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SATELLITE BROADCASTING BIBLIOGRAPHY

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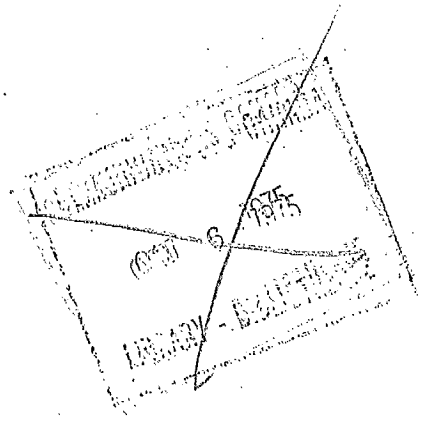

SATELLITE BROADCASTING BIBLIOGRAPHY

1962

1. *TV Broadcast from an Earth Satellite.* Gould, R.G. Trans IEEE, CS-10, p.193, June 1962.

Considered the need for, and the feasibility of, direct continental TV broadcast to conventional home receivers from an orbiting stationary satellite. Considerations include (a) audience time and language differences (Western Hemisphere); (b) lack of programming material and (c) frequency allocation problems.

1966

2. *Spaceborne Transmitter for Direct Color Television Transmission from Satellites.* Kiesling, John D. IEEE Trans. on Broadcast & TV Receivers, BTR-12, 73, May 1966.

A study of the Cost tradeoffs between the ground receiver and the spacecraft in satellite systems.

3. *Earth Stations for Reception of Television Signals from a Stationary Satellite.* Jansky, D.M. and C.E. Sampson. AIAA Communications Satellite Conference, Washington, 2-4 May 1966.

4. Documents of the XIth Plenary Assembly of the CCIR, Oslo, 1966. Vol. V - Sound Broadcasting TV.

Refers to a number of technical questions raised and which form the basis of study programmes.

5. *Communications Satellite Earth Station Technology.* Edited Lectures from a Seminar sponsored by the Communications Satellite Corporation and held in Washington, D.C., May 1966.

A very comprehensive coverage of Communications Satellite Technology.

6. *Technical & Cost Factors that Affect TV Reception from a Synchronous Satellite.* Jansky and Bailey Systems Eng. Dept., Atlantic Res. Corp. Final Report No. TR-PL-9037 to NASA under Contract NASW-1305, 30th June, 1966.

The aim of the study was to determine the cost and the quality of TV reception from satellites, for a wide range of transmitted power, frequencies in the range 200-1200 MHz and for components available in the 1966-70 time range. The resulting combinations of receiving station parameters ranged from

low-cost, home-type installations to specialized stations feeding terrestrial distribution systems.

1967

7. *Satellite Communications in Canada.* Northern Electric Laboratories, Ottawa. Study for Ministry of Transport (Contract No. 78927, 1967). 5 Volumes:-

Vol. I - Requirements
II - Satellites (prep. by Hughes Aircraft Co.)
III - Ground Stations
IV - Interference
V - Evaluation
(see Errata sheets in Vols. III & IV).

8. *A Survey of Space Applications.* NASA SP-142, April 1967.

An extensive general review under the headings of:

(a) Feasibility & practicability of using space Systems.
(b) Relative economic trade offs of using space and conventional systems.
(c) Priorities of research, development & operational activities.

9. *A Status Report on Some Aspects of Space Broadcasting Direct to Low-Cost Receivers.* Wilson, W.R. CRTC, Ottawa, May 1967.

The review paper discussed the economic and technical factors involved in the development and operation of space broadcasting systems designed for service direct to home or to low-cost community terminals.

10. *RF Design of Communication Satellite Earth Stations.* C.L. Cuccia et al. Three Parts. Microwaves, Vol. 6, May-July 1967.

Part 1, "Sensitivity and the Antenna Sub-system," discussed the receiving sensitivity parameters of the earth station and how RF aspects of the antenna and feed system affect the earth station's sensitivity. Part 2, "The Earth Station Low-Noise Amplifiers," concerned the effect of the low-noise preamplifier on sensitivity. Part 3, "The Communication Track and Transmit Circuits," presented the factors affecting power amplifier selection, the tracking system and component availability.

11. *Distribution of TV Service by Communication Satellites.* CBC Preliminary Study, September 1967.

A general discussion of requirements in terms of channels, programme time, time-zone scheduling etc. and of the cost of several possible

systems options that might be considered to fill the requirements.

1968

12. *Communications Satellites for Education, Science & Culture.* Schramm, W. Inst. of Joint Communications Research, Stanford Univ. Reports and Papers on Mass Communications, No. 53. UNESCO, 1968.

The paper reviewed the development of communications satellites and examined their possible roles for these purposes. It concluded that technology has far outrun plans for its use. It emphasized that careful planning would be necessary to exploit the new technology in areas where economic utility is not so apparent.

13. *The Role of Satellites in World Communication Systems.* Armstrong, C.A. IEEE Conference Record. International Conference on Communications, 1968.

Stressed the requirement for a systems approach to policy and decision-making with respect to satellite communications-

(a) impact on, and relation to, existing systems;
(b) international arrangements;
(c) cultural and social implications, etc.

14. *Impact of Projected Space Services upon Utilization of the Radio Frequency Spectrum - Final Report.* Jansky and Bailey Systems Dept., Atlantic Res. Corp. Submitted to Executive Office of the President, OEP under Contract OEP-SE-66-7, January 1968.

A comprehensive study to determine the radio frequency spectrum requirements for allocation to space services during the period up to 1980. Separate appendices of graphical and tabular technical supporting material.

