

FROM SATELLITE TO EARTH STATION TO STUDIO TO S-T-L TO MDS TRANSMITTER TO THE HOME;  
PAY TELEVISION COMES TO ANCHORAGE, ALASKA

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This paper presents the technical and operational considerations associated with a new, and unique, Pay Television service recently introduced into the Anchorage, Alaska, marketplace. The pay service incorporates the delivery of various programming sources via satellite, earth station design, studio origination system design and operation, interconnection of the studio with the distribution medium via point-to-point microwave (studio-transmitter-link), and the delivery of the pay product to the subscriber in the single family dwelling via the common carrier facilities of a Multipoint Distribution Service (MDS) microwave station. System design parameters and daily operational procedures will be discussed in depth as well as the first wide-scale utilization of a MDS facility to serve the private home marketplace with a pay channel.

It was at the NCTA convention in Chicago that Telecommunications Systems, Inc. (TSI), a Baltimore based communications and consulting engineering company, operating its own Multipoint Distribution System (MDS) properties, reached a preliminary agreement with two individuals who were committed to the idea of bringing a quality, premium programming package to Anchorage, Alaska. The TSI role was to be general technical consultants, systems designer, overall supervisor of equipment installation as well as start up, and to assist with the initial retail marketing program.

Along with the usual technical challenges that such a project presents, bringing Pay Television to Anchorage, Alaska also traversed some sticky political problems which I will just briefly mention throughout the course of this paper because of their intrinsic value to any pioneer bold enough to do a number of things first within a short time period.

The first chore was to arrange for the receipt of programming material. The first technical challenge came during the design of the earth station facility itself. Visions, Ltd., the pay programmer, had established its offices in an industrial park in the center of the municipality of Anchorage. It was their desire to locate the earth terminal adjacent to their offices which would also contain their studio complex. Because RCA Alascom had, over the years, utilized terrestrial microwave communications systems throughout the State of Alaska, we were not able to frequency coordinate a receive antenna for the desired location because of its proximity to downtown Anchorage. Parabolic dishes as large as 12 meters could not be utilized. Rather than forfeit the promotional benefits of a centrally located earth station clearly visible to all of the Anchorage, population, Visions elected to utilize an Antennas for Communications (ATC) CH-14M conical horn antenna. This would be the first known application of a conical horn antenna for Pay Television purposes anywhere. The antenna is of one-piece fiberglass, with a cloth radome, and measures approximately 37 feet from top to bottom. The diameter of the horn is 14 feet. The manufacturer provides the following specifications relative to the CH-14M:

Gain	- 43.5db at 4GHz
Frequency Range	- 2-20GHz
Noise Temperature	- typically 20K @ 4GHz (not including Galactic noise)
Design Windload	- 125 mph

It was determined that the horn reflector antenna would perform at the lowest side lobe levels of any type of parabolic antenna. Additionally, the horn reflector antenna will perform at the lowest wide-angle side lobe levels thereby permitting frequency coordination of the earth station in downtown Anchorage despite the neighboring terrestrial microwave systems operated by RCA Alascom.

Visions decided to establish a system capability so that a full programming package inclusive of Home Box Office, Madison Square Garden, and WTCG/Channel 17 could be provided to their potential subscribers. Unfortunately, the Home Box Office footprint from the primary

satellite, RCA SATCOM II, had the poorest signal strength in Alaska. Minimum system design objectives of 50db ("clear day" signal-to-noise ratio at the video output) and a carrier-to-noise ratio of 12db at the receiver input were established. To satisfy these objectives as well as provide for "worst case" conditions, a 48<sup>OK</sup> parametric preamplifier, manufactured by AIL, was selected; as a backup, a GasFET low noise amplifier with a noise temperature of 90<sup>OK</sup> was also selected. Three Microdyne receivers, one tunable and two fixed, were selected for the purpose of being able to handle a minimum of two channels simultaneously with backup capabilities.

On July 15, 1977 attorneys for Visions, Ltd. filed their earth station application with the Commission.

Up to this point, I have not mentioned the method of distributing the signal to the potential subscribers subsequent to receipt of the programming material via the satellite. After all, there isn't a cable system within 200 miles of Anchorage and, of course, little time to build one. The owners of Visions had considered the possibility of building a cable system but abandoned the idea because of time and cost factors as well as the fact that broadcast signals are readily available off-the-air to the home from the three commercial television stations and the PBS station located within Anchorage. Having been introduced to the capabilities of MDS, Visions had earlier embarked on an analysis to determine if MDS could fulfill their needs as the distribution medium for their programming package. Their investigation came at a time when MDS technology was advancing rapidly and lower cost receivers were being introduced by several manufacturers that would permit the private home marketplace to be economically served by MDS; at least this conclusion held true for Anchorage, Alaska. The Anchorage population is ideally located for service by MDS. Its 200,000 plus population all reside on a relatively flat piece of land approximately 10 miles in radius having a high soil content of peat. Peat keeps the foliage in the area to a minimum; well below roof level in most circumstances. The MDS operator in Anchorage had located his transmit facility on a nearby mountain thereby placing his transmit antenna over 2,000 feet above the average terrain of the Anchorage metropolitan area but only 8½ miles from the population center. Adequate signal-to-noise ratio (S/N) could be obtained at receive sites incorporating the lower cost MDS down-converter/antenna as the following path loss analyses indicates:

Parameter	Receive Antenna Gain (db)	
	<u>16</u>	<u>20</u>
Operating Freq. (MHz)	2154.75	2154.75
Free Space Path Loss- 8.5 miles (db)	122	122
Transmission Line Loss(db)	1	1
Field Losses/Fade Margin	5	5
Antenna Gain		
Transmit	16	16
Receive	16	20
Net Path Loss (db)	96	92
Transmitter Power (dbm)	40	40
Received Carrier Level(dbm)	-56	-52
Receiver Sensitivity (dbm; 8db noise figure)	-98	-98
S/N Ratio (db)	<u>42</u>	<u>46</u>

The output power of the transmitter was later to be increased to 50dbm in order to provide service to that segment of the Anchorage population located within "holes" or shaded areas. The MDS transmitter would also later be interconnected with the Visions studio by an 11GHz studio-transmitter-link utilizing a Farinon transmitter/receiver. The STL path is approximately 8 miles.

Having filed its application to construct an earth station and having obtained the air-time from the MDS operator in Anchorage, the next major task was to determine programming so a studio may be designed providing the capability to construct a high quality premium programming package. The emphasis was on "live" premium television. The Anchorage population previously had little access to "live" programming from outside of Alaska. Most near-real-time events were tape delayed; even Monday night football. Network programming was provided on a delayed basis anywhere from one to three weeks depending on the particular network involved. Therefore Visions chose to construct a programming package that was truly unique and not necessarily an alternative based upon the obvious deficiencies of the local Alaska broadcasters when compared to the "lower 48" broadcasters. Another significant consideration was the Anchorage time differential with regard to events occurring in New York City, Las Vegas, or California. Anchorage is five hours earlier than Eastern Standard Time and two hours earlier than Pacific Standard Time. Therefore it was decided that the greatest flexibility in the construction of a truly high quality programming package was to provide the capability for taping the incoming program material for retransmission at the most convenient time period for the viewer in Anchorage. After obtaining the necessary taping permissions, HBO would be seen at the same time in Anchorage as it is elsewhere; namely, the prime 6:00pm to midnight period. "Live" events, which may be originating in Madison Square Garden at 8:00pm New York time, could now be shown "live" in Alaska at 3:00pm, Anchorage time, without the necessity of preemption.

The Visions desire for a high quality programming package containing a mix of all available product dictated the capability which their studio complex required. Seven (7) Sony VO-2800 video tape recorders/playback machines were utilized as the heart of the origination center. All seven machines would be automatically pre-programmed and controlled for all functions including record and playback by a Digitrol II microprocessor. To best explain the design and the capability of the system, I will describe to you a typical programming day. The Visions program guide for Friday, December 30, 1977, listed the following program menu for the day:

12:30 pm	Scream Theatre "The Human Monster"
(LIVE) 2:30 pm	NBA Basketball New Orleans Jazz vs. N.Y. Knicks
	5:00 pm "Part 2 Sounder"
	7:00 pm "Inside the NFL"
<u>HBO</u>	8:00 pm "Birch Interval"
	10:00 pm "A Clockwork Orange"
	12:30 am "Casino De Paris"
2:00 am	Visions Blockbuster "Dog Day Afternoon"
4:00 am	Visions Blockbuster "Shampoo"

The above programming schedule would be accomplished in the following manner:

<u>EVENT</u>	<u>DESCRIPTION</u>
#1	"Scream Theatre" consists of locally originated product procured by Visions ahead of the scheduled playback date. In this case "The Human Monster" is a monochrome "oldie" transcribed on 3/4" u-matic cassettes (2) and is 1 hour and 13 minutes in length. Each cassette has been cued for automatic start, transfer and rewind functions. The microprocessor will automatically bring the movie up at the desired start time of 12:30pm.
#2	At approximately 1:43pm the "stand-alone" operation ends and the microprocessor automatically switches from the end of the movie (prompted by a cue tone) to a Systems Concepts character generator. The character generator formats the screen into three fields. The top third of the screen contains the Visions logo and displays time, temperature and date. The middle field of the screen contains the AP newswire. (In Alaska, only the broadcast newswire is available.) The lower third of the screen contains pre-programmed alphanumeric usually of a promotional nature. Background music comes up automatically with the character generator. The background music is originated by a reel-to-reel, automatic reversing Sony tape deck.

<u>EVENT</u>	<u>DESCRIPTION</u>
#3	At 2:30pm the operator utilizes a combination of routing switchers and a special effects generator to fade out the character generator and place onto the line the Madison Square Garden NBA basketball game at the appropriate moment as determined visually by the operator. The basketball game is being received "live" by the satellite feed, transponder 22, from the fixed frequency Microdyne receiver and redistributed without time delay.
#4	Remove the stand-alone product, "The Human Monster", from the VTR's