COMSAT®

COMMUNICATIONS SA CORPORATION MAGAZINE

NUMBER 4

VIEWPOINT

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

Two recent experiences of mine make clear, I believe, how far we have come in this relatively brief and exciting period of time we call by the name of "the Space Age." Recently I was in Auckland, New Zealand, for the 10th Meeting of Signatories of the International Telecommunications Satellite Organization (Intelsat), a gathering at which I had the pleasant task as Chairman of the previous year's meeting, of convening the meeting, offering the opening remarks and introducing the Postmaster General of New Zealand. While there, I and my fellow Intelsat Signatory representatives had an opportunity to see on local television the truly thrilling landing of the Space Shuttle Columbia culminating its spectacular first mission. As I watched the coverage of the landing of the shuttle, I was impressed not just with how smoothly this historic first mission ended, but with the fact that the witnessing of this momentous space event by multitudes throughout the world depended on an earlier application of space technology in which our organization has been privileged to play such a key role; viz, the establishment of a global communications satellite network. In the television coverage I and my fellow Signatory representatives watched, we saw how routine yet how efficient and effective world telecommunications have become through satellites, for that television transmission reached us in New Zealand via an Intelsat satellite in orbit 22,300 miles over the Pacific Ocean, a Comsat-operated earth station serving the Pacific region and an earth station owned and operated by the New Zealand administration. Thus, an older well-established symbol of the age was introducing to us the newest child in the space family, a child of whom great things are forecast.

A short time later I was in Etam, West Virginia, for dedication of the 14/11 gigahertz antenna at the Comsat-operated earth station there. With the advent of the Intelsat V series of satellites, the Intelsat global communications satellite system is operating not just in the 6/4 gigahertz frequency bands but in the 14/11 bands as well, making possible the increased capacity essential to the rapidly growing demands for greater capacity and new services.

Thirteen years previously, as President of Comsat, I attended the dedication of that same earth station. In my remarks then I told the audience that "this earth station stands as your landmark in the new communications era that has just begun." Since that day, Etam has become the world's busiest earth station.

As with the television coverage via satellite of the Space Shuttle mission, this milestone, this significant expansion both for Comsat and for Intelsat, shows that those of us in the business of making use of space have come quite a long way. Our business retains all the vitality, all the optimism of youth, but it is youthfulness tempered by the maturity that comes through a record of success.

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Publisher: Communications Satellite Corporation
Dr. Delbert D. Smith
Senior Vice President
Corporate Affairs

Editor: Stephen A. Saft

Chief Photographer: William J. Megna

Circulation: Tina Arthur

Contributing Staff: Robert E. Bernier, Division Director, Corporate Promotion; James T. McKenna, Director, Advertising and Promotion; Robert E. Weigend, Director, Government Relations; Edgar Bolen, William L. Brobst, Tish Fonda, Michael K. Glasby, Gunnar Hughes, Patricia A. King, Karen Kipnes, Len Koch, Dorothy S. Kozman, Lani Hummel Raleigh, Jacqueline A. Wakeling, and Kathryn A. Young.
Liaison Assistance: Debra Benham, Marketing Services Specialist, Comsat General Corporation; Judith S. Elnicki, Vice President, Public Affairs, Satellite Television Corporation; Allan Galfund, Manager, Information Activities, Comsat Laboratories; Dallas Gale, Staff Assistant for Communications, ERT; Edmund Harvey, Manager, Graphic Arts; Betsy T. Kulick, Analyst, Intelsat Affairs, International Communications Services; Elizabeth Schulke, Assistant for External Affairs, Maritime Services.

Cover: The historic first mission of the Space Shuttle Columbia begins with liftoff from Complex 39, Pad A, NASA Launch Complex, Cape Canaveral, Florida on April 12 at 7:03 a.m. Photo by William J. Megna.

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From the Editor

The good spirit engendered by the very successful first mission of the Space Shuttle Columbia continues to produce optimistic reverberations throughout this Corporation and, one assumes, in all circles where the business of making use of space is proceeding or contemplated. So strong is that spirit in us, in fact, that we could not resist the temptation of putting a photograph of the shuttle launch taken by our chief photographer, William J. Megna, on our cover, and we could not resist telling our own version of the shuttle story, which begins on page 5.

The article on the marriage of satellite communications and water height monitoring beginning on page 15 was put together only after we spent a week of intensive touring of the Arkansas River, touring which started high in the Rocky Mountains at the headwaters of the river and which involved interviews with a great number of people. We would be remiss if we did not take this opportunity to thank all the people in Colorado who did so much to make the trip such a rewarding experience. The people we wish to thank are cited in the article. They are: Dr. Jeris A. Danielson, Colorado State Engineer; Mr. James F. Blakey, District Chief, U.S. Geological Survey, Water Resources Division; Mr. Jerry Hughes, Subdistrict Chief, USGS Water Resources Division; Mr. Ralph W. Adkins, Director, Water Operations, CF&I Steel Corporation; Mr. Frank Milenski, farmer and President of Catlin Canal Company; Mr. Wayne W. Whittaker, Secretary, Catlin Canal Company; Mr. Robert Jesse of the Colorado Division of Water Resources; and Mr. Larry Jones of the USGS Water Resources Division.

We would also like to thank the Honorable Ronnie Flippo, Chairman of the Subcommittee on Space Science and Applications, Committee on Science and Technology, U.S. House of Representatives for his thought-provoking article entitled, "Man in Space? The Road Not Yet Taken," beginning on page 10.

Stephen A. Saft

Signatories meet in New Zealand

Sixty-four of Intelsat's 106 Signatories met in Auckland, New Zealand from April 13 to 16, 1981, for the annual Meeting of Signatories. Dr. Joseph V. Charyk, President and Chief Executive Officer of Comsat, opened the meeting in his capacity as Chairman of the 1980 meetings. Mr. W.H. Hickson, Director General of the New Zealand Post Office, was elected as the new Chairman, and Mr. T. Hidaka, Chairman of the Board of KDD (Japan), was elected as Deputy Chairman. One of the major activities of the Meeting of Signatories is to determine the minimum investment share required for representation on the Intelsat Board of Governors; this year, the minimum share has been set at 1.7 percent, which is the share currently held by Nigeria, the thirteenth largest Intelsat investor.

The Meeting of Signatories approved a recommendation by the Board of Governors to increase the Intelsat capital ceiling from $1,200 million to $2,300 million for financial commitments including modified Intelsat V and Intelsat VI spacecraft and launch vehicles, and construction of the new Intelsat headquarters building.

Finally, the meeting approved the determination that the provision of space segment to Mexico for its domestic public telecommunications requirements is to be considered on the same basis as international public telecommunications services. In the past Intelsat has made similar rulings concerning the provision of domestic services for Algeria, Australia, Brazil, Chile, Colombia, Denmark, Nigeria, Peru, Sudan, and Zaire.

Microtest receives power supply license

Comsat Laboratories has licensed Microtest, Ltd., of Bodmin, Cornwall, U.K., to manufacture and market an earth station high voltage power supply designed and developed by Comsat Labs Electric Power Department. The power supply meets the requirements for an efficient and reliable power conditioning and control unit to operate a helix-type traveling wave tube (TWT) producing 300 watts output power at 6 gigahertz. Helix-type TWTs have an advantage over the coupled-cavity-type TWTs in that they provide the broadband capability required for satellite communications.

A number of TWT power supplies have been built to meet Radio Frequency (RF) Laboratory requirements for use in the high power amplifiers and have been successfully used in the Reliable Earth Terminal station at Comsat Laboratories.

First Quarter results are reported

Comsat has reported Net Income of $20,109,000, or $2.51 per share, for its consolidated operations for the first quarter of 1981. Included in Net Income for the first quarter is a non-recurring item in the amount of $11,769,000, or $1.47 per share, resulting from a change in accounting policy. As of January 1, 1981, the Corporation changed to the flow-through method of accounting for investment tax credits on all of its property which is not public utility property. This change accelerates the reporting of earnings resulting from investment tax credits that would otherwise be reported in subsequent years. The Corporation has adopted the flow-through method, which is commonly used by commercial and industrial corporations, in recognition of the growth of its diversified businesses. Overall, the results represent an increase of $10,220,000, or $1.27 per share, from the first quarter of a year ago.

Net Income Before Cumulative Effect of Change in Accounting Policy for the first quarter of 1981 amounted to $8,340,000, or $1.04 per share, a decrease of $1,549,000, or 20 cents per share, from the first quarter of 1980 and a decrease of $1,377,000, or 18 cents per share, from the fourth quarter of 1980. The decrease from the first quarter of 1980 is attributable primarily to planned increases in costs related to Satellite Business Systems (SBS), a partnership formed by Aetna Life & Casualty, IBM and Comsat General Corporation, Comsat's wholly owned subsidiary, to provide advanced communications satellite services primarily for business customers. The decrease from the fourth quarter of 1980 is attributable primarily to an 11.8 percent reduction effective January 1, 1981 in the rates Comsat charges for services it provides through the Intelsat System.

The Comsat Board of Directors has declared a quarterly dividend at 57.5 cents per share, payable June 8 to shareholders of record on May 8.

Operating Revenues for the first quarter of 1981 totaled $77,934,000, an increase of $7,904,000 from the first quarter of 1980. Operating expenses for the first quarter of 1981, including income taxes, were $67,340,000 up $7,807,000 from the first quarter of 1980.

The Corporation's share of losses and amortization of certain costs related to SBS is included in Other Income (Expense)—Net. The SBS-related expenses reduced Net Income for the first quarter of 1981 by $4,183,000. The reduction attributable to SBS for the first quarter of 1980 was $2,428,000.

Operating Revenues for the first quarter of 1981 were down $4,036,000 from the fourth quarter of 1980, Operating Expenses were down $2,819,000, Net Operating Income was down $1,217,000 and Net Expense under "Other Income (Expense)" was essentially unchanged.

Labs Director keynotes Kuwait conference

Dr. John V. Harrington, Senior Vice President for Research and Development and Director, Comsat Laboratories, delivered the keynote address at an international symposium, "Innovations in Telecommunications," held in Kuwait, April 4 through 8. Forty-one speakers from the United States, United Kingdom, France and Kuwait presented papers at the symposium.

The symposium, sponsored by the Kuwait Foundation for the Advancement of Sciences, was attended by other Comsat staff: Pier L. Bargellini, Senior Scientist, who served as a program committeeman and session chairman, S. J. Campanella and R. J. Fang, all from the Labs and David W. Lipke, Comsat General, all of whom presented papers.

Dr. Harrington's address dealt with trends in electronic information transfer. He described the development of electrical communications from the discovery of electromagnetic waves and the important early practical applications of electrical phenomena. He spoke of the advancement of the technology from amplifying devices, which had such a "profound effect" on the development of radio communications, to vacuum tubes and the solid-state amplifier.

Dr. Campanella's subject was voice processing techniques while Dr. Fang's paper dealt with a bandwidth and power efficient modulation system. David Lipke's dissertation was on the subject of maritime satellite systems.

Third East Coast earth station plans are announced

Comsat World Systems Division has announced that it plans to construct a $50-million satellite communications earth station in central Pennsylvania to handle the growing volume of international communications traffic in and out of the eastern United States.

Comsat World Systems Division, which is responsible for constructing and operating the new earth station on behalf of the U.S. Earth Station Ownership Consortium (ESOC), has secured an option on a 107 acre site in Cleveland Township approximately 10 miles from Bloomsburg. Comsat will have a 50 percent ownership interest in the new facility. The other ESOC members which will have an ownership interest in the new facility are AT&T, ITT WORLDCOM, RCA GLOBCOM and Western Union International.

"This earth station will provide the Bloomsburg area with additional jobs and revenues, and the new station will be fully compatible with the existing environment," said Robert Kinzie, a Comsat World Systems Vice President. "This facility is key to Comsat's continuing ability to meet the growing need in the United States for reliable international satellite communications."

The planned site was selected because it lies in an area with very little radio frequency interference, an important factor in the clear reception and transmission of international satellite communications. The communication traffic consists primarily of overseas telephone calls, as well as television, telex, facsimile and data services.

Current satellite traffic between the United States and other points in the Atlantic Ocean region is expected to double in volume by 1985, and to double again by 1991.

Today, traffic among points in the Atlantic Ocean region and the eastern United States is served by earth stations located in Etam, West Virginia and Andover, Maine. Each of these two stations handles more international traffic than any of the other 263 earth stations in the world-wide system serving more than 130 countries.

Intelsat VI RFP released

The Request for Proposals (RFP) for the Intelsat VI satellite, with nearly triple the capacity of the Intelsat V, was released by Intelsat on March 26. The action followed the approval of the RFP by the Intelsat Board of Governors at its meeting in March. Culminating studies begun in the early 1970s, the Intelsat VI is expected to meet system requirements into the 1990s. Intelsat plans call for responses to the RFP to be received in July 1981, with contract award to the successful bidder expected in early 1982 and delivery of the first spacecraft in 1986.

The Intelsat VI will be the most complex commercial communications satellite ever built, and, at nearly two tons, it will be one of the heaviest. Designed to take full advantage of the launch vehicles expected to be available by 1986, Intelsat VI will be compatible for launch by both the U.S. Space Transportation System (Shuttle) and the European Space Agency's Ariane 4. Through the use of highly advanced frequency reuse and multiple access techniques, the Intelsat VI will have a capacity of some 40,000 voice circuits, plus capacity for TV and SPADE services. The VI will serve as the vehicle by which the Intelsat system will move from predominantly analog modulation schemes to the more efficient digital modes of transmission, thus permitting significant increases in system capacity.

Included in the RFP is a request to bidders to consider the addition of an option package, including use of some of the frequencies allocated by the 1979 World Administrative Radio Conference, and to increase power in the global transponders for enhanced television quality and increased FM capacity. Bidders are also asked to address an upgraded Intelsat VI to take advantage of anticipated expanded launcher capability; and specifically to respond on a sample growth capabilities package of a 10-year design life, plus maritime communications capability or more use of the newly allocated frequency bands.