15. *Space Communications and Broadcasting.* Paper prepared for Outer Space Affairs Group of the U.N. by Rydbeck, O., Director-General, Swedish Broadcasting Corporation (OSAG Background Paper No. 9, 15th April, 1968).

An extensive, general, non-technical review of the historical development of current space communications systems and organizations. Presentation of some of the problems and problem areas of concern to broadcasters and indications of possible approaches to solution.

16. *Communications Satellite Technology in the Next Decade*, Stampfl, R.A. Report No. NASA-TM-X-701-68-137, NASA (Goddard), April 1968.

After initial experimentation at lower altitudes the American commercial communications satellites program has settled on, and is likely to continue exclusive use of, geosynchronous orbits perhaps making use of orbital inclination to the equatorial plane to obtain specific geographical coverage. System capability during the next decade will exceed current economic and rate regulatory considerations. Hence, reliability and long life

will be emphasized to lower communication costs even more than commercial communications satellites have achieved. It is anticipated that system capability will be extended to relay TV channels on a routine basis and provide broadcasting to community receivers for educational purposes. Further, the system capability will provide higher gain, multiple access and special-purpose links heretofore not served operationally by satellites. One special-purpose link would be inter-continental communications and air-traffic control combined with data collection.

17. *Ultimate Subjective Quality of a Satellite TV Network Covering Europe and Africa.* Benoit, A. and H. Godfroid. IEEE Trans. on Broadcasting, BC-14, p. 49, June 1968.

A technical paper treating a 625-line system, with a transmitting frequency in the 4-12 GHz range and on the basis of a ground distribution system from a central receiving station.

18. *The Role of Small Earth Stations in Future Civil Communications Satellite Systems.* Blonstein, J.L. U.N. Conference on Exploration of Peaceful Uses of Space, June 1968.

19. *Multikilowatt Transmitter Study for Space Communications Satellites.* Volume I, Summary Report, Phase I. General Electric Co., Report No. NASA-CR-109651 (DOC-688D4268; N-70-27440) under NASA Contract No. NAS8-21886, 10th June 1968.

The report discussed a study of high-power transmitters with potential application to satellite TV broadcasting. The study included circuitry, thermal control mechanisms and mechanical configurations. Key technical problem areas were defined and further study of these was recommended.

20. *Preliminary Views of the U.S.A. for the WARC for Space Telecommunications.* Doc. 12610/1-3.1.21, 28th July, 1968.

A comprehensive position paper on spectrum requirements and sharing and notification and registration procedures for frequency assignments. Good introductory section on the applications of satellites - broadcast, resources, etc.

21. *Satellite - Distributed Educational Television for Developing Countries* - 4 volumes - prepared for Agency of International Development, Washington, D.C. by Stanford Res. Inst. on Contract AID/csd-1901 (SRI Proj. 7150) August 1968.

Vol. I - Summary Report, W. Schramm & W.J. Platt
Vol. II - The Case of India, W. Schramm & L. Nelson

Vol. III - The Case of Latin America, W. Platt et al.
Vol. IV - Working Papers, W. Schramm et al.

The study was designed to determine the potential of Satellite-delivered educational broadcasts through analysis of two developing regions. Emphasis of the studies was to be on the educational, economic, cultural, organizational and political factors affecting the feasibility and utility of Satellite Communications. The Project was related to the Activities of the President's Task Force on Communications.

Vol. III includes an extensive bibliography.
Vol. IV contains a set of Computer-based, cost models to be used to examine various systems options and sets of parameters.

22. *Satellite Communications for National Development Purposes* - UNESCO Study for a Pilot Project in India. Telecommunications Journal., 35, No. 8, pp. 408-411, 15th August, 1968.

An extended summary of the study, covering background, technical details, cost estimates and implementation plans.

23. *Millimeter Waves Study*. Radio Frequency System Quarterly Report, 1st September-1st December 1968 (Auburn University, Alabama, Microwave Research Lab.) Contract NAS8-11184 for NASA.

In the millimeter wave study, efforts were directed toward the definition of the satellite earth transmission channel at K_a band. Attention focused on amplitude variations, limitations and distortions due to ionospheric and tropospheric attenuation, refractive effects and fading. In the work on the radio frequency systems progress is described in the construction and testing of a 2250-MHz prototype television exciter unit.

24. *Feasibility Studies of Direct Voice Broadcast Satellites*. Kuhns, P.L. Report No. NASA-TM-1747, NASA (Lewis Research Center), 16th September, 1968. (DRB/DSIS Accession No. 69-10627).

The studies, conducted in 1966-67, included audience and receiver analyses, conceptual spacecraft configurations, technological and cost evaluations and data on indigenous noise.

The studies concluded that voice broadcasting was feasible from the technological standpoint for launches in the early 1970's, provided that effort was applied immediately on items requiring long development and testing times.

25. *The Technology Potentials for Satellite Spacing and Frequency Sharing*. J.L. Hult et al. Rand Corporation, Memo No. RM-5785-NASA, October 1968, prepared for NASA.

This Memorandum described the important factors influencing satellite spacing and frequency sharing. In particular, it derived the

system parameter constraints that could improve the compatibility of and benefits for satellite and microwave relay systems sharing a common spectrum. Three types of stations must be considered in analysing such spectrum sharing: terrestrial microwave repeaters and terminals, satellite repeaters and earth-station terminals.

26. *Satellite Broadcasting.* Pritchard, W.L. Paper presented at AIAA 5th Annual Meeting, Philadelphia, October 1968.

A general background paper from the Director of the COMSAT Laboratories.

27. *Broadcast Satellites - Their Applications and Implementation Impediments.* Haviland, R.P. Paper No. 68-1064, AIAA 5th Annual Meeting, Philadelphia, October 1968.

