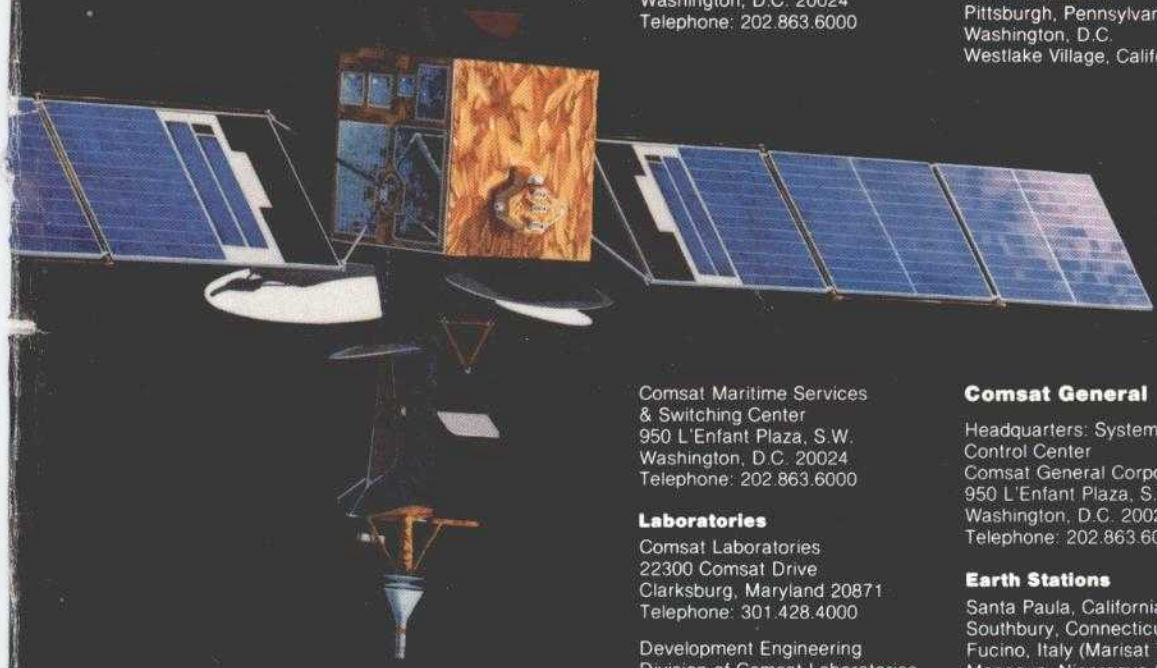

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Earth Stations

Andover, Maine
Brewster, Washington
Etam, West Virginia
Jamesburg, California
Pago Pago, American Samoa
Palau, Rep. of Palau
Paumalu, Hawaii
Ponape, Fed. States of Micronesia
Pulantat, Guam
Susupe, Northern Mariana Islands
Truk, Fed. States of Micronesia
Yap, Fed. States of Micronesia

Comsat General

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Comsat General Corporation
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Earth Stations

Santa Paula, California
Southbury, Connecticut
Fucino, Italy (Marisat TTC)
Managua, Nicaragua (Nicatelsat)

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CGIS

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COMSAT

Comsat at 20

On August 31, 1962, President John F. Kennedy signs the Communications Satellite Act. On October 22, 1962, the Incorporators of the Communications Satellite Corporation meet for the first time. On February 1, 1963, the Certificate of Incorporation creating **Comsat** is signed by an official of the government of the District of Columbia. On February 15, 1963, the new Corporation occupies Tregaron, the estate in northwest Washington that was the home of Joseph Davies, the first U.S. Ambassador to the Soviet Union. On March 10, 1963, the Comsat Board of Directors elect the Corporation's first two principal officers—Leo D. Welch, former Chairman of Standard Oil Company, as Chairman and Chief Executive Officer; Dr. Joseph V. Charyk, former Undersecretary of the Air Force, as President.

Thus begins the 20 years of history of the Communications Satellite Corporation, a history synonymous with the birth, development and flourishing of satellite communications as a commercially viable industry, a history rich in firsts in the spheres of technology, international diplomacy and business.

Our 20 years of history are recorded in the form of a chart of milestones in the center of this magazine. View that chart and, like those of us who have been part of at least some of that history, marvel at all that has been accomplished in so short a time.