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The Space Shuttle
Comsat's Role

by Arnold W. Meyers, Manager, Operations International Communications Services

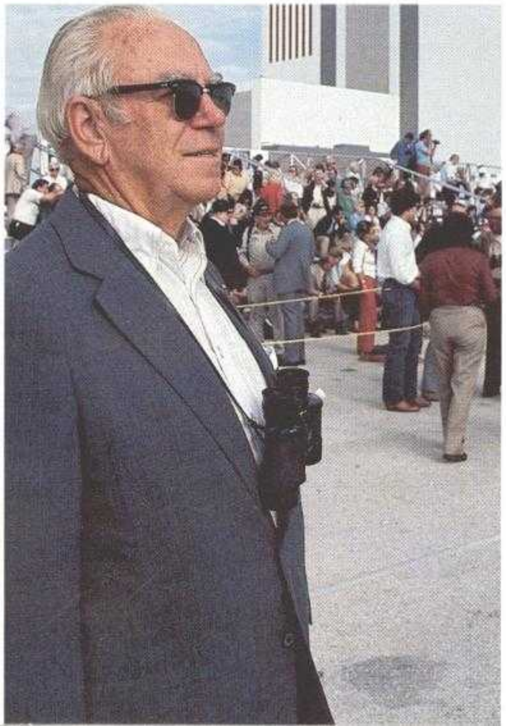
Another step toward fulfillment of man's dream to expand his knowledge of the universe was realized on April 12, 1981 when the Space Shuttle Columbia was successfully launched from Complex 39A at NASA's Kennedy Space Center. This first mission of the Space Shuttle Columbia was designed to prove that the same vehicle could perform three distinct roles—rocket, spacecraft and glider—and that a vehicle returning from space could remain in sufficiently good condition to make its reuse possible. Some specific objectives of the mission were the verification of the maneuvering capability of its engines, the operation of multiple onboard computers and the opening and closing of payload bay doors while 170 miles above the earth's surface. All indications are that this flight met or exceeded its objectives.

Besides this one, three more test flights will be flown in the next 18 months by the Columbia. When the test flights are complete, each Space Shuttle will be prepared for use in at least 100 missions; and as a spacecraft/aircraft the shuttle will be able to place 65,000 pounds of equipment, such as satellites and unmanned spacecraft or fully equipped scientific laboratories, into orbit for further space exploration and research. The shuttle will also be prepared to return 32,000 pounds of payload back to earth.

As the final countdown of this test flight approached and the Columbia sat poised, ready for the historic mission, we at Comsat together with NASA's Goddard Space Flight Center were completing last minute details that would allow the Columbia to keep in contact with NASA's mission control at the Johnson Space Center throughout the three-day flight.

Comsat's primary concern in corroboration of the Columbia's mission was to ensure the continuous operation of that portion of the NASA communication network that is accommodated via Comsat's earth stations and Intelsat satellites. The NASA communication network, referred to as "NASCOM," is a worldwide two million circuit-mile communication network which provides instantaneous voice and data communications in support of the space shuttle mission. Comsat provides an essential part of the NASA communication network connecting the various NASA stations that track the Space Shuttle Columbia and mission control. Preparations for Comsat's support began as early as December 1980 shortly after we received a letter from Leonard C. Manning, NASA Communications Manager at Goddard Space Flight Center—the nerve center for NASA's communication network. Mr. Manning reminded us of the importance our satellite system would have in the overall success of the mission and stated that "the Intelsat system plays a critical role in the worldwide NASA Communication Network. It is essential that we continue to receive the excellent support we have enjoyed in the past if our support of the Space Shuttle missions is to be realized. I am confident we can count

John D. Harper, Comsat's Chairman of the Board, at Cape Canaveral awaiting launch of Space Shuttle.



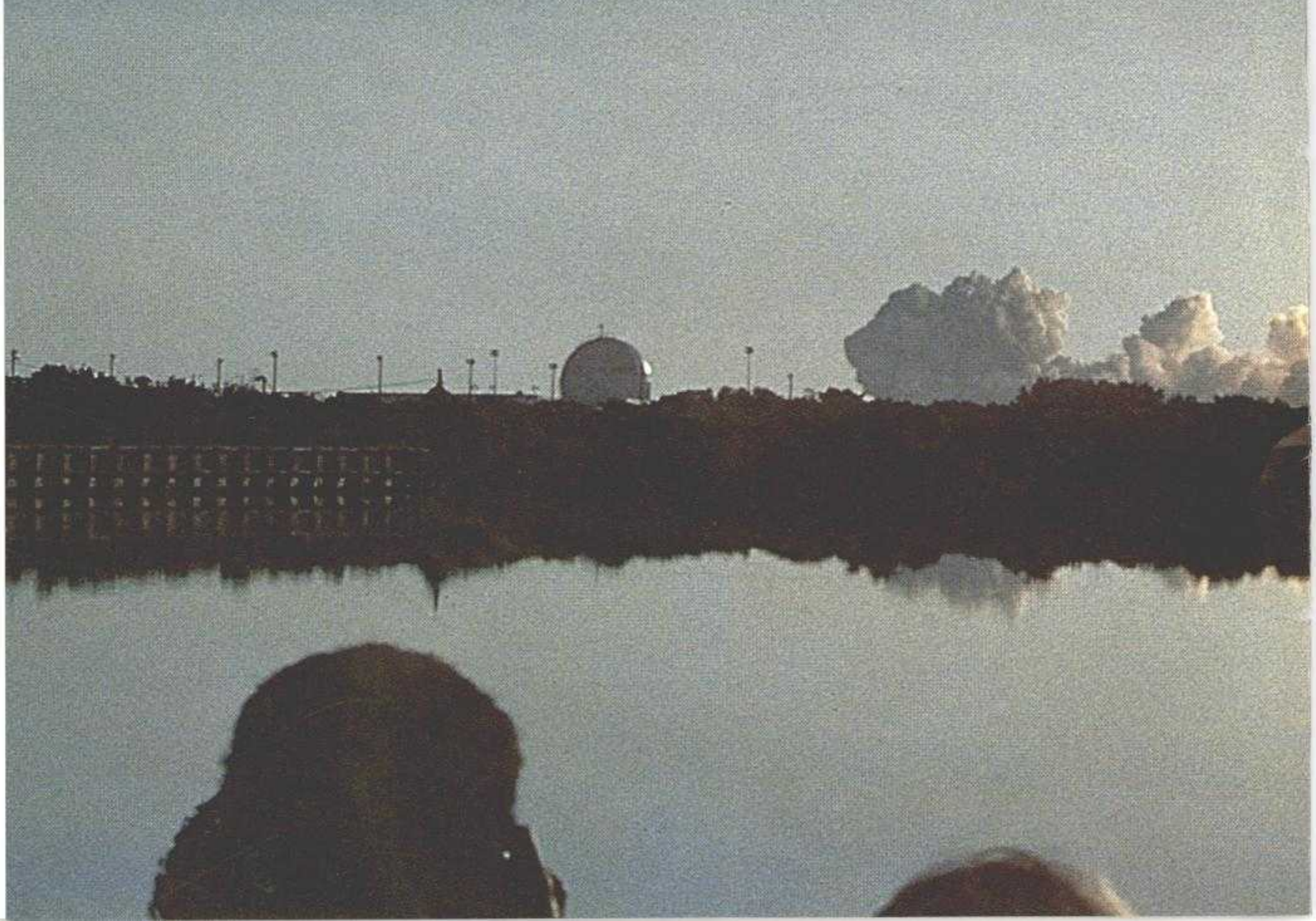
on that support."

What NASA required of **Comsat** was that we take every precaution possible to ensure that the Space Shuttle voice and data information collected at NASA tracking stations in Bermuda; Devils Ashpit, Ascension Island; Kauai Island, Hawaii; Dan Dan, Guam; Orroral Valley, Australia and other locations around the world arrive at NASA without interruption. In preparation for this support and to prevent, to the extent possible, any interruption to the NASA communication network, NASA systematically conducted several pre-launch exercises to verify the integrity and performance of their network. These exercises, termed by NASA as "Special Coverage," placed all points along the communication path on alert that a phase of launch preparation was in progress. During these periods of "Special Coverage," a test firing of the shuttle's main engine was conducted and functions of on-board flight systems were verified along with a number of other tests that, in effect, simulated actual launch conditions.

After a number of simulations were conducted and precisely at launch minus 50 hours, NASA again placed its communications network into "Special Coverage." This time it was not a simulation. As launch minus 8 hours approached, the NASA communication network was placed in a new facet of readiness, termed "Critical Coverage," which continued throughout the mission and terminated when the Columbia safely landed at Edwards Air Force Base in California.

During the mission it was the NASA communications network that carried the essential information monitoring the performance of the Columbia and provided voice communication with the astronauts. The voice and data information was transmitted from the Columbia to one of NASA's worldwide spaceflight tracking and data network (STDN) stations and then was sent to an associated earth station operating in the Intelsat system. The signals were in turn transmitted via an Intelsat satellite to **Comsat** earth stations located on the East and West Coasts of the United States and then extended to NASA.

In addition to providing part of the essential communications link for NASA, **Comsat** took a number of precautionary measures to ensure that the quality and integrity of the Intelsat communication network was of the highest standard possible. **Comsat** personnel at Headquarters in Washington, D.C. and technicians at earth stations located in Paumalu, Hawaii; Jamesburg, California;



Pulantat, Guam; Andover, Maine; and Etam, West Virginia supported a number of NASA simulations and were on constant alert throughout the entire mission. Operations and maintenance activities at the **Comsat** earth stations were carefully planned with all NASA schedules in mind, and maximum attention was given to any maintenance problems associated with the NASA circuits. Redundant equipment at the **Comsat** earth stations was tested and verified for proper operation in the event of a failure, and emergency equipment such as generators for power and light was prepared for instant use. Contingency plans for restoration of any of the **Comsat**-provided segments were reviewed to make certain they could be put into effect should an emergency arise.

The mission rules from NASA were clear: An interruption to selected **Comsat**-provided communication links prior to liftoff, and the countdown could be brought to a halt. To ascertain the continuity of our service, we remained in continuous contact with NASA to secure real-time information on the mission.

Through use of escalation procedures and paging devices, we made certain that key **Comsat** individuals could be reached 24 hours a day to provide assistance should it be required for resolution of emergency conditions involving the **Comsat**-provided system.

As the last minutes of a flawless shuttle mission approached, we watched with awe the television pictures of a perfect landing at Edwards Air Force Base. **Comsat** also televised to the world the whole historic event—both launch and landing and segments in-between. As one NASA official put it, "The Space Shuttle is truly a worldwide event." The hours of preparation were well spent and our communication support to NASA was as successful as the mission itself. On April 17, 1981, **Comsat** received this message from an official of NASA: "I want to take this opportunity to personally thank you and the employees of your organization for the support you provided for America's first Space Shuttle flight. As the entire nation watched one of the most flawless manned spaceflight efforts to date, we in NASCOM also observed the excellent performance of our circuitry. Any problems that occurred (and they were few) were handled in an extremely professional and competent manner, and the majority of problems were

Moments after liftoff, the shuttle casts a beautiful reflection in a canal off of the Banana River. All photos except landing by: William J. Megna.

dispatched in short order. I can unequivocally state that there were no NASCOM problems that impacted support of the STS-1 mission.

"As a matter of interest, this was the first major mission where extensive use was made of the wideband (56 kilobits per second and 224 kilobits per second) data circuits from the spaceflight tracking and data network (STDN) stations. From our pick up of the pre-launch count on April 11th at 1100Z until after the landing on the 14th at 2200Z, our preliminary figures indicate NASCOM transmitted to the mission control center at the Johnson Space Center over 14 million 4800-bit blocks of data. Of this 14 million, only 578 blocks were received in error giving us a good block throughput of 99.996 percent. Our initial analysis of the astronaut air-to-ground circuits indicates performance was also outstanding with only three conversations breaking up, and this was attributed primarily to loss of signal (LOS) at the STDN stations. Collectively, we have established a new benchmark of excellence that we can aspire to achieve on all flights. I am confident that with your continued cooperation, this can be achieved in the future. Again, I thank you for your excellent support.

"Signed: William B. Dickinson, Chief, NASA Communications Division, Goddard Space Flight Center, Greenbelt, Md."

Below, the shuttle moments before touchdown on a dry lake bed at Edwards Air Force Base, California, April 14, 1:20 p.m. EST. Right, Comsat officers Donald E. Greer and Delbert D. Smith watch launch.

As in previous manned spaceflights, the international system of communication satellites and earth stations contributed an integral part in support of the mission. We look forward to the continued success of the Columbia and to the future of NASA's entire Space Shuttle program.

COMMENTARY

by Dr. Delbert D. Smith
Senior Vice President, Corporate Affairs,
Communications Satellite Corporation

"The shuttle is a marvel of space technology. If all goes well, Columbia will pave the way for incredible new space programs." Such exclamations were frequently heard among the numerous spectators waiting during the quiet, pre-dawn hours prior to Columbia's launch this past April. The crowds populating the reviewing stands, alongside NASA's mammoth vehicle assembly building, were sprinkled with politicians and celebrities; all of whom shared the hope that the launch would authenticate their claims and meet their expectations. As the Columbia stood on its pad, illuminated by the searchlights, one could feel the enthusiasm and desire for success which permeated the crowd. It was almost as if the onlookers expected to drive the Columbia upward by sheer force of will.

What transpired that day and during the remaining 52 hours of the unquestionably successful space shuttle mission, is now history. The excited assertions made in the hours prior to the launch, by those individuals fortunate enough to be present, afterwards gave way to serious contemplation of the shuttle's impact on society. For those in the satellite communications industry, the shuttle's success brings an element of reality to futuristic communications concepts, which are dependent on the ability to orbit larger, heavier and more sophisticated space systems.