The non-technical paper reviewed (a) the published advantages of broadcast satellites, noting that the relative importance of these varies with the state of development of a country and (b) the impediments to implementation of such satellites.

28. *Direct Broadcasting from Satellites.* Colloquium organized by Professional groups of the IEE and held 4th November, 1968. Colloquium Digest No. 1968/24.

A comprehensive symposium, with an extensive bibliography.

29. *Television by Satellite.* The Radio and Electronic Engineer, 36, p.273, November 1968.

A technical discussion of the subject of direct broadcasting vs a wire distribution system from central ground receiving stations. Concludes that (a) the former is within the state-of-the-art only if new frequencies, antennas and new or adapted receivers are used and (b) there are many areas, which are already high in programme distribution and receiver densities, where the latter will fill the requirement.

30. *Study Programme for Canadian Domestic Communications Satellite.* RCA Ltd. Montreal. 5 Vols. (For Department of Industry, Trade & Commerce - Proposition No. 2220-1), 25th November 1968.

31. *Final Report, President's Task Force on Communications Policy.* U.S. Government Printing Office, Washington, D.C., 7th December 1968.

The Report was organized around the following topics (a) the organization of the U.S. international Telecommunications industry; (b) policies to support and strengthen INTELESAT; (c) Telecommunications needs of less-developed countries; (d) uses of domestic satellites; (e) structure and regulation of the domestic carrier industry; (f) future opportunities for TV; (g) spectrum use and management and (h) Federal Government roles in Telecommunications.

32. *Comments on the Proposed Canadian Satellite Project.* Wilson, W.R. Technical Advisor, CRTC, Ottawa, 24th December, 1968.

A general (mainly non-technical) discussion of Canadian broadcasting requirements and of the relative suitability of UHF and 4 GHz systems to fill the requirements. Included consideration of costs, implications of cooperative arrangements with the U.S., coverage maps and statistics on possible Northern Canadian population coverage.

33. *Efficient Spacing of Synchronous Communications Satellites.* Harrison, E.R., Bell System Technical Journal 47, p. 2379, December 1968.

The paper compared the orbit packing efficiency of equatorial circular synchronous orbits and those inclined with respect to the equator. The latter appear to move in a figure 8. The study showed that, for frequencies above 12 GHz and a 1^0 closest-spacing between satellites, the optimum scheme for the flatter orbit permits approximately 6 times as many satellites as does the former.

34. *Parametric Representation of Ground Antennas for Communication Systems Studies.* Pope, D.L., Bell System Technical Journal 47, p. 2145, December 1968.

Mathematical models relating the gain, cost, diameter, frequency and rms surface tolerance of ground antennas were developed for both exposed and radome-enclosed parabolic reflectors. Diameters considered ranged from 15 to 500 feet while frequencies vary from 1 to 100 GHz. Data from existing installations were used to develop standard cost vs diameter and rms surface tolerance vs diameter relationship.

35. *A Model of a Domestic Satellite Communication System.* Tillotson, Leroy C., Bell System Technical Journal 47, p. 2111, December 1968.

A preliminary study of a domestic satellite system was reported. An effort was made to conceive a system to carry the greatest possible amount of traffic. By making full use of modern rocket technology including the Saturn V class propulsion systems, highly directive multibeam antennas operating in the range from 15 to 40 GHz, interference resistant modulation methods, highly stabilized synchronous repeater platforms, and integrated solid state microwave repeater electronics, a very large communication capacity could be obtained. For example, using 50 ground stations and 50 satellites operating in bands at 20 and 30 GHz, each 4 GHz wide, a total of 100 million voice circuits, or equivalent, could be provided.

1969

36. *Useful Applications of Earth-Oriented Satellites - Broadcasting.* Prepared by Panel 10 of the Summer Study on Space Applications, NRC, for NASA. National Academy of Sciences, 1969.

A study of broadcast satellites, with suggested technical systems, cost and economic studies, identification of uses and users of the systems (and the effect of the introduction of this new broadcast system). Included a number of technical and cost tables and an extensive bibliography.

37. *Useful Applications of Earth-Oriented Satellites* - Report of the Central Review Committee. Prepared by the Central Review Committee of the Summer Study on Space Applications, NRC, for NASA. National Academy of Sciences, 1969.

This summary review of the activities of the Summer study included a series of conclusions and recommendations under such headings as:-

(a) Costs, Social and Economic returns;
(b) International implications and cooperation;
(c) Organization and scope of future programmes.

38. *Problem of International Communications with Reference to INTELSAT.* Memo from the Legal Division, Dept. of External Affairs, Ottawa, 1969. No author indicated.

Discussion of events leading up to the establishment of INTELSAT and of the negotiations in 1969 toward evolving a more permanent international structure.

39. *Transponders for Communications Satellites.* Dawson, G. Electrical Communications (ITT), 44, p. 308, 1969.

A review of transponder technology and outline of possible future developments, with specific reference to the INTELSAT Series.

40. *Report of the Working Group on Direct Broadcast Satellites.* U.N. General Assembly, Committee on the Peaceful Uses of Outer Space, A/AC-105/51, 26th February 1969.

A study of the technical feasibility of Communications by direct broadcast from satellites and the current and foreseeable developments in the field, including comparative user costs and other economic considerations. Considered only 800 MHz and 12 GHz systems. Concluded that systems based on existing, unaugmented receivers are not foreseen for the period 1970-85, but that development of augmented receivers could make operation feasible by 1975. However, the system would at the same time require heavy costs for development of the space segment of the system. Broadcast into Community receivers could be possible by 1975.

