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# PACKET SATELLITE TECHNOLOGY REFERENCE SOURCES

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## ABSTRACT

This paper describes briefly the packet satellite technology developed by the Defense Advanced Research Projects Agency and several other participating organizations in the U.K. and Norway and provides a biblography of relevant papers for researchers interested in experimental and operational experience with this dynamic satellite-sharing technique.

## INTRODUCTION

Packet Satellite technology was an outgrowth of early work in packet switching on multiaccess radio channels carried out at the University of Hawaii with the support of the Defense Advanced Research Projects Agency (DARPA). The primary difference between the earlier packet-switched ARPANET [1, 2] and the ALOHA system developed at the University of Hawaii [3] was the concept of multiple transmitters dynamically sharing a common and directly-accessible radio channel. In the ARPANET, sources of traffic inserted packets of data into the network through packet switches called Interface Message Processors (IMPs). The IMPs used high speed point-to-point full-duplex telephone circuits [4] on a store-and-forward basis. All packet traffic for a given telephone circuit was queued, if necessary, in the IMP and transmitted as soon as the packet reached the head of the queue. On such full duplex circuits there is exactly one transmitter and one receiver in each direction.

The ALOHA system, on the other hand, assigned a common transmit channel frequency to ALL radio terminals. A computer at the University of Hawaii received packet bursts from the remote terminals which shared the "multi-access" channel. Under the control of a small processor, each terminal would transmit whenever it had traffic, and would await an acknowledgement, on another frequency, dedicated to the service host. If no acknowledgement was received, the terminal processor would transmit again at a randomly chosen time. The system operated on the assumption that no store-and-forward or radio relay was needed. The University of Hawaii researchers later demonstrated that the ALOHA concept worked on a satellite channel linking Hawaii and Nasa-Ames via NASA’s ATS-1 satellite [5, 6]. A variety of more elaborate satellite channel assignment strategies were developed and analyzed in the early 1970’s [7-13, 31].

THE ATLANTIC PACKET SATELLITE EXPERIMENT (SATNET)

In 1973, DARPA began the development of a packet satellite system which would support the sharing of a common, high speed channel among many ground stations. Using an INTELSAT-IV satellite, the Atlantic Packet Satellite experiment was carried out with the cooperation and support of the British Post Office, COMSAT Corporation, Linkabit Corporation, and Bolt Beranek and Newman Corporation, later joined by the Norwegian Telecommunication Administration and the Norwegian Defense Research Establishment (NDRE). Along with University College London and COMSAT Laboratories, NDRE became one of the major users of the SATNET system.

During 1975-1978, SATNET underwent a broad range of performance evaluations and tests. Since 1979, it has served as a stable support for international experiments and demonstrations of command and control technology of interest to DARPA, NDRE and the U.K. Royal Signals and Radar Establishment (RSRE). Late in 1982, a ground station was added to connect the German Aeronautics and Space Research Establishment (DFVLR) into the system.

The early development of SATNET is outlined in [14]. The system design is documented in [15-22]. Experience with the operation of the SATNET is reported in [23-24] and experimental results in [25-26]. Potential services which might be supported by this technology are discussed in [27].

The integration of the packet satellite technology into a larger, multiple packet network context is discussed in [28-29]. The system is expected to continue in use to support joint research by DARPA, RSRE, NDRE, DFVLR and UCL. DARPA and the U.S. Defense Communications Agency are experimenting with a 3 megabit/second domestic packet satellite system to determine whether packetized voice and data services can be integrated economically using this technology. DARPA and the U.S. Naval Electronic Systems Command recently demonstrated a Mobile Access Terminal Network (MATNET) which uses packet satellite techniques to support ship-ship and ship-shore communication over a shared FLTSATCOM satellite channel [30].

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