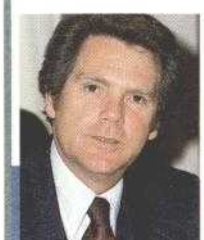
A new generation of satellites will become feasible, increasing the scope and magnitude of our current global communications networks. As a result, significant changes will occur throughout all segments of society, in people's life-styles and in the way that business is conducted. For example, individuals in the future may be able to shop, pay bills, conduct banking transactions, attend classes, vote, consult doctors, receive mail, direct inquiries to the local library, and visit with friends and relatives, all without traveling. In the corporate world, teleconferencing may become widespread, transmitting not only words and graphics, but expressions as well, thereby becoming a fully interactive medium.

In the not too distant future, a typical office desk may be transformed into an electronic console. Mail, reports and memoranda will be electronically displayed and stored, and the controls for these systems could eventually become voice activated. At that point the medium would become "transparent" because people could interact with others who are thousands of miles away in the same manner and often with the same effectiveness as if they were in the same room together. What may be the most dramatic change in our society, brought about by future communication systems made possible by the space shuttle, is physical decentralization. Offices and factories could be spread across the country without losing their production coherence or their effectiveness because of their ability to interact with advanced space communications systems. In fact, much of the work done in today's offices may eventually be completed by workers in their homes. These potentials can be realized to a large extent through advanced space communications systems. With the fact of the Columbia's successful mission, we have proof that our technological capability is established. It now remains for us to utilize this capability effectively for the benefit of the public.

The Road Not Yet Taken

M A N I N

by the **Honorable Ronnie Flippo**, Chairman
Subcommittee on Space Science and Applications
Committee on Science and Technology
U.S. House of Representatives



The invitation to submit this article came as a very welcome opportunity. Many readers may know that I have just been elected Chairman of the Space Science and Applications Subcommittee by my colleagues on the House Committee on Science and Technology. Becoming Chairman at this time gives me a good chance to take a fresh look at our space program and where it is going. I intend to focus on our man-in-space program.

While I do plan to review our space plans and goals thoroughly, critically, and without preconceived notions, I will be working with a definite point of view. I have served on the Space Science and Applications Subcommittee for the last four sessions of Congress, under the leadership of Committee Chairmen Olin E. Teague of Texas and Don Fuqua of Florida successively and I expect to continue in their constructive tradition. I believe the benefits of our space program have greatly exceeded its costs in the past, and I believe that the same positive balance would hold in the future. With the new Administrator of NASA and a new administration settling into place, now is a good time for a tough, explicit review, to address our space policy directly and not merely to arrive at a *de facto* policy through an accumulation of small decisions.

More importantly we are now on the threshold of having new operational capabilities in space. I refer of course to the great success of the first flight of the Space Shuttle. We know now that the Shuttle works and this will give us the resolve to push through the tedious problems that will arise as we try to make the Shuttle operational and reduce the turnaround time. We will be able to put man into space in a benign environment and eventually we will do this relatively economically and routinely. Low-earth orbit is accessible to large payloads—Shuttle design capability is 65,000 pounds. We will be able to learn even more about the planet we live on. Although we have been exploring our home planet scientifically for perhaps 200 years, remote sensing from space continues to reveal new things, and Shuttle capability will undoubtedly increase the rate of discovery.

I am particularly intrigued by what we can learn from a program of remote sensing for geological applications. This is an area which clearly has major importance to the private sector, and in time will be taken over by them after NASA has shown the way. Thinking of this program, I am reminded of an image suggested by Laszlo Versenyi. Writing on limits to growth in the *Berkshire Review*, he naturally enough considers resources, and writes of a cave man thousands of years ago. All reasonable people would agree that the cave man was poor, very poor, yet when he looked out from his cave he was (unknowingly of course) gazing on great wealth—ores, coal, petroleum. But he could not tap them. Versenyi notes that the natural resources available to us "ultimately depend on human resources, i.e. on human resourcefulness." I do believe that our space program will increase our resourcefulness. Who knows what wealth we are now overlooking?

I want to expand on this idea of "resourcefulness" as a way of discussing our space program. It is a matter of faith for Americans that one way we become more resourceful is through research and development. Our civilian space program is made up of such research and development activities. What we are looking for is the relationship between research and the consequent economic activity that would indicate an increase in resourcefulness. I don't hope to derive a strict cause-and-effect relationship—that has been unsuccessfully sought by many before me—but Lester Thurow in his book *The Zero-Sum Society* discusses the research/economics relationship in a way that I find illuminating. He

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compares the relationship to building a road into an undeveloped area, an apt comparison in that building a road can make new resources available. In this image scientists are like scouts, far ahead of the actual builders, exploring and mapping the countryside. From all the area mapped, the engineers then pick the best route and make plans. These are the developers of technology. The truth of the matter is, however, that the road won't be built—i.e. the technology developed and put to work—unless there is an economic driving force. I like this image because it teaches three lessons about research. First, you have to map a large part of the countryside, not just a right-of-way. Some of the mapping—some of the research—will be "wasted," but you can't know the best route if you don't know most of the countryside. Second, it makes clear the futility of trying to predict the economic driving force before the countryside is even explored. The final lesson is that although we know that roads are for the most part good, or at least can be made benign, they don't all lead to gold mines.

How does this apply to our civilian space program? Writing in this magazine, I need not recount the success of the space communications business. This is a road that has been built, and is being widened. It is important to remember that the use of space to enhance communications on earth is a special case, because the telecommunications system already existed: Most U.S. homes already had a television and telephone, and in the case of all telephones and many television sets the users were accustomed to paying monthly service fees. At the risk of being too simple, all we had to do was replace a limiting link with one of much greater capacity. Other areas of potential application may not have an existing infrastructure that can be so easily utilized to deliver the benefits of space technology, which means that the economic driving force may be hard to elicit.

In its present status, our Landsat capability is analogous to the road that is mostly designed but not yet built because the economics won't drive it. As I have indicated previously in discussing geological applications, I think that events—shortages—will force us into developing and using an operational remote sensing capability for mineral and energy exploration, but we aren't there yet. A bit of reflection on this reveals a failure mode that I fervently hope we are wise enough to avoid. It is a failure that can occur if we wait too long to develop this particular new resourcefulness. Undoubtedly resource shortages, as with petroleum, reduce our aggregate wealth and restrict our budgets. Doing research and development requires non-capital investment funded by the deferral of present consumption. When our aggregate consumption is already reduced (as by a petroleum shortage of the kind that we are threatened with), then it becomes politically difficult to put more of our wealth into developing a remote sensing system that will pay off some time in the future. We must not wait to exploit the capabilities of space until they become prohibitively expensive in a shrunken economy. Rather we must use them now to create more wealth.

At this point, I want to address the fundamental question of where we should go with respect to man in space. This question is in the stages of exploration where we must think hard, and ask hard questions. I believe intuitively that man has an economic role in space but I know that intuition won't get a funded program through the Congress. I need to build an argument, an argument that will produce a favorable consensus.

continued next page

First, let's acknowledge that there are some obvious roles for man. Astronauts can repair and adjust equipment on satellites. They can replace instrument modules, as is now planned for the space telescope. Generally, this amounts to taking advantage of the adaptability and flexibility offered by man. In other respects man is not very adaptable, and this is a drawback. I am thinking of the life-support and safety systems demanded for manned missions which make them very expensive. Further, the presence of man can degrade system performance: for example, men moving about in a spacecraft reduce the effective pointing stability of a telescope mounted on the spacecraft.

This is where we are now. We may have learned just enough to become preoccupied with the problems and difficulties. We need to look further.

We need to ask whether there is a broader role for man, and what is that role? For example, do we need a permanently manned space station? Why, or for what purpose? At this time perhaps what we need is only a "bunkhouse" for short stays, something that would free the Shuttle for travel and not demand that time for work in space be balanced against shuttle launch-to-launch turn-around requirements. What about geostationary orbits? What about large communications stations or even a solar power satellite? I don't want to fall into the trap of looking for payoffs before the countryside is explored, but what are the potential benefits of having a man in space?

Should we be considering manned planetary exploration? Does this mean that we should begin developing a new family of vehicles?

I believe that we are going to learn a great deal about how the earth's weather and climate phenomena are governed by apparently unrelated events on the sun (again this is intuition). To reach the desired level of understanding of this interaction I think we may have to combine traditional solar-terrestrial physics studies with planetary exploration. In other words, we may have to expand the scope of our comparative planetology efforts. Would the presence of man in space help in this effort? Do we need "bunkhouses" orbiting other planets?

Finally, we in Congress must ask—what other questions need to be asked? Are we being too timid? How can we think broadly and boldly without slipping into baloney?

One is not encouraged by reviewing the history of the kind of technological forecasting we need to do. Nevertheless, perhaps rushing in where wise men would not, I hope to lead the Subcommittee on Space Science and Applications in asking these questions. While we have to keep a civilian space program alive, and that means fighting day-to-day budget battles, we also have to look ahead. As T.S. Elliot has observed, "The fact that a problem will certainly take a long time to solve, and that it will demand the attention of many minds for several generations, is not justification for postponing the study...Our difficulties of the moment must always be dealt with somehow: but our permanent difficulties are difficulties of every moment."

I am determined to grapple with the problem of where man is going in space. If in my tenure we don't find the final answer, we will at least have made a departure and left a record and a civilian program for others to build on.

CHAPTER TWO:

SATELLITES AND NATURAL RESOURCES

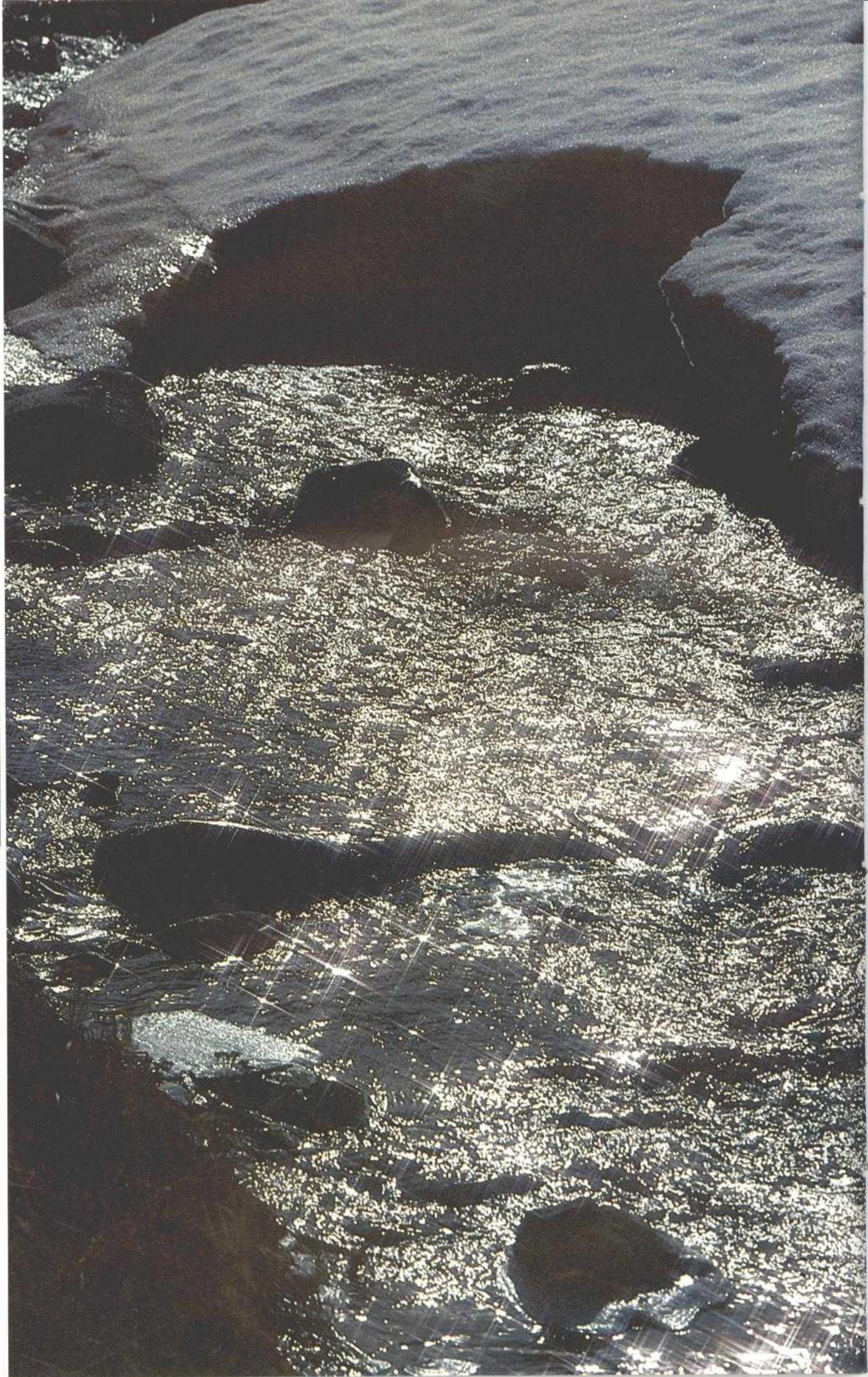
by Richard S. Bodman, President and Chief Executive Officer, Comsat General Corporation

Several years ago **Comsat** decided that a major new opportunity for our satellite and related technologies lay in the accelerating global need to better understand, manage and develop natural resources. We built upon our communications, engineering and systems strengths by adding expertise in the physical sciences, data processing and natural resource management. The acquisition of Environmental Research & Technology (**ERT**) in the summer of 1979 was the key to this addition of expertise. We are combining the unique coverages of satellites to meet the need to measure often dispersed and remote resources on earth and to tie together the system by use of distributive automatic data processing. The end result will be more accurate, useful and timely information for resource managers, both public and private. Our initial entry into this exciting field began last August when the first 15 water stage measuring stations in New England became operational in a Pilot Program sponsored by the U.S. Geological Survey. (See **Comsat Magazine**, Issue Number 2, for the basic details of the Pilot Program.) Today we have 105 data collection stations operating in Arizona, Colorado, Pennsylvania, Texas and New England. We are concluding a start-up period which will move us from installation, test and refinement to the development and delivery of enhanced information services.