41. *Space Broadcasting - How, When and Why.* Haviland R.P. Bull. of the Atomic Scientists, p.39, March 1969. (First presented to the U.N. Conference on the Exploration and Peaceful Uses of Space, Vienna, August 1968).

A mainly non-technical discussion, including satellite requirements, language problems, interference, programme requirements, etc.

42. *Expandable Truss Antenna Growth Characteristics.* Report No. GDC-DCL-69-001, General Dynamics (Convair Division), March 1969.

The report dealt with the application of a unique antenna concept to large-diameter, space reflectors operating at frequencies above the UHF band. The configuration is considered to be particularly applicable to systems requiring antennas with diameters from 20 to more than 100 feet.

Aspects studied included RF performance and thermal distortion.

A bibliography of other GDC reports on large erectable space antennas was included.

43. *Use of the Frequency Spectrum above 11.7 GHz in Canada.* Report prepared for the Department of Communications by the Telephone Association of Canada, in preparation for a WARC of the ITU (1970 or 1971), April 1969.

Mainly technical, with special reference to traffic forecasts, propagation phenomena, possible system configurations and spectrum needs and allocations.

44. *The Advantages of Demand Assignment for International Satellite Communication Systems.* Pritchard, W.L. and J.G. Puente, 1969 (Communications Satellite Corp. Washington, D.C. Presented at the 9th British Interplanetary Society European Space Symposium, London, 14-16 May 1969. Sponsored by International Communications Satellite Consortium).

Methods of accessing a satellite and assigning satellite channels between earth terminals are discussed with special emphasis on techniques of demand assignment along with its technical and economic advantages.

45. *Some Possible Concepts for a Second Phase of Communication Satellite Developments in Europe.* Simons, N. 28th April 1969 (Ministry of Tech. London, Eng.). Presented at the 9th British Interplanetary Society European Space Symposium, London, 14-16 May 1969.

The requirement for distribution of television programmes in Europe in the period 1975-1985 is examined as a possible theme for the second phase of developments to follow the Eurovision project. It is shown that a system of semi-direct television using an intermediate satellite should be by far the cheapest available method. It would also be economic

in terms of frequency spectrum and possess other advantages. The savings as compared with conventional, ground-station distribution, even when the system is loaded with the full costs of launcher development, appear to be substantial.

46. *Broadcast Satellites: Their Potential Use for Educational Purposes and Their Relationship to International Understanding and Cooperation.* Hanessian, John, Jr. and J.B. Margolin. Occasional Paper No. 3, Program of Policy Studies in Science and Technology, The George Washington University, Washington, D.C., July 1969. Statement to U.S. House of Representatives Committee on Foreign Affairs (Resolution No. 236 - "Satellite Broadcasting: Implications for National Policy"), 22nd May 1969.

The presentation reviewed the subject under headings including (a) Educational Applications, Requirements and Benefits; (b) International Considerations and (c) Educational Potential and Implications for U.S. Foreign Policy.

47. *The Domestic Telecommunications Carrier Industry. Part I.* Rostow, E.V. President's Task Force on Communications Policy. June 1969 (PB-184417).

48. *Satellite Communications & ETV in Less-Developed Countries.* Rostow, E.V. President's Task Force on Communications Policy. June 1969 (PB-184415).

49. *Preliminary Technical Study of a Direct Telecast Satellite.* NASA Technical Translation TT F-12381, July 1969. Translation of a French (CNES) 1968 Document.

Presented the philosphy and technical details of a system for a developed area.

50. *Multikilowatt Transmitter Study for Space Communications Satellites. Volume II.* General Electric Co. Report No. NASA-CR-102593 (N-70-28535) Under NASA Contract No. NAS 8-21886, 30th July, 1969.

A continuing study of the development of high-power and high-efficiency amplifiers. The supporting technology areas studied included monitor and protective circuitry, thermal control and space qualification. The need for caution was emphasized, in scaling low-power test and analytical results to higher-power levels, since some phenomena associated with high-power breakdown are not well understood due to lack of pertinent data.

51. *Communications Satellites - Success in Space.* Gicca, F.A. Electronics World, 82, 23, July 1969 and 82, 44, August 1969.

A two-part review of the history of Communications Satellite developments.

52. *Broadcasting from Satellites.* Working Papers submitted to the Working Group on Direct Broadcast Satellites, U.N. Committee on the Peaceful Uses of Outer Space. February-June 1969. Series includes submissions by Canada and Sweden, U.S.A., U.S.S.R., U.K., etc. For identification of Documents, see Report of the Second Session of the Working Group, DOC No. A/Ac. 105/66, 12th August, 1969. (Next item).

A general, extensive review of broadcast satellite operations and implications. Included a readable discussion of technical feasibility and characteristics.

53. *Report of the Second Session of the Working Group on Direct Broadcast Satellites,* U.N. General Assembly, Committee on the Peaceful Uses of Outer Space, A/Ac-105/66, 12th August 1969.

Continued the studies outlined in Item No.52 to cover the implications in the social, cultural, legal and other areas.

A very good summary of the discussions of the working group.

54. *Ultimate Communication Capacity of the Geostationary Satellite Orbit.* J.K.S. Jowett et al. Proc. IEEE, 116, p. 1304, August 1969.

A technical discussion of the ultimate limit to the number of communications channels that an orbit can support in a given bandwidth due to adjacent satellite interference. Discussed in terms of antenna beamwidth, channel power, satellite separation, frequency (including frequencies above 6 GHz) and modulation method (FM & PCM for Telephony & FM for TV).

55. *The Promise of UHF Satellites for Mobile Services.* Hult, J.L. RAND Corp. Report No. P-4170, August 1969. (AD-691-868).