The following pages describe our early experience in providing hydrologic information to the water managers and users of Southeastern Colorado. Our story focuses in part upon the reactions of this diverse community of water users to our first operational results, and their views about its potential. Through the invaluable aid of the U.S. Geological Survey, Water Resources Division, and its Pueblo Subdistrict, we were able to capture the importance of water and its effective management at the grass roots. Those with experience with the system or who see its potential tell their own story, which I will not try to embellish upon here.

However, I would like to take this opportunity to look into the future. I am convinced that we made the right decision three years ago to go into the resource information service business. The opportunities for **Comsat** to contribute to improved resource use are limited only by our imagination, skills and dedication. Together with our customers, I believe we will be able to achieve startling advances in techniques, productivity and cost efficiencies similar to those made in satellite communications between Early Bird and Intelsat V, and I am especially excited about the prospect of our being able to provide our services at continually declining rates to our customers, as has happened with our Intelsat business.

I also am confident that our currently limited range of water data products and services in Colorado will be expanded to include dynamic information about rainfall, snowpack, irrigation, water quality and industrial processes. The future will also bring new information service opportunities in the marine environment, forests, mineral development, transportation and a host of other applications. In summary, this is the second chapter in what I trust will be a new volume of **Comsat** products and services.



The Arkansas:
Story of a River

In the administration of a river in Colorado, satellite communications is beginning to play a significant role.

by ***Stephen A. Saft,*** *Editor*
Photography by ***William J. Megna***

In Colorado, the demand for water has almost always exceeded the supply. As a result, water in Colorado has long been the object of intensive efforts to control what there is and to find ways to tap still more sources. Thus, Colorado bears a common history with most of the other states of the western United States.

Now faced with even greater demands on what water there is, the result of burgeoning population growth and the continuing high demands of traditional water users in agriculture and industry, Coloradoans are finding the need to manage the water they have and the need to develop new sources even more critical than before. And they are finding the marriage of satellite communications with water gaging an extremely helpful water management tool.

We learn these things as we trace the course of one of the major rivers originating in the state—the Arkansas—over much of its 300-mile course within the state, a river that within state lines already has 14 satellite-linked gaging stations on it, a river already burdened with heavy demands. We learn these things as we talk to water experts with the federal government, to Colorado water officials and with representatives of principal water using groups—the farmers and industrialists.

Among peaks towering 14,000 feet above sea level, the Arkansas River begins as a series of streams carrying the product of melting snow. Near the mining town of Leadville (elevation over 10,000 feet), the streams converge for a moment of high-mountain serenity called Turquoise Lake, then move on as a single surging creek. Rushing steadily downward, the creek fills with the bounty of still more mountain tributaries, creeks bearing names like Clear, Pike, Cottonwood, Chalk, Browns and the South Arkansas.

By the time it reaches the town of Salida, about 60 miles to the south, the Arkansas is a river, a small one, but still a river. Later, it will pass by cities with names like Pueblo, Wichita, Tulsa, Muskogee and Little Rock.

In all this river called the Arkansas, the 13th largest river in the United States, the 44th largest in the world, flows through four states—Colorado, Kansas, Oklahoma and Arkansas—over a course 1,459 miles long before finally spilling into the mighty Mississippi about 100 miles southeast of Little Rock in the State of Arkansas. As it travels, the river takes the bounty of lesser streams,

"We have the ability to interpret water problems using computer models, which take into account all the elements of the hydrologic cycle, how they affect each other, and how geology plays a part... The more complete the real-time data network, the better."

Jerry Hughes, *Colorado Subdistrict Chief, Water Resources Division, U.S. Geological Survey*

"When you are administering on a real-time basis, you need to have input on a real-time basis as to what's in the system. That's why I see this satellite communications approach as being very useful."

Dr. Jeris A. Danielson, Colorado State Engineer

Once water flowed here. Section of Catlin Canal Company irrigation ditch devoid of water.

creeks and rivers covering an area of land 150,000 square miles in size. And when it finally gives up its own bounty, it fills the Mississippi at the average rate of 45,100 cubic feet of water per second.

Seeing the Arkansas River as a beautiful gushing creek high in the Rocky Mountains, one wants to imagine it as pristine and unsullied by human intervention as we think it must have been in earlier times when members of the Ute and Arapahoe nations and other Indian tribes that lived on the land we now call Colorado camped along its shores. What else we see and what we learn as we talk to people who know the river leaves a different impression.

We see the dam that forms Turquoise Lake. We see the Charles H. Boustead Tunnel which brings water a distance of over five miles from the western side of the Continental Divide as part of a large-scale water diversion effort called the Fryingpan-Arkansas Water Project. We see the Pueblo dam and the six-mile-long lake it forms near Pueblo, Colorado, a city of 100,000, and from which the water for hundreds of thousands of acres of farms comes and, too, upon which the burgeoning city of Colorado Springs, population about 350,000, also in part depends. We see the dam for the Catlin Canal Company and much of the Catlin's system of irrigation ditches which by itself supplies the water for about 450 of those farms covering about 20,000 acres. We hear about all the other dams, canals, and diversion tunnels that do something to the river by which humankind seeks to exercise control over—that is, to make beneficial use of—its precious store.

The fact is, water is far too valuable a commodity in the West and especially along the Arkansas River not to have been the object of man's need to exercise control. Interestingly, so heavy is the demand for the Arkansas's water that by the time it reaches Garden City, Kansas, it is normally bone-dry. Significant replenishment does not really occur again until it wends its way through Oklahoma.

Frank Milenski, a farmer from the heart of Colorado's Arkansas River Basin and for 21 years President of the Catlin Canal Company, tells us, "There is nothing more valuable than water. It is the lifeblood of the West." Jerry Hughes, Colorado Subdistrict Chief with the Water Resources Division of the U.S. Geological Survey in Pueblo, makes sure we understand how that lifeblood is valued along the Arkansas River. "Water is money in this river system," he tells us, "and millions of dollars are spent in managing it."

Through the combined efforts of government agencies, both state and federal, the attempt is made to account for every single drop of water in the river at every moment in time. The principal agencies are the U.S. Geological Survey (USGS), the nation's collector and repository of information on many of our natural resources including water, the U.S. Bureau of Reclamation and the U.S. Corps of Engineers, the latter two of which build and operate dams and other water control structures, and the Colorado State Engineer's office. In the State of Colorado, it is the State Engineer who has the lead position when it comes to regulating the use of water in the state.

We learn that the management effort conducted by the State Engineer in concert with the USGS and other federal agencies is not motivated by bureaucratic caprice. On a river like the Arkansas where what water there is has long been overappropriated, it is the users of the water who demand its orderly regulation. Without clearly defined rules on its use and people empowered to see that those rules are carried out, obtaining water would be a chaotic and dangerous free-for-all.

We learn that the principle upon which water use is regulated in the state is called the Doctrine of Prior Appropriation. Dr. Jeris A. Danielson, the Colorado State Engineer, tells us about this. The Doctrine of Prior Appropriation "means first in time, first in right," he says. "That is generally the water law throughout the arid West. That means the first person to put the water to use has the better right. On nearly all of our streams there are more users than there is water available. This means we curtail the junior users to make sure the senior users get their required amount."

Irrigation Division Engineer Robert Jesse of the Colorado Division of Water Resource is the man under Dr. Danielson directly concerned with determining who gets the water available along much of the Arkansas including how the water that is stored in the six-mile-long reservoir behind Pueblo Dam is disbursed. Like his boss, Jesse has trouble with the word "manage" and prefers to say that his job is to "administer" the water of the Arkansas.

It is Jesse and the people who work for him who have the very complex job of determining, based on the amount of water available, how much water each holder of a water right can be allotted each day. In effect, Jesse is the man who orders the opening and shutting of headgates on municipal, industrial and agricultural ditches. It is the headgates that stand between the river and the users of the system.

Jesse explains his job this way: "Each ditch has almost as its charter a decree (covering water) of the district court, and each decree has several elements: a priority date, a priority amount, a location and a use. If you know the date of your priority and you know how much water you have, you can tell which ditches are in (receiving water) and which ditches are out (not receiving water)...The river doesn't go from flood stage when (all the decree holders) would be on to dry stage when they would all be out. It is always somewhere in-between.

"As it goes up a little, we might turn on one more little ditch or 10 more or 100 more. If it goes down, we might do the reverse...We look at the various water rights and determine who should be changed. We then send out the change. We call the change 'the river call.'

"That's the term you'll hear most often. When you hear people sitting around drinking coffee in (a southeastern Colorado farming community like) Rocky Ford, more than likely they're going to be talking about the river call. They're going to want to know what the call is today. The call is always a date... the date of the most junior ditch receiving water..."

Thus, to do his job, Jesse needs access to large amounts of information of a legal nature on the ranking in terms of priority of all the water decrees within the area he administers, but he also needs large amounts of information on the amount of water in the system at every given moment. Gathering that information and supplying it to Jesse and his counterparts throughout Colorado and, in fact, throughout the country is a cooperative effort involving state and local government but in which the lead agency is the U.S. Geological Survey, an agency of the U.S. Department of the Interior.

Jerry Hughes, USGS Subdistrict Chief, tells us, "We are responsible for the collection of data relating to water resources. We are also responsible for the interpretation of that data. We collect data on surface water flow, on ground water levels, and on water quality related to both ground and surface water...We

Satellite-linked water-height monitoring site at Parkdale just a few miles above Royal Gorge. There are a total of 14 satellite-linked sites on the Arkansas River in Colorado.

"We look at the various water rights and determine who should be changed. We then send out the change. We call the change 'the river call.'"

Robert Jesse, *Irrigation Division Engineer, Colorado Division of Water Resources, photographed at Pueblo Dam.*

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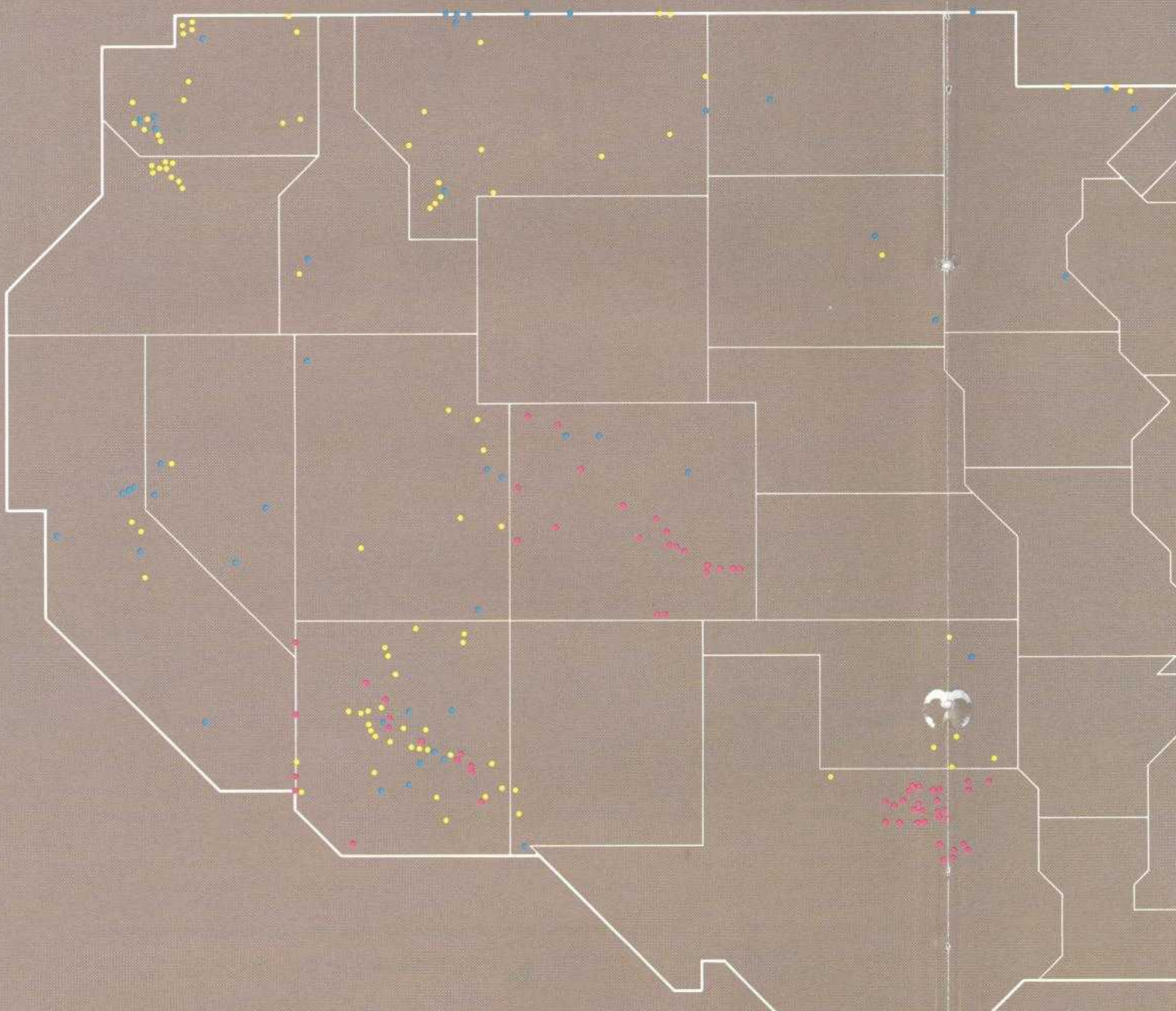
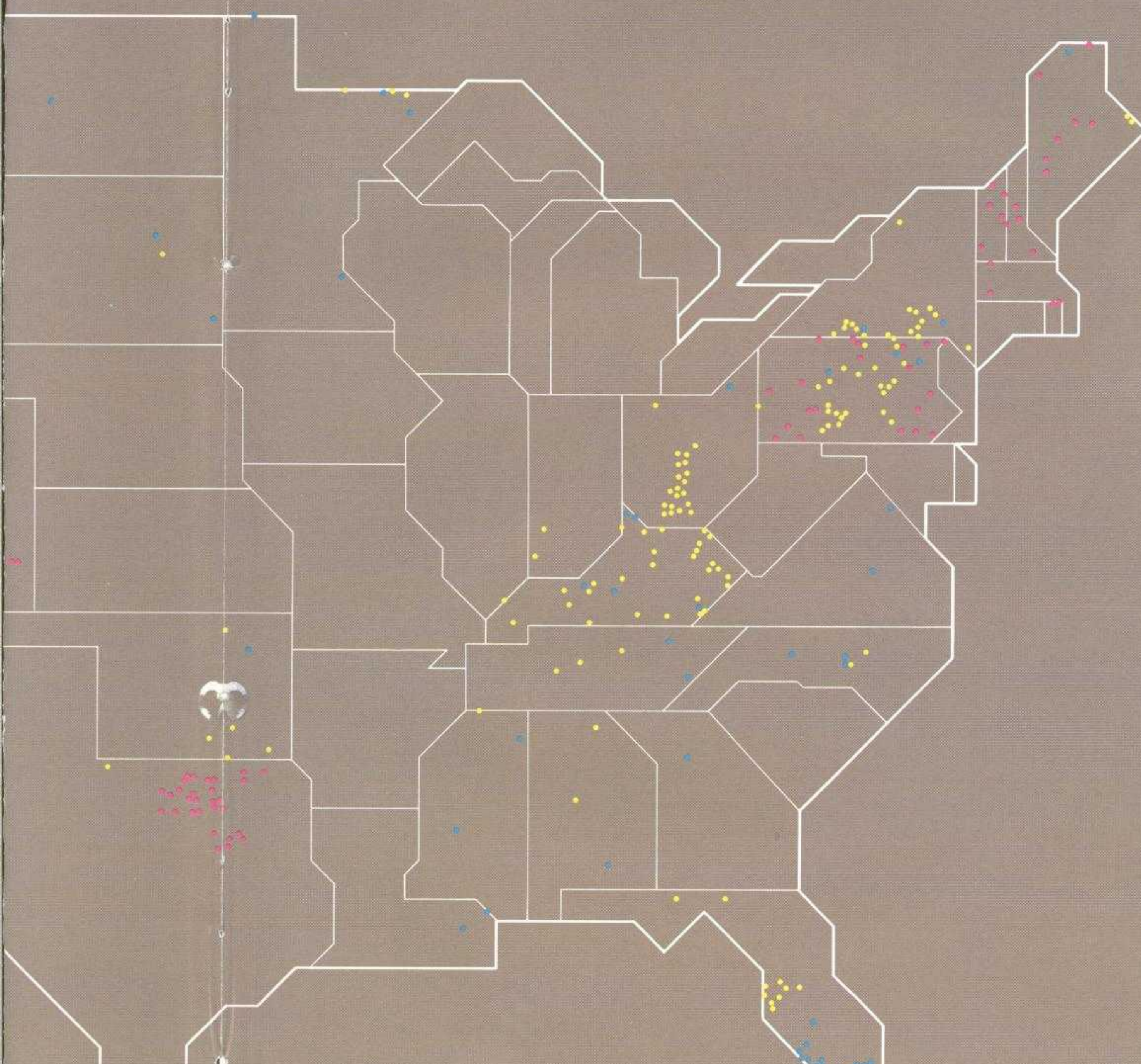