The paper outlined some important factors in Spectrum management and use, satellite relay systems and service applications to positioning, communications and broadcasting.

56. *Cable TV and Satellites.* Feldman, N.E. RAND Corp. Report No. P-4171, August 1969. (AD-691-869).

Compared the roles of cable, cable-satellite and direct-broadcast-satellite systems in terms of equipment costs and channel requirements. Application to the areas of instruction, culture and commerce stressed.

57. *Lightweight Large Area Solar Arrays.* Abbott, D.D. Proceedings 4th IEEE Conference, Washington, D.C., September, 1969.

The paper reviewed current developments in this area and included a number of summary charts and tables, array illustrations and references. State-of-the-art designs of 5000 sq.ft. and 20-30 watts/lb. were discussed. Rollup arrays appear to have certain advantages over foldout arrays, but the former exhibit some troublesome interactions with the satellite that require further study.

58. *Satellite Television Distribution. Service from Geostationary Satellites to Community Antennas in Multiple-Coverage Areas.* A.K. Jefferies et al. Proc. IEEE, 116, p. 1501, September 1969.

A technical treatment of the subject of multiple programme coverage for a number of continuous areas (e.g. countries in Europe). Also applicable to Canadian Provinces? For a typical area such as Europe and for domestic reception via community antennas, four programmes could be provided to each of 30 countries, using 8 satellites in an orbital arc of 20^{0} and frequencies in the region of 12 GHz. Direct reception at domestic receivers would require greater transmitter power and an orbital arc of 35^{0}.

59. *Orbit Allocation of Domestic Communications Satellites.* Shinji, M. Proceedings of the IEEE, 57, p. 1655, September 1969.

An efficient method of packing domestic communications satellites was described. In this method, inclined elliptical synchronous orbits are used instead of inclined circular synchronous orbits. The total number of communications satellites is, for example, 8.4 times larger than that for the equatorial system only.

60. *Evaluation of Development Costs and Possibilities of Direct TV Satellites.* Kotowski, P. ELDO Publication 23, Paris, September 1969. (N-69-40214). Presentation at Colloquium on Direct Satellite Broadcasting, Hamburg, September 1969. In German.

Discussion of costs of launch vehicle, satellite and receivers.

61. *Space Services for Broadcasting - Terminology.* CCIR Doc. x 274E - XI/262E, dated 15th September 1969 (under cover of Doc. IV/357-E, dated 18th September 1969). Ref. also Doc. IV/454-E dated 2nd October 1969, which comments on the above. Doc. No. 454 is now identified as Report No. 471, Documents of the XIIth Plenary Assembly, New Delhi, January 1970.

62. *Brief prepared by Canadian Association of Broadcasters for Preparatory Policy Conference of the Liberal Party of Canada,* Harrison Hot Springs, B.C., November 1969. Submitted under covering letter dated 26th September 1969.

63. *Domestic Communications Satellite System - Study of a Second Generation.* Interim presentation, October 1969. Prepared by L.C.T. Paris for the Department of Communications.

A technical presentation of details of options available for a satellite system for the 1975 period.

64. *An Evaluation of TV Broadcast Satellite Systems.* Hesselbacher, R.W. Paper No. 68-1061, AIAA 5th Annual Meeting Philadelphia, October 1968. (Published later in SPACECRAFT AND ROCKETS, p. 1124, 6th October 1969.

The paper presented the results of an evaluation of technological and cost factors associated with TV broadcast satellite systems. Several transmission frequencies in the 0.8 - 12 GHz range, with both AM & FM, were used in the study. Three services were chosen as examples -

(a) A Community/Distribution service to India;
(b) a Direct Service to Alaska; and
(c) an Instructional TV Service to the U.S.

65. *Broadcasting from Space - Closer to Reality, 1969.* Fink, D.J. and R.W. Hesselbacher. GE Paper at 20th International Astronautical Congress, Argentina, October 1969.

A primarily non-technical paper dealing particularly with US cooperative programmes with Brazil and India, with particular reference to experimental systems in India in 1972-73, using the ATS F&G satellites.

66. *Radio and TV Broadcasting.* Dominion Bureau of Statistics Report No. 56-204, October 1969.

67. *Feasibility of Sound and Television Broadcasting from Satellites.* CCIR Doc. IV/458/E, dated 2nd October, 1969. (Now identified as Report No. 215-2, Documents of the XIIth Plenary Assembly, New Delhi, January 1970).

Dealt with technical questions relating to direct-broadcast satellites. Included an extensive bibliography from both the CCIR and the open literature.

68. *Government sets up Special Study Group to Analyze Telecommunications Industry.* Canadian Electronics Engineering, 13, p. 28, October 1969.

A discussion of the role and organization of the Telecommission set up under the Department of Communications.

69. *Satellite Communication for Small Users.* Welti, G.R. Paper No. 69-1073, AIAA 6th Annual Meeting and Technical Display, Anaheim, California, October 1969. A ComSat paper.

Studied methods of extending satellite communication service to small users such as villages, aircraft, buoys, ships, machines, etc.

Approach is in terms of spectrum allocation and technical and economic considerations.

70. *Key Technologies for High Power Broadcast Satellites.* Rutsein, I. Paper No. 69-1069, AIAA 6th Annual Meeting and Technical Display, Anaheim, California, October 1969. A GE paper.

A technical paper dealing with the technologies required by a high-power TV Broadcast Satellite. Time frame is mid 1970's to early 1980's. A number of technical areas are ranked in terms of the state-of-the-art and of priorities required for further development work.

Concluded that no technological breakthroughs are required, but an intensive effort in engineering to exploit existing concepts.