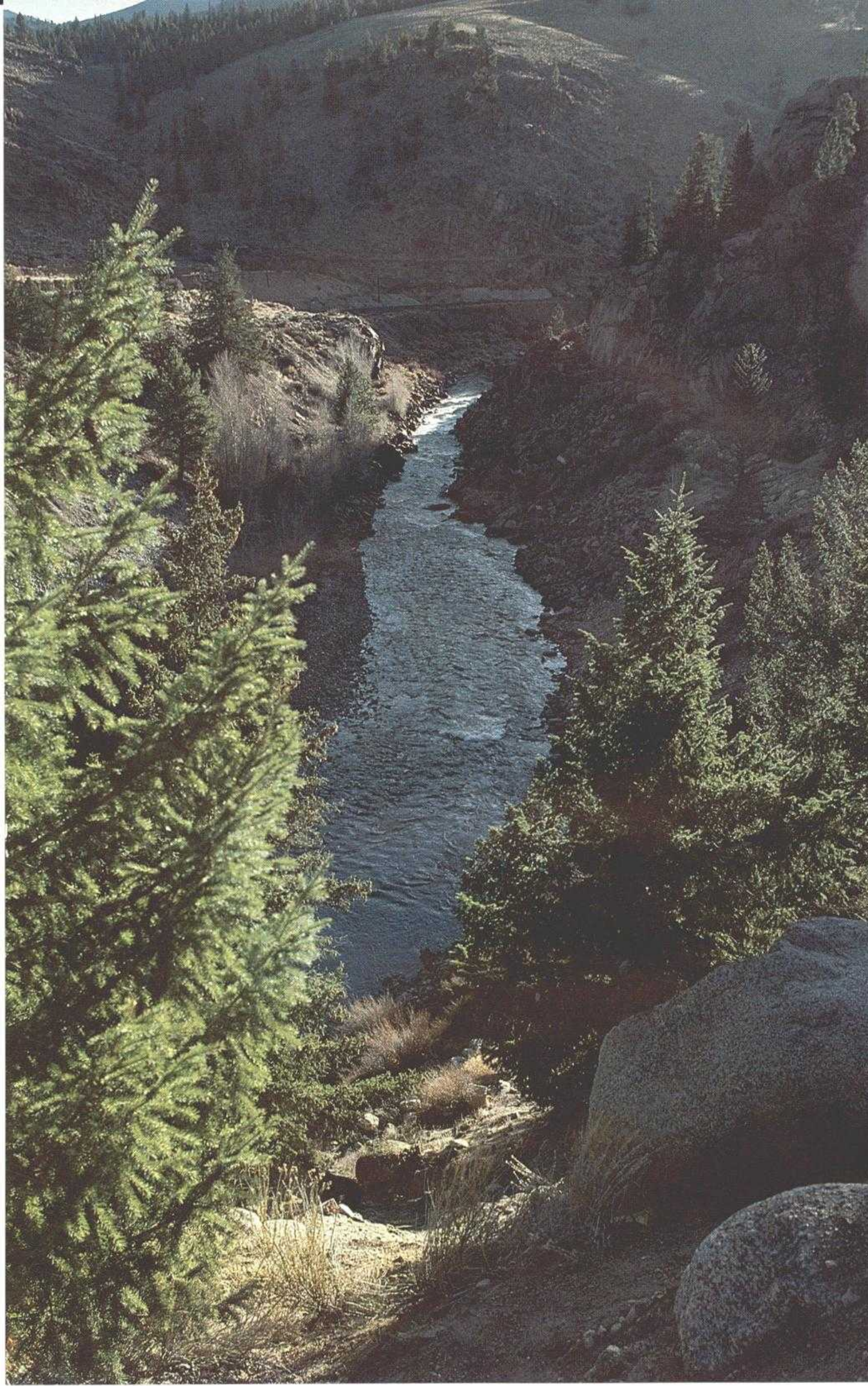
● Active Comsat General Satellite-Linked Sites

● Active USGS Satellite-Linked Sites

● Inactive USGS Satellite-Linked Sites

SATELLITE-LINKED WATER MONITORING SITES





collect this data. We ensure its quality, and then we store it... The data is the key part of the system. I don't believe that there is any other agency in the United States that has the logistics, the knowhow, the development capability to collect data with the precision that we do and then store it and be able to retrieve it with the same degree of accuracy and dependability."

The principal tool of the USGS and its cooperating agencies in determining water flow are monitoring stations—small shelters beside the waterways being monitored containing equipment to sense and record the height of the water in the waterway. The hydrologist wants to know water height because the key formula he works with is, as Jerry Hughes explains it, "Q=VA, water volume equals velocity times area. The width times the depth gives you the area."

There are, of course, other factors that the hydrologist must take into account, Hughes tells us. The changing configuration of the waterway as a result of erosion or sediment buildup alters the velocity and area and thus requires that discharge be recomputed monthly. The development of rating curves is essential so that the hydrologist can determine the discharge through a particular channel for each given height of water.

Thus, we learn how important mathematical computation is to the job of the hydrologist—the ability to be able to plug in numbers for a group of interrelated variables—and just how important water height readings are in the whole process. What we begin to see is the importance of the role satellite communications can play in hydrology, in the management or administration of a river like the Arkansas, especially when satellite communications are a part of a computer-linked data gathering and data interpreting network.

The principal way the USGS and its cooperating agencies have been gathering the all-important water height readings from the 9,000 water monitoring sites it has around the country, including about 65 on the Arkansas and its tributaries, has been largely a manual affair. A USGS employee or employee of a cooperating agency hikes, takes four-wheel-drive vehicle or helicopter to the station, enters it, and either writes down the information shown or collects the paper tape from the water height recorder.

Only after the employee returns to his office does the information reach the subdistrict and district offices of USGS, and, from there, get transmitted to USGS headquarters in Reston, Virginia. Clearly there is nothing real-time about such a system as this. Hence, there are severe limitations on how useful the system can be to someone like Irrigation Division Engineer Robert Jesse who has to make decisions every day, occasionally every hour, on what headgates to leave open and which to order closed.

In talking with James F. Blakey, District Chief, USGS Water Resources Division, who is Jerry Hughes' boss, we learn that in its effort to increase the speed with which it collects and makes water flow information available USGS has tried both leased line and radio transmissions and that systems like this continue to be used by the agency in various locations including some in Colorado. District Chief Blakey tells us, "For many years we've looked at leased line; we've looked at radio to achieve real-time transmission. These have certain drawbacks, the biggest one being that your radio system or your leased line system usually fails when you need it the most. When you have a tremendous thunderstorm, the whole works goes down, and that's when you should have had it."

As Blakey and his assistant in charge

Facing page, head waters of the Arkansas above Leadville, Colorado. Below, the minutes of the Catlin Canal Company dated January 5, 1904 in which then President of the canal J.C. Vroman describes how building of the canal made possible transformation of land fit only for "the coyote, the rabbit and the rattlesnakes" into habitable farm country.

"With the satellite transmission system, we know within a matter of minutes or hours that we do have a problem..."

James F. Blakey, left, District Chief, Water Resources Division, U.S. Geological Survey. Right, Larry L. Jones.

of satellite-linked water monitoring in Colorado, Larry L. Jones, see it, tying all 250 water gaging stations in the state to a satellite communications system does not make sense. You do not need real-time information out of every site. But by tying a number of sites together into a network feeding information into a computer, many benefits result.

Blakey states, "The general practice is to visit a remote station perhaps once a month. During that month, you've recorded (the water height of the adjoining waterway) with an on-site recorder. There is always the danger that this instrument will shut down for some reason. If it happens within two days of one of our people visiting the site, then we've lost 28 days of records. With the satellite transmission system, we know within a matter of minutes or hours that we do have a problem and an individual can go out and repair the station. Thus, we can substantially reduce our lost records.

"It can also be of benefit to us in working up our annual records. We analyze, reduce and publish daily flows for these stations on what we call a water-year basis. So this information (from a satellite communications network) can help us keep our records more current. For the cooperator or water information user, these records are also valuable. This can be anyone who's making management decisions based on water availability."

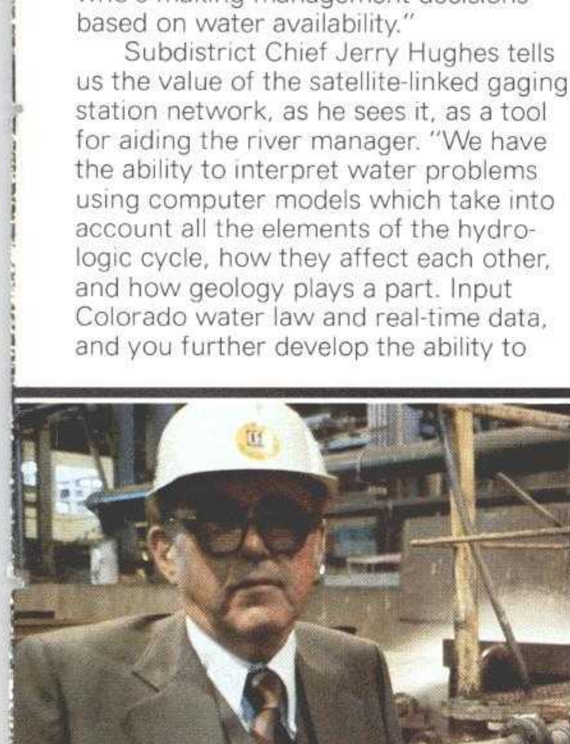
Subdistrict Chief Jerry Hughes tells us the value of the satellite-linked gaging station network, as he sees it, as a tool for aiding the river manager. "We have the ability to interpret water problems using computer models which take into account all the elements of the hydrologic cycle, how they affect each other, and how geology plays a part. Input Colorado water law and real-time data, and you further develop the ability to ask real-time management questions. The more complete the real-time data network the better..."

State Engineer Jeris Danielson also sees the value of the technology as a management tool or, as he prefers to call it, as "an aid to administration." Using the Arkansas as his example, he tells us, "The Arkansas being as over-appropriated and heavily administered as it is, we are making decisions on an hourly basis as to which headgates should be opened and which headgates should be closed... A small rainstorm on a tributary, for example, can add flows to the system, and we have no knowledge of it. The river comes up, and we have a junior shut down simply because yesterday there wasn't enough water to serve him...When you are administering on a real-time basis, you need to have input on a real-time basis as to what's in the system. That's why I see this satellite communications approach as being very useful."

Another value for the system is as an "early warning system," as USGS's Larry L. Jones calls it, in case of floods. State Engineer Danielson expounds on that. "Contrary to the East, we have vast segments of the watershed that are very underpopulated. A rainstorm can occur or a dam can fail, and we may not know about it for a matter of hours. The first intimation we might get is when the first little town is swept away. With a system of gaging stations where you can monitor immediately what's happening, a flood wave moving down a remote section of stream can trigger a station, let us know, 'Hey, there's a bunch of water coming down.'"

Says Subdistrict Chief Hughes, "Every 15 minutes, we can access information on Fountain Creek, or on the upper part of the Arkansas River coming into Pueblo Reservoir. We can see how big a flood peak we have and how fast it is moving. We can then

Facing page, a large section of the 38-mile-long Catlin Canal. Below, control wheel for a headgate.

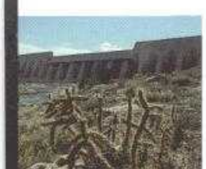


"If we had these sensors, we could immediately see that there's a washout. We can isolate the reach of the 46-mile canal where we have the problem."

Ralph W. Adkins, *Director, Water Operations, CF&I Steel Corporation. Behind him, 7 inch diameter casing goes through heat treating operation.*

"I think satellite measuring... will certainly be one of the greatest boons that we can have..."

Frank Milenski*, left, President, Catlin Canal Company.* *Right,* ***Wayne W. Whittaker****, Secretary, Catlin Canal Company.*



Pueblo Dam behind which is a six-mile long lake holding water for irrigation and municipal needs.

advise the Corps of Engineers and local Civil Defense agencies, who have responsibility over life and property, on the magnitude and behavior of the flood."

In our travels, we also talk to major water users. They make clear to us that they see tremendous potential for satellite communications as an aid to water management and, specifically, as an aid in the work they do. We talk to Ralph W. Adkins, Director, Water Operations, CF&I Steel Corporation, Pueblo. Water is a vital component of the steel-making process, we find out, and CF&I like all steel mills needs a lot of it—70 million gallons of new water per day to fill a total daily need of 210 million gallons. To supply that water, Adkins oversees a private water system that carries water from the Arkansas in a 46-mile-long canal and which includes four reservoirs.

Adkins describes an application of satellite-linked water monitoring that he believes would be beneficial to his company. The approach he describes would use satellite-linked sensors at eight locations along the 46-mile-long CF&I canal. "From time-to-time, we'll have a groundsquirrel, a gopher or a muskrat who will burrow into a ditch bank... and start a leak. In a very short order your ditch is gone... If we had these sensors, we could immediately see that there's a washout. We can isolate the reach of that 46-canal where we have the problem. We wouldn't have to start at the lower end and drive the whole length of the canal to find our problem."

Catlin Canal President Frank Milenski also sees great potential in the marriage of satellite communications and water gaging. The main canal for the Catlin bringing water from the Arkansas to the 450 farms it serves is 38 miles long, and there are many times that number of laterals bringing water to individual fields. (Wayne W. Whittaker, Secretary of the Catlin, tells us that there are 350 stockholders in the canal and a total of 218 headgates connecting the main canal with the laterals, which themselves total about 675 miles in length.)

Milenski tells us, "You could put gaging stations right in the canal. You could tell what every section of the canal had in it at any given time. I think that would be a great boost."

We return from our travels along Colorado's Arkansas River convinced that satellite communications definitely can help us manage one of the nation's most important resources—water. We have seen much and talked to many people, and what we have learned proves to us that there is indeed an important role for this technological achievement of the latter Twentieth Century in activities so basic as making sure that water for people, industry and farms is fairly distributed and that destruction from floods is substantially reduced.

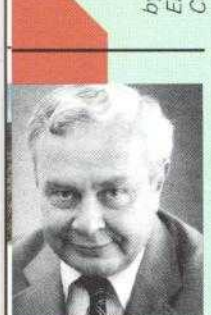
We take encouragement from the words of Frank Milenski. "I think satellite measuring coupled with the (computer) model that is being developed and with all the information that has been learned over the years will certainly be one of the greatest boons that we can have when it comes to where water is coming from, what's happening to it and where it's going."

INTELPOST

The new look of international mail

Someday as much as 50 percent of international airmail may be carried electronically via communication satellites positioned in geosynchronous

by **Helmo Raag**, Director
Electronic Mail Systems
Comsat General Corporation



orbit 22,300 miles above the oceans. The International Electronic Post (Intelpost) system, now in operation, is the first major step in this direction.

Intelpost is a new experimental international electronic mail system of the United States Postal Service (USPS) and of a number of foreign Postal and Telecommunications Administrations (PTTs). Comsat designed and installed the Intelpost system under contract to the USPS and also entered into contracts with the PTTs to assist in installing their systems. In August 1980, all Intelpost activities of Comsat were taken over by Comsat General Corporation.

There are operational Intelpost centers at present in six countries: Argentina, Canada, the Netherlands, Switzerland, the United Kingdom and the United States, and commercial service from the United States is being provided now to Canada, the Netherlands and the United Kingdom. A number of other countries are in various stages of planning their Intelpost installations.

It is generally agreed that electronic mail systems are of interest first of all to business and government users, and an international approach to electronic mail, especially for intercontinental application, is particularly attractive. The generally longer distances involved, time-zone differences and different business office practices in different countries, accentuate the advantages of electronic mail. Market surveys and experiences with the Intelpost system have shown that among the businesses which have requirements for delivery of time-sensitive information are banks, import-export companies, law and accounting firms, news and information services, securities and commodity exchanges, commercial shipping enterprises and world trade associations.

Electronic mail messages can be divided into two broad categories: coded alphanumeric messages (e.g. telex), and raster-scanned and printed messages (e.g. facsimile). Alphanumeric coding requires a relatively small amount of data to be transmitted (e.g. a three hundred word page results in about 15,000 signal elements), whereas high resolution raster-scanning requires vastly more signal elements, typically about 600,000 or more signal elements per page, even if complicated data compression techniques are used. Alphanumeric messages are limited to the repertoire of characters on the keyboard of the sending and receiving terminals, whereas raster-scanning permits the transmission of graphics, handwritten text, signatures, and alphabets of any language.

The technology for rapid, reliable and high quality electronic mail systems exists and is being further developed. In addition to advances in electronic mail terminal technology (e.g. scanners, printers, optical character recognition equipment, and word processing systems), important progress has been made in other relevant areas, especially in minicomputer and microcomputer fields. In scanning and printing technology, present high resolution laser plain paper printers and document scanners provide very high quality and should not be compared with the low quality reproduction commonly associated with the word "facsimile." For transmission of electronic mail, the international global Intelsat satellite system is especially well suited. Using the Intelsat system, Intelpost reaches directly across oceans and handles easily the high data rate electronic mail signals necessary when high resolution raster-scanning is used. Indeed, satellites are much better suited to carry high data rate signals than submarine cables.

The Intelpost system uses high speed (10-12 seconds/page) and high resolution (200 lines/inch) facsimile input and output apparatus, interfaced to a minicomputer at each center for store-and-forward operation. The capability of handling alphanumeric messages is currently being considered as an optional addition to the system because various European Administrations have expressed interest in it. All messages are stored in the computer before transmission and are stored also after reception. This provides many technical and operational advantages. Elaborate document control and error control techniques are used in the computer to computer transmission. All Intelpost centers are interconnected to form a packet switched network with each center being able to act as a source or a destination of a message to or from any other center in the network.

For Intelpost service, the customer or a postal courier brings the documents which are to be sent to the Intelpost center or to a receiving post office. There are USPS Intelpost centers at present in New York and Washington and numerous receiving post offices in each city as well. A transmittal form is filled out and the original document is returned to the sender after transmission or forwarded to the receiver by air mail at the sender's option. The received Intelpost mail from foreign centers is inserted by postal clerks into special envelopes and delivered either by special delivery, through regular mail in the receiving country or held for window pickup. Customer premise terminals are currently being considered as optional Intelpost system features in some countries. All of the participating postal administrations charge the equivalent of approximately $5 per page for Intelpost service.

Development and introduction of the Intelpost system has generated widespread interest among the postal and telecommunication organizations around the world, and has accelerated the discussions and debates among the postal and telecommunication organizations about their respective roles in electronic mail. The Intelpost centers in the United States became operational in the spring of 1979, but the USPS was not able to lease international circuits from the U.S. international record carriers to overseas points because their tariffs exclude the resale of these circuits. The Federal Communications Commission ruled that to make an exception to the USPS would be discriminatory to other users of leased international circuits, and the international record carriers have not been willing to eliminate the resale restriction to all users. Thus the USPS could not start commercial Intelpost service.

Meanwhile, the Intelpost installations in Canada and the United Kingdom became operational and service was initiated between those countries. Then the Netherlands and Switzerland joined the Intelpost network, and the Argentinian center was installed in June 1981. The Federal Republic of Germany has been interested in the Intelpost service from the start, but refrained from moving ahead with the project until the USPS overcomes its regulatory problems. The French Intelpost site in Paris was installed in the spring of 1979, but a dispute between the postal and telecommunication arms of the French PTT has prevented it from being connected into the Intelpost network.

Finally, the USPS found a way to initiate commercial Intelpost service by negotiating an agreement with Canada Post that makes use of the regulatory peculiarity that communication circuits between the United States and Canada are regarded as domestic circuits. The resale restriction does not apply to domestic circuits. Thus the USPS initiated Intelpost service to London from New York and Washington in January 1981 with London bound electronic mail transmitted via an Intelpost computer at Toronto. This cannot be regarded as a permanent solution. Clearly, ways must be found to overcome the regulatory problems for Intelpost service in the United States.

An interesting approach to Intelpost service was adopted in Canada by Canada Post and Teleglobe. This approach has now been adopted in Australia as well by Australia Post and OTC(A), and it holds promise for defining the respective roles of the postal and telecommunication authorities in most countries. Canada Post operates the Intelpost center where mail is sent and received. This center is connected to the Teleglobe center which acts as an international gateway for Canada and connects to centers in other countries. Indeed, there are good technical reasons for separating the Intelpost system operation in two: one type of center for mail input and output, document control, customer billing; the other type of center for controlling traffic routing and flow, communication protocol conversions, and network status monitoring. Such a division of functions can serve both the technical needs of a world-wide Intelpost system and the institutional roles of the postal and telecommunication authorities in many countries.

The experience to date with the Intelpost system has shown that there is widespread interest in international electronic mail, and the technology is available, but it is necessary to arrive at a cooperative solution involving the roles of the postal and telecommunication authorities in providing this service. It is apparent that it is not practical for either organization to provide the service alone, but if a cooperative solution is found, the general public will benefit from this attractive modern technology for which satellite communications are especially well suited.

Network Management Action System

for the next generation of traffic growth

by **Herbert A. Hanson**, Senior Project Manager
Project Management and Engineering Division
International Communications Services

The Network Management Action System (NMAS) is a direct consequence of the explosive growth of international communications. This exponential growth in demand for services, especially between the United States and Europe, has resulted in a parallel expansion in facilities to accommodate the traffic. As a consequence of this expansion and Comsat's dedication to improvements in both the technological and operational state of the art, the formulation and implementation of a comprehensive computer aided management system was started. This system is the NMAS.

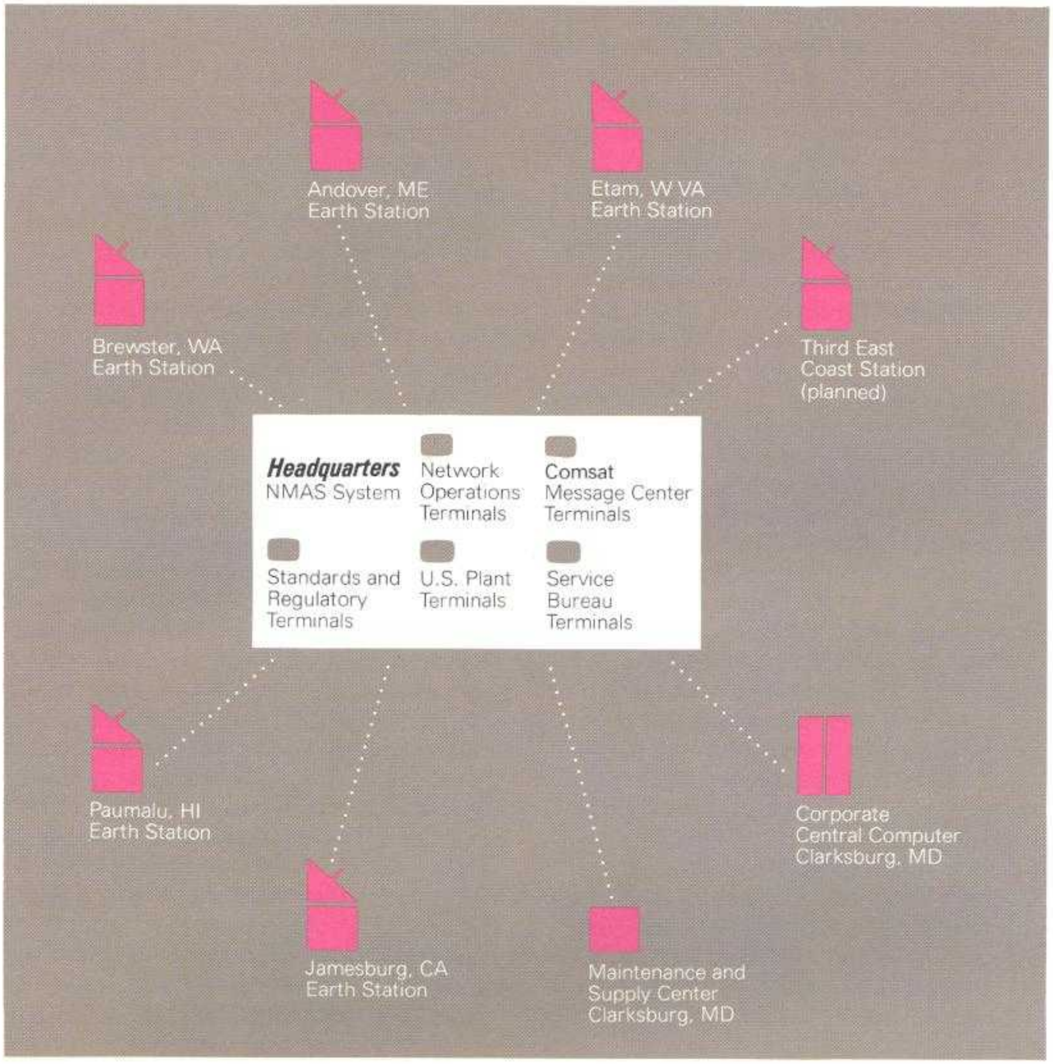
There are several objectives which have been established for the Network Management Action System. These objectives include automatic file and record maintenance, automatic message switching and routing, logistics support for the earth station physical plant, and surveillance of the earth station technical parameters. For implementation purposes, these broad objectives have been grouped into two categories and are treated as subsystems of the NMAS. The categorical subsystems are Management Information Services and Monitor and Control Support.