71. *Educational Uses of Satellites in Developed and Less Developed Countries.* Harley, W.G. Paper No. 69-1071, AIAA 6th Annual Meeting and Technical Display, Anaheim, California, October 1969.

A non-technical discussion dealing mainly with:

(a) questions of decisions about possible sources of programme material;

(b) the relation between satellite and existing ground-based systems and

(c) international implications.

72. *TV Broadcast Satellite Study.* Jansen, J. et al. TRW Report No. 08848-6002-RO-00. (NASE CR-72510), 24th October, 1969. Final Report under NASA Contract No. NAS3-9707.

A report that discussed the various technical aspects relevant to development and design of TV broadcast satellites and the user equipment for receiving the broadcasts. Parametric cost data vs overall system performance were presented. Potential audiences were identified, with particular emphasis on education. Analysis was based on the frequency range 0.9-12 GHz. Report included extensive sets of Tables, Illustrations and References.

73. *Some Future Trends in Broadcasting.* ADM(R), Department of Communications. Speech to Central Canada Broadcasters' Association, Ottawa, 28th October 1969.

74. *Study of the Satellite/Earth Station/Domestic - Receiver Chain in a Satellite System for TV Distribution.* Dr. A. Benoit et al. Proc. IEEE, 116, 1797, November 1969.

A technical study which discussed, as an illustration, the application of the methods described to a system to cover Europe, N. Africa and the Middle East.

75. *TB Broadcast Satellite (TVBS) Study.* Hesselbacher, R.W. General Electric Co. Space Systems Organization. NASA Contract No. NAS3-9708.
Vol. I - Summary Report, August 1969 (NASA CR-72578).
Vol. II - Research & Technology Implications, October 1969 (NASA CR-72511).
Vol. III - Technical Report, November 1969 (NASA CR-72579).

Reported results of a study of technological and cost factors associated with TVBS systems. Satellite conceptual designs were suggested based on technology estimates for the early 1970's.

Satellite systems were compared cost-wise with terrestrial systems.

76. *The Operation of Molniya Communications Satellites.* Allan, R.R. Royal Aircraft Establishment. Report No. TR-69266, November 1969 (AD-702006).

A review of the USSR programme, with particular emphasis on an analysis of the non-stationary orbits.

77. *The Improvement and Development of Canadian Broadcasting and the Extension of U.S. TV Coverage in Canada by CATV.* CRTC Public Announcement, 3rd December 1969.

Details of the background, submissions and recent decision regarding the importation of Broadcasting programmes by microwave.

Statistics on geographical coverage of Canadian and Northern U.S. TV stations, Canadian coverage by CATV, viewing of Canadian & U.S. TV programmes in Canada, etc.

78. *The Use of Artificial Earth's Satellites for Television Broadcasting.* I. Ya Petrov et al. Telecommunications and Radio Engineering (Moscow), 24, No. 12, 55, December 1969.

The main parameters of a TV Broadcasting system, for the reception of TV broadcasts by domestic community receivers, were analyzed. The calculations were based on the use of the 0.8 and 12 GHz bands. The analysis included consideration of organizational and legal factors (e.g. different receiver standards, languages, time zones, etc.).

79. *Polarization Discrimination in Satellite Communications.* Dudzinsky, S.J. Jr., Proc. IEEE, 57, p. 2179, December 1969.

Calculated that up to 30 db isolation could be achieved, with very little increase in cost and complexity, by using orthogonal polarizations on two channels.

Adaptive antennas to adjust the polarization could give additional protection.

80. *The Impact of CATV in Canada on the Audiences to Canadian TV Stations.* CBC Research Report No. TB-69-74, December 1969.

The third in a series. This report dealt with the particular impact on audiences to different categories of station and to individual stations within these categories.

1970

81. *Spectrum Allocations for Space Broadcasting.* Wilson, W.R. Preliminary Comments Concerning Preparation for The World Administration Radio Conference (WARC). CRTC, Ottawa, 5th January 1970.

82. *Community Antenna TV.* Dominion Bureau of Statistics Report No. 56-205, January 1970. (Annual Statistics for 1967 and 1968).

83. *State-of-the-Art in SHF Power Amplifiers Covering the Power Range 100 Watts to 1 KW for Space Application.* Trip Report by R.G. Aiken, Department of Communications, Communications Research Centre, February 1970.

84. *Why Space Broadcasting?* Haviland, R.P. IEEE Spectrum, 7, p.86, February 1970.

Examines some non-technical factors that will influence both policy and technical decisions. Suggests a community Satellite service for developing countries, and a programme equalization service for developed countries, with both areas adopting a combined Satellite-terrestrial system. International relations and spectrum conservation are stressed.

85. *Development of Circuitry for a Multikilowatt Transmitter for Space Communications Satellites.* General Electric Co., Space Systems Organization. Interim Technical Report under NASA Contract No. NAS-8-24771. 20th February, 1970 (N70-28060) (NASA No. CR-102688).

The study is a continuation of a previous one on the definition of space transmitters (50w.-20Kw) with emphasis on space TV broadcast satellites. The aim is to develop, and construct a prototype of, a UHF AM-TV satellite transmitter. The system missions envisaged include a direct or semi-direct TV broadcast function with conventional ground TV receivers, probably using improved ground antennas but operating without receiver modifications.

86. *TV Satellite Broadcasting.* Hieber, S. Publication No. 26, European Space Vehicle Launcher Development Organization, Paris, March 1970 (N-70-27527). In German.

The report outlined significant feature of possible satellite broadcasting and programme distribution services. Direct and indirect TV services to individuals and communities were considered. Technical factors

underlying reception quality, such as modulation techniques, receiver sensitivity, antenna types, frequencies, satellite orbits and power and coverage area, were discussed.