The Need for NMAS

To the extent to which it is practical relative to Comsat's needs, the Management Information Services subsystem is being designed to substantially reduce the paperwork required to support the network operations functions. At the same time, the system will greatly increase information availability on a timely basis. The key word here is timely. The working files required to support network operations have grown in direct proportion to overall system traffic growth. The length of time required for information retrieval has increased accordingly. Without corrective measures, the time required for the implementation of service changes will become unacceptably long. The NMAS will not only make required information available to operations personnel immediately upon request, but also will provide the mechanisms for keeping the files current with respect to system configuration as changes are made.

Additionally, the need for routine "documents" required for operations internal coordination, control, and approvals will be reduced. These internal management procedures will be implemented through the computer terminals located in appropriate offices of the operations staff. Procedurally the management controls will be the same but the amount of paper required and the length of time needed to complete a transaction will be substantially reduced.

Currently, all message traffic (telex, teletype, etc.) for operations management, both domestically and internationally, is processed on standard machines. To send a message requires typing the message, converting the typed message to punched paper tape, then loading the tape and transmitting the message on a particular machine depending upon the message destination. Unless a received message is to be retransmitted, the processing of punched paper tape is not required for messages addressed to Comsat. In any case, message processing is currently a time consuming and labor intensive process. The NMAS will relieve a large part of this burden by providing automatic message switching, routing, and formatting. The system also includes an optical character reader (OCR) and a paper tape punch and reader. The OCR will permit the processing of typed messages from sources not supported with computer terminals, and the paper tape punch and reader will provide for system back-up in the event of malfunction. All of the routine functions of time/date recording, message logging, message



file maintenance, copy distribution, etc., will be performed by the NMAS computer system.

The NMAS incorporates Headquarters and earth station requirements into a common network of essentially identical computer systems located at each site. The particular computer system selected for the NMAS permits a task to be performed interactively by computers at more than one location with access to data files at those or other locations. With few exceptions, the capabilities which exit at Headquarters and at the earth stations are the same. Thus, software capabilities implemented at Headquarters are also available at the stations unless specifically restricted by the applications programs; the reverse situation exists as well. This arrangement permits access

Network Management Action System (NMAS) to meet Comsat's international service coordination needs for the 1980s and beyond.

- fast headquarters/earth stations coordination
- quick, efficient voice, data and television implementation of customers' orders
- fast centralized monitoring of earth stations
- real-time ordering and fulfillment of earth station spare part needs

to unrestricted file information regardless of location. Data base files which are required at both the earth stations and Headquarters, such as equipment records, inventory listings, channel and circuit assignment records, and schedules, will be controlled by the location with prime responsibility for the particular file, and the information will be available to all locations, as required, for the task at hand.

The Scope of NMAS

The illustration on page 29 shows the relationship of the central communications function and the operating earth station system. Also depicted is the interrelation of the several functions of the Network Operations Division of Comsat World Systems which the NMAS will support. The implied linkages illustrate how information exchange of multiple-accessed data base files is brought about among several user organizations of the system.

The introductory comments and the illustration of interrelationships of the Management Information Services portion of the NMAS might suggest a relatively simplistic system. Such is not the case. The NMAS is a very complex, interactive system designed and structured to satisfy Comsat World Systems' unique requirements for system management. Unlike many applications for computer systems installed for management information purposes, this particular system cannot be implemented with "standard" software modules (programs). Rather, it is necessary that essentially all of the required applications software be developed specifically to satisfy the needs of World Systems. Because of the magnitude and complexity of the applications software development problem, the NMAS project was scheduled for a four-year span. However, to permit early, but limited, use of the system, it was necessary to specify all of the required software modules and to define the interrelationships of each module with the others. If the project had not been approached in this way, there would be a substantial risk that much of the software would have to be rewritten as the system evolved.

There are seven major categories of applications programs which must be developed for the NMAS to satisfy the basic requirements for Network Operations: Earth Station Management, Customer Service, System Maintenance and Supply, and Monitor and Control Support. The number of discrete program modules in each category ranges from seven to 25 for a total of 80 separate modules. These numbers do not include the software programs required for screen formatting and display for the computer terminals and for the printers or for message switching and routing management.

Furthermore, the number of prime applications program modules cited does not include any of the modules normally expected for the support of financial administration or personnel administration. Software to support these functions already exists in the large Corporate central computer facility located at Comsat Laboratories in Clarksburg, Maryland. The NMAS computer system is interconnected with this facility so that the need for the additional software modules will not be required at this time. The basic NMAS project was formulated and structured to satisfy the requirements of the International Communications Services Division of World Systems. However, the design criteria which were established for the NMAS included requirements for system growth, both hardware and software, without forced obsolescence of the portions already in service. Strict adherence to this requirement will permit extension of the system to perform other functions, as may be required in the future.

Because of the role which the NMAS is required to perform, it is essential that the overall system design allows for partial failure without either an interruption of service or a loss of data. Vital to satisfying this requirement is the design and implementation of the computer system which is the core of NMAS. In addition it is necessary that essential maintenance and repair functions on any portion of the system be able to be performed without service interruption. A combination of techniques are employed in the system to satisfy these requirements. The most commonly used technique is the use of equipment and functional redundancy; including the central computer system. The computer system selected for the NMAS uses multiple data processors and system control software configured and implemented in a fashion that allows for failure without interruption of the data processing function. Depending upon the activity level of the computer system at the time of a failure, the system user may notice a slight increase in response time; the system keeps on working without interruption. Electrical power for the NMAS is backed up with emergency power and batteries so that in the event of a power failure, there is no data loss and the system resumes its functions after a brief interruption. (At the earth stations no interruption occurs. However, a brief interruption at Headquarters may be evident to an earth station user depending upon the transaction which is in process at the time.)

The communications network which interconnects Headquarters and the earth stations employs a combination of diverse circuit routing and automatic "dial-up" over the long distance telephone system to protect the NMAS from interruptions. The software used for communications between the computers is designed to protect the system from loss of data if and when an interruption should occur. This combination of diversity routing, automatic dialing, and protective software in combination with redundancy of the data transmission equipment, provides a satisfactory level of insurance for protecting overall system continuity of operation. As a final measure of functional protection for operations, a limited number of teletype machines which are now used for communications will be retained.

The Headquarters Facilities

The most visible part of the NMAS project is the modifications to the Headquarters facilities to accommodate the computer system installation and to integrate the International Communications Services communications facilities into a cohesive, computer supported system. This installation work is now being completed on the east end of the sixth floor of the Headquarters building.

There are four functional organization units which are integrated with the communications support facility; the Comsat Service Bureau (CSB), the Comsat Message Center (CMC), the NMAS Computer Center (CC), and the Word Processing Center (WPC).

The Message Center and the Service Bureau are 24-hours-per-day, seven-days-per-week operations, and it was necessary to provide for an air conditioning system which is independent of the building central system. Also, to ensure continuity of operations in the event of power failure an emergency (back-up) power system had to be provided. In addition, it was necessary to provide, for 27 people, work facilities which are compatible with computer oriented operations. Because of the limited floor space available to accommodate these facilities, a special overall design which is compatible with the L'Enfant Plaza building structural and mechanical features had to be developed. Finally, because of the number of printers involved and the confined space, particular attention had to be given to noise control.

A raised anti-static, carpeted computer floor was installed in the area to provide a plenum system for air distribution, space for installation of air conditioning unit plumbing and for power distribution, and an easily accessible area for cabling the computer system and terminals. This raised floor arrangement provides both esthetic benefits and noise control because of the carpeting and the distribution of very low velocity air. Additional noise reduction is achieved by acoustically treating the interior of the ceiling light coffers and installing specially made light and sound diffusion grills. All of the interior walls will be covered with noise reduction panels and surface materials.

The Earth Station Facilities

The physical size of the NMAS installations at the earth stations is substantially less than that at Headquarters. These installations consist of the basic computer system, three or four additional racks of supporting equipment, and monitor and control subsystem support modules in the station equipment areas. The NMAS equipment installation at the stations will be done the same as for communications equipment at the stations, and the control console will be located in the station control center area.

The Monitor and Control Support part of the NMAS will provide earth station operations staffs with a centralized capability for monitoring equipment status and controlling the communications equipment configuration. The amount of equipment at the Comsat earth stations required to satisfy requirements for service has increased to the point where it is becoming very difficult to maintain an accurate summary of overall station status. Installation of the Monitor and Control Support system will not only alleviate this problem but will provide accurate records of changes of status. The control features, both automatic and semi-automatic, will permit a quick reaction by station staff to correct for equipment malfunctions. An awareness of degraded performance will permit corrective action before a service interruption occurs. The Monitor and Control Support system will provide notification of unsatisfactory equipment performance in addition to automatic switching of in-service and backup equipment in the event of equipment failure.

At the largest Comsat earth station, Etam, West Virginia, it will be necessary to monitor over 20,000 data points to provide the required information. Because a majority of these data points must be sampled as frequently as once per second the most practical solution is the use of a "central computer" supported by a number or microprocessors (computers on a chip). The "central computer" is the NMAS computer located at the earth station. The microprocessors will be located in the equipment areas of the station and will contain logical and memory capability. This arrangement will permit limited data processing and equipment control functions on a localized basis for the type of equipment with which each microprocessor is associated. The microprocessors and their software programs are being developed specially for the Monitor and Control Support function. This arrangement of microprocessor working under control of the NMAS computer provides the flexibility needed for configuration changes and long term growth at the earth stations.

The Network Management Action System is one of the most complex (both technologically and operationally) projects undertaken by Comsat. The practicality of undertaking a project of this magnitude and complexity was made possible by the establishment of the Project Management and Engineering (PM&E) Division within World Systems as a consolidated function. This arrangement coupled with Matrix Management structuring and techniques for the management of large projects permits the effective use of the diverse talents within Comsat for the maximum benefit of the Corporation. The PM&E Division under the leadership of Francois Giorgio is applying this same approach to other large projects at Etam (including the diversity earth station at Lenox, West Virginia), Andover, Brewster, and the new third East Coast earth station.

FOR THE RECORD

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

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

Welcoming Remarks by John D. Harper, Chairman of the Board, at the 14/11-Gigahertz Antenna Dedication, Etam, West Virginia, May 1, 1981.

It is with great pleasure that I welcome Senator Randolph, Chairman Lee, and all of you who are with us today to witness the dedication of our new 14/11-gigahertz antenna here at the Etam Earth Station.

It is fitting that on such an occasion as this we recall the tremendous progress which has been made with the advent of satellite communications. In less than twenty years we have seen the establishment of a global satellite system which provides rapid, economical and high quality communications between over 130 nations. We have seen the establishment of maritime mobile satellite communications, domestic satellite communications, and the utilization of satellites in other applications such as meteorology and remote sensing. These accomplishments, many of which were in no small measure achieved by Comsat through its team of bright, dedicated professionals, have demonstrated the many and varied benefits which are available through the use of space systems.

These accomplishments were the results of leadership, commitment and hard work of visionaries who could foresee the fact that the technology could be developed and that worthwhile benefits could accrue.