87. *A TV Broadcast Satellite System for ETV/ITV.* Bergin, P.A. Paper No. 70-452, AIAA 3rd Communications Satellite Systems Conference, Los Angeles, April 1970.

The paper analyzed the computerized synthesis of a minimum-cost system, in terms of such parameters as number of channels and beams, receiver population and operating frequency.

88. *Tubes for High-Power Microwave Transmission in Space.* Ramins, P. NASA (Lewis) Technical Memorandum No. X-52759. Presented at AIAA 3rd Communications Satellite Systems Conference, Los Angeles, April 1970.

The paper gave details of a research programme aimed at developing tubes for operation at frequencies up to 12 GHz, with output power up to 5 Kw. cw, efficiency in excess of 75% and 2-5 year lifetime.

89. *High-Power Spaceborne TV Transmitter Design Tradeoffs for the 1970-85 Period.* Lipscomb, E.T. Paper No. 70-434, AIAA 3rd Communications Satellite Systems Conference, Los Angeles, April 1970.

The paper reviewed satellite TV broadcast technical requirements and constraints and their impact on transmitter design. An extensive bibliography was included.

90. *Frequency Sharing between FM & AM-VSB TV Transmission Systems.* Miller, E.F. and R.W. Mhyre. NASA (Lewis) paper for presentation at the AIAA 3rd Communications Satellite Systems Conference, Los Angeles, April 1970 (NASA Tech. Memo. X-52755).

Presented results of a lab study of frequency-sharing possibilities for the UHF, S & X bands.

No general conclusions could be reached. They will depend on the factors obtaining in any particular case - user cooperation, tolerable interference level, holes in coverage patterns, etc.

91. *Spectrum for Area Coverage from Satellite Relays to Small Terminals.* Hult, J.L. Rand paper presented at AIAA 3rd Communications Satellite Systems Conference, Los Angeles, April 1970. To be published as Rand Report No. P-4301. (N70-27796).

The paper considered the small-terminal area coverage for both mobile and broadcast services. The relative capacity figure-of-merit for satellite down-link frequencies was tabulated. The effect of frequency choice on the earth terminals and on the total system cost was considered. The use of small adaptive or adapted arrays at the earth receiving terminals was advocated.

92. *The Wired Nation.* Smith, Ralph L. The Nation, p. 582, 18th May 1970.

The paper reviewed the history of CATV in the USA and discussed the economic, cultural, social, legal and technical implications of the new medium and its relation to existing distribution systems (e.g. AT & T).

93. *The Role of Small Earth Stations in Civil Communication Satellite Systems.* Blonstein, J.L. Telecommunication Journal, 37, p. 221, May 1970.

The paper reviewed the potential applications of communication satellites and examined the parameters of the family of small earth stations that might emerge as part of the systems. These parameters assumed operation in the 4 and 6 GHz bands.

94. *Domestic Communications via Satellite.* Gross, W.B. Telecommunications, 4, p. 21, May 1970.

The paper developed the technical parameters for a system for the 4 and 6 GHz band, with a 30-foot ground antenna, multiple-access digital service and a life of five years. A projected system configuration would involve CATV, microwave links and local loops. Cost estimates were included.

95. *Ground Signal Processing Systems, Summary Report on Analysis, Design and Cost Estimating.* Miller, E.F. Report No. NASA CR-72709, General Electric Co., June 1970. NASA Contract No. NAS-3-11520.

The report considered the cost and technical parameters of ground signal - processing systems for low-power, colour TV signals from satellites. Frequencies considered were in the 2.5 and 12 GHz bands. The project is to extend to the design and fabrication of prototype units.

96. *The Telesat Canada Domestic Communications Satellite System.* Dalfen, C.M. Journal of International Studies, Stanford University School of Law, 5, p.84, June 1970.

A comprehensive review of the background, planning and structure of the Canadian domestic system.

97. *Low-Cost Receivers and the Use of Direct-Broadcast Satellites for Instructional Television.* Janky, J.M. Journal of International Studies, Stanford University School of Law, 5, p. 138, June 1970.

The technical paper discussed the application of direct-broadcast satellites to beam instructional television to community receivers in developing countries. It described the design of the system and presented a detailed description of the equipment necessary for direct reception, including a cost estimate for production in a user nation.

98. *Conference Record of IEEE 1970 International Conference on Communications*, San Francisco, 8-10 June 1970. IEEE Cat. No. 70C21-COM.

The conference included (a) a session on Satellite Communication systems, with papers on Fence and Pit Shielding of Earth Stations, Design of Transportable Earth Stations and Earth Station Transitions within the Intelsat System and (b) a session on Regional Communications Satellite Systems and Technology, with papers on Domestic Systems for Australia, Low-cost Receivers for Instructional Broadcasting, Domestic Satellite Design and Multiple Beam Antennas for Satellites and for Earth Stations.

99. *Western Union Submission to F.C.C. for U.S. Domestic Communications Satellite System.* July 1970.

The proposed system would consist initially of three geostationary satellites (located over the equator at 95^{0}, 102^{0} and 116^{0} West Longitude) and six earth stations.

Initial operation of the system could begin two years after approval and full operation eight months later.

Each satellite would carry 12 transponders, with center-frequency spacing of 40 MHz, up-link frequencies would be in the band 5925-6425 MHz and down-link frequencies in the band 3700-4200 MHz. Attitude would be maintained to better than 0.1 degrees.

The satellite antenna would be 60 inch and mechanically despun. Multiple feeds would provide coverage of the Contiguous States with a 6.8 x 3.5 degrees coverage. Additional feeds would provide spot-beam coverage of Alaska and Hawaii with reduced power and sensitivity.

Of the 6 earth stations 4 would be "major", with either 2 or 3 45-foot antennas and 2 would be "minor" with one 45-foot antenna and a second of 32 feet.

Unit estimated costs are (approximately) -

Satellite	8M
Launch	6M
Major earth station	4-6M (depending on number of antennas)
Minor earth station	1.6M

100. *A Satellite System for CATV.* Q.B. McClannan et al. Proc. IEEE, 58, 987, July 1970. Part of a special issue on CATV.

The authors analyzed a satellite CATV system intended to distribute 6 TV channels to 10-foot-antenna terminals at the CATV head ends. Three satellites would provide coverage of the USA. Operation would be in the 12 GHz band.

101. *Soviet Communications Satellites.* Plummer, K.L. Spaceflight, 12, No. 8, p.322, August 1970.

This technical review of the Soviet programme included details of the spacecraft, orbital elements and operational uses.

102. *Possible Applications of Communications Satellites to Offshore Systems.* Briskman, R.D. IEEE Trans. on Aerospace and Electronic Systems, AES-6, p.606, September 1970.

The paper reviewed the current status of satellite communications systems and the potential for further development, with emphasis on applications related to offshore activities. Special reference was made to the need for small, simple, reliable and economic earth stations.

103. *Artificial Site Shielding for Communications Satellite Earth Stations.* Lucia, E.F., Jr. IEEE Trans. on Aerospace and Electronic Systems, AES-6, p.612, September 1970.

The possibilities of using pit shielding have been investigated as a means of providing isolation between potentially-interfering terrestrial relay terminals and earth stations.

The procedure was illustrated by reference to the shielding of a 32 foot antenna, which provided an advantage of 25 db.

104. *Some Calculations on Coupling Between Satellite Communications and Terrestrial Radio-Relay Systems Due to Scattering by Rain.* Gusler, L.T. and D.C. Hogg. Bell System Technical Journal, 49, p.1491, September 1970.

Interference between a satellite-communications ground station and a terrestrial relay station because of coupling due to rain is a relevant factor in considerations of frequency sharing by the two services. This paper reported studies of the phenomenon for frequencies between 4 and 30 GHz, ground-station antenna elevation of 30^{o}, interstation distances from 5 to 200 km and rainfall rates up to 400 mm/hr. While the results are sensitive to a number of factors such as the rainfall rate and distribution, separation between the stations and the gain and the relative orientation of the antennas, it was concluded that the possible coupling interference should be considered in deciding on the location and parameters of ground stations and terrestrial-relay terminals. It was tacitly assumed that satellite systems above 10 GHz will no doubt use a space-diversity system of two or more earth stations to avoid outages due to attenuation by rain.

105. *Inquiry into Policy to be Followed in Future Licensing of Facilities for Overseas Communications.* F.C.C. Docket No. 18875. Submission by COMSAT, September 14th 1970.

The case for support for Satellite Communications vs other systems (e.g. cable).

106. *Production Design of a $100 Antenna-Receiver for Reception of Television from Satellites at 2.6 GHz.* J.M. Janky et al. Stanford University Status Report on NASA Contract on Low-cost Antenna-Receiver, 7th October 1970.

The report described an Antenna-Converter package to be mass produced for use with a standard TV receiver. The study resulted in estimates of factory and installed costs of $100 and $500 respectively. For 12 GHz an increase in the factory cost of 100-200%, and a reduction in performance of 3-8 db, were estimated.

107. *A Satellite System for Avoiding Serial Sun-Transit Outages and Eclipses.* Lundgren, C.W. Bell System Technical Journal, 49, p.1943, October 1970.

The paper proposed and analyzed the operation of pairs of satellites in particular, slightly-inclined orbits, phased so that different satellites are north and south of the equator to avoid the sun-caused outages. Inclinations are in the range 2-9 degrees. The proposed system has the further advantage that it requires only one-half the minimum orbit spacing required by geostationary systems to prevent the mutual outages of neighbouring satellites.

108. *Application by American Telephone and Telegraph Company for Authorization to Construct and Operate a Domestic Communications Satellite System.* Submitted to the Federal Communications Commission, Washington, D.C., 19th October, 1970.

The proposal involved the construction and operation of five earth stations, to be associated with the two satellites leased from COMSAT. Each earth station would include two 100-foot antennas for working with both satellites simultaneously. There would be no receive - only earth stations.

The schedule calls for the launch of the first satellite 30 months after FCC approval is granted.

Estimated unit installed cost for the earth stations is 5-7M.

109. *Application of Communication Satellite Corp. for Authority to Construct High Capacity Communications Satellites to be used as Part of a Domestic Communication Satellite System to Provide the use of Satellites & Association Services to AT & T.* Application by the Communications Satellite Corporation to the U.S. Federal Communications Commission, Washington, D.C., 19th October, 1970.

The proposed system would provide the A.T & T. with facilities for domestic services. Two satellites would be deployed initially, with a third as a spare. A fourth satellite would be constructed later. A.T & T. would own and operate the earth stations. The satellites would cover the Continental U.S.A. (including Alaska).

Each satellite would carry 24 transponders with a useful bandwidth of 34 MHz and operating in the 4 and 6 GHz bands. Polarization

diversity would be employed to conserve frequency spectrum. Each satellite would carry, in addition, beacons at 20 and 30 GHz.

COMSAT investment over the seven-year programme period would be 114M. Annual charge to A.T & T. would be 29M. The first launch would be approximately 30 months after granting of approval.

The application included the text of the agreement between A.T & T. and COMSAT.