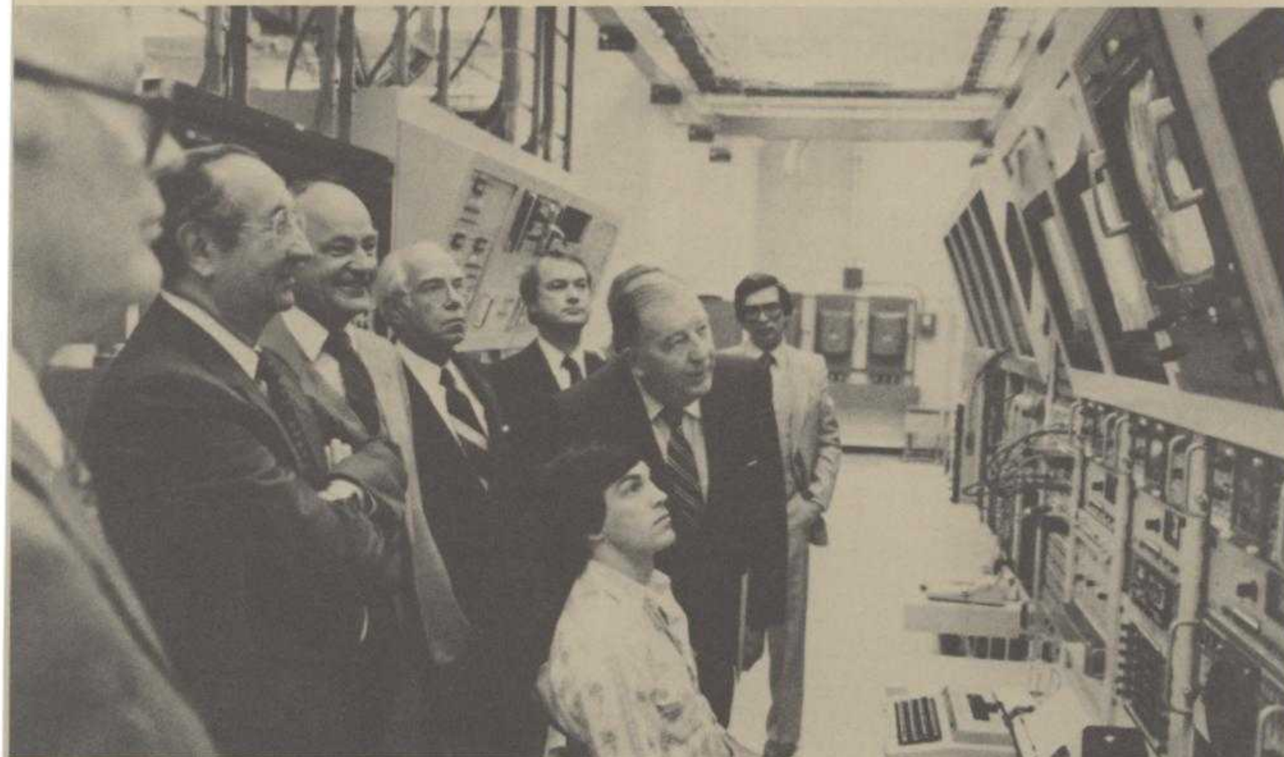
One such visionary is Senator Jennings Randolph, who has served in the House of Representatives between 1933 and 1947 and in the Senate since 1958. During his distinguished career in Congress he has been a primary author and leader in aviation and space legislation. During the 1930s and 1940s he demonstrated profound vision by his leadership, authorship and support for aviation legislation including the Civil Aeronautics Act, the Federal Aid to Airports Act and the National Air Museum Act. As a result of such pioneering efforts, today we have a strong aviation industry; an airport development fund which was instrumental in the creation of this nation's airport network; and the National Air and Space Museum which is the most popular museum in the world and which memorializes our aviation and aerospace achievements for posterity.

Senator Randolph's leadership in our field has continued throughout his public life. He supported the Communications Satellite Act of 1962 which was the genesis of Comsat and the global satellite system. In addition, he helped bring high-technology facilities such as this Etam Earth Station and the National Radio Astronomy Observatory in Green Bank, to the State of West Virginia. Senator Randolph truly is a visionary.

Another visionary is Chairman Robert E. Lee, who is now in his fourth term on the Federal Communications Commission and who has served on the Commission since October of 1953 and was appointed as Chairman April 13th of this year. The skill, direction and leadership which he has demonstrated throughout his tenure on the Commission is recognized by successive Administrations, both Republican and Democratic, as evidenced by his reappointments to the Commission.

Chairman Lee has recognized the importance of international cooperation in the advancement of telecommunications services which utilize, on a shared basis, the radio spectrum and geostationary orbit; and to this end he has been an active leader at numerous International Telecommunication Union and other international conferences. His vision of cooperation and advancement of technology, both on an international and domestic basis, have helped create a regulatory environment that has been conducive to private enterprise initiatives and innovative systems of the future.

We must heed the example set by people such as Senator Randolph and Commissioner Lee, and the many others who have helped develop today's satellite communications and other



Watching demonstration of new equipment during dedication of new antenna at Etam Earth Station are, from left, Dr. John L. McLucas, President, Comsat World Systems Division; Mr. Robert E. Lee, then Chairman, Federal Communications Commission; Dr. Joseph V. Charyk, President and Chief Executive Officer, Comsat; Mr. John D. Harper, Chairman of the Board, Comsat; Dr. Delbert D. Smith, Senior Vice President, Corporate Affairs, Comsat; Senator Jennings Randolph (D—W.Va.); and Mr. Carl A. Sederquist, Director, Network Operations, International Communications Services. Conducting demonstration is earth station's Charles R. Fetty (seated).

space applications, by being the visionaries for tomorrow. We already have indications of the possibilities for the decade to come. With the successful launch and return of the space shuttle Columbia the range of possibilities becomes immense.

Comsat and its subsidiaries will continue to be visionaries in the development of additional benefits from space applications. Comsat's Satellite Television Corporation subsidiary has taken a bold and significant step in this direction with the development of its proposed direct broadcast satellite system. Implementation of such a service would take advantage of Comsat's broad range of resources and talents, and would be a shining example of yet another benefit of satellite communications.

This dedication of the new Etam Antenna is significant in that it not only marks the beginning of transoceanic communications in the Intelsat system using a second frequency band; it also is significant in that it represents Comsat's ability to meet the demand for economical and efficient communications services. Comsat welcomes this new phase in global communications; and we look forward to new horizons in satellite communications in the future.

Dedication Address by Dr. Joseph V. Charyk, President and Chief Executive Officer, at the 14/11-Gigahertz Antenna Dedication, Etam, West Virginia, May 1, 1981.

In the communications industry, "number one" is a substantial achievement. From its beginning in 1968, the Etam Earth Station has earned its position of number one by serving as the pioneer in the advancement of satellite communications technology. Etam was the first U.S. station to operate with the Intelsat III satellites which established the global satellite system in July 1969.

Etam was also the first U.S. station to introduce, in 1973, the SPADE system wherein a pool of frequencies is kept available for users on an as-needed basis, permitting one country to call up another as the occasion demands without establishing a full-time circuit. In 1973, Etam was also the first U.S. station to be equipped in the Atlantic region for high speed digital data (50 kilobits-per-second, or 100,000 words per minute) service to Europe.

The Intelsat IV-A satellites achieved a significant increase in communications capacity and flexibility by introducing frequency reuse through beam separation, and use of this technique by the Etam station represented the first commerical application of this concept in satellite communications.

The Etam station is continually being modified to accept and process signals in a wide variety of ways and to take advantage of the new capabilities of the Intelsat V series of satellites, such as frequency reuse through polarization and, of course, the third antenna to use the new, higher, frequency bands.

As you know, Comsat's goal is to maintain the highest quality satellite communications service here at Etam, and in this regard we have taken steps to develop an additional 14/11 gigahertz antenna at Lenox, West Virginia, some 30 miles from here. This diversity site will insure high quality transmissions in the higher frequency bands during periods of attenuation by rainfall. Lenox will be linked to Etam by microwave, and will help keep Etam number one in terms of quality of service...

Expansion is the watchword for satellite communications today. In March of this year Comsat leased its 10,000th international satellite communications circuit, which is a significant achievement. To add perspective to this number of circuits, consider that it represents nearly two-thirds of all overseas communications in and out of the United States. It is roughly equivalent to the satellite circuits of Great Britain, Canada, Japan and West Germany combined! It represents almost one-fourth of all circuits now in use in the entire Intelsat global system which serves 134 countries.

Yet we expect that this number of circuits—as large as it seems now—will double in the next four to five years. In the Atlantic area, which is of direct concern here at the Etam Station, the traffic is projected to reach over 33,000 circuits in 1985.

This expansion is occurring around the globe, both in terms of circuits and in terms of satellite systems. In total, there presently exist over 60 operating communications satellites in geostationary orbit, and some 50 additional communications satellites are now being planned worldwide. The Intelsat growth rate continues at greater than 20 percent per year compounded. To meet this growing demand we have developed, and will continue to develop, facilities such as Etam's new antenna which will help meet this burgeoning growth...

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

"Intelsat: Operational Realities for a Future of Change," opening statement by Irving Goldstein, Senior Vice President, Comsat World Systems Division, at the meeting of the Indian and Pacific Ocean Regions Operations Representatives, Bangkok, Thailand, April 21, 1981.

The Intelsat system is characterized by dynamic expansion: a look into the future reveals that we can expect continuous growth and increasing complexity. For example, in the next twenty years, traffic in the system is projected to increase to over 700,000 channels. To meet that kind of growth, technological improvements will be required throughout the system. The challenge of providing those improvements will be met in space as well as on the ground; all will impact to varying degrees upon the role that the Operations Representatives play in Intelsat. As the system evolves, it will become increasingly important that the policy planning and operational elements within the Intelsat organization continue

Irving Goldstein, Senior Vice President, International Communications Services

to work in concert, with mutual awareness and appreciation for each other's responsibilities.

Intelsat is entering the last two decades of this century faced with the need for dramatic technological changes and improvements in order to continue provision of satellite communications services at their traditional high level of quality while not adding an unnecessarily high level of expenditure to the space and earth segments.

The first of these technological changes has already begun with the successful launching of the first Intelsat V in the Atlantic Region. The onset of the Intelsat V era signals the introduction into the system of dual polarization operation; use of the 14/11 GHz frequency bands; provision of maritime services; and further refinement of frequency reuse techniques. Each of these technological improvements, of course, has required modification to the earth segments, and it is noteworthy that of almost one hundred antennas required to undergo retrofit for dual polarization operation, more than 60 percent have already been prepared. This includes several earth stations in the Indian Ocean region where dual polarization operation will not commence until early 1982. Numerous other Signatories in the IOR have indicated their plans for retrofit during 1981.

Another, quite significant technical improvement which accompanies the Intelsat V is, of course, the introduction of TDMA, a subject of paramount importance to both the Board of Governors and the Operations Representatives...

The alternative to TDMA, of course, is the possibility of a system in which satellites saturate within two to three years. The system would soon require numerous operational satellites in each region, multiple, continuing transitions, and even more antennas—an awesome situation to contemplate. The system and cost implications for operation in a non-TDMA system are unacceptable to Intelsat; thus, to continue to meet the growing demands for ever more sophisticated telecommunications services, TDMA must be implemented...

continued from page 4

Board approves TDMA policy

The basic principles of a charging policy for future offerings of digitally-derived services were approved by the Intelsat Board of Governors at its meeting in March 1981. The set of principles, which will be applied when Intelsat introduces Time Division Multiple Access/Digital Speech Interpolation (TDMA/DSI) in the Atlantic region beginning in 1983 and in the Indian Ocean region one year later, sets the charge for a TDMA/DSI voice circuit at 12.5 percent below that for an FM voice circuit. The Board also decided to review the charging principles not later than three years after the initial operational implementation of TDMA in the Intelsat system.

In other action, the Board approved the incorporation of nickel-hydrogen batteries (developed by Comsat Laboratories for Intelsat) on Intelsat V (F-5) through (F-7), in place of nickel-cadmium batteries; the nickel-hydrogen batteries are expected to contribute to higher spacecraft performance and longer life expectancy. The Board also authorized the lease to Mexico of up to six transponders for domestic services and approved the relocation of Intelsat IV (F-3) to 307°E to provide the service. Finally, the Board authorized Ford Aerospace and Communications Corporation (FACC) to continue long lead efforts begun in December 1980 for up to three additional modified Intelsat V spacecraft. At its December meeting, the Board had agreed to purchase three such spacecraft in order to meet increasing traffic demand and to provide operational flexibility.

Corporate Locations

Comsat

Headquarters, Executive Offices
Communications Satellite Corporation
950 L'Enfant Plaza, S.W.
Washington, D.C. 20024
Telephone: 202.863.6000

STC

Satellite Television Corporation
1301 Pennsylvania Avenue, N.W.
Suite 1201
Washington, D.C. 20004
Telephone: 202.626.3600

ERT

Environmental Research & Technology, Inc.
696 Virginia Road
Concord, Massachusetts 01742
Telephone: 617.369.8910

Regional Offices:
Atlanta, Georgia
Ft. Collins, Colorado
Houston, Texas
Lombard, Illinois
Pittsburgh, Pennsylvania
Westlake Village, California

World Systems

Comsat World Systems Division &
Satellite Launch Control Center
950 L'Enfant Plaza, S.W.
Washington, D.C. 20024
Telephone: 202.863.6000

Laboratories

Comsat Laboratories
22300 Comsat Drive
Clarksburg, Maryland 20734
Telephone: 301.428.4000

Development Engineering
Division of Comsat Laboratories
5 Choke Cherry Road
Rockville, Maryland 20850
Telephone: 301.840.5600

Maintenance and Supply Center
22300 Comsat Drive
Clarksburg, Maryland 20734
Telephone: 301.428.4286

Earth Stations

Andover, Maine
Brewster, Washington
Etam, West Virginia
Jamesburg, California
Pago Pago, American Samoa
Paumalu, Hawaii
Pulantat, Guam
Susupe, Northern Mariana Islands

Comsat General

Headquarters: Switching Center and System Control Center
Comsat General Corporation
950 L'Enfant Plaza, S.W.
Washington, D.C. 20024
Telephone: 202.863.6010

Offices

Houston, Texas
New York, New York

Earth Stations

Santa Paula, California
Southbury, Connecticut
Fucino, Italy (MARISAT TTC&M)
Managua, Nicaragua (Nicatelsat)

Integrated Systems

Comsat General Integrated Systems (CGIS)
Headquarters, Microwave Division
1131 San Antonio Road
Palo Alto, California 94303
Telephone: 415.966.8440

CGIS Digital Division
7801 North Lamar Boulevard
Suite F-40
Austin, Texas 78752
Telephone: 512.451.7938

TeleSystems

Comsat General TeleSystems, Inc.
2721 Prosperity Avenue
Fairfax, Virginia 22031
Telephone: 703.698.4300

Office of Corporate Affairs, Periodicals
Communications Satellite Corporation
950 L'Enfant Plaza, S.W.
Washington, D.C. 20024
Telephone: 202.863.6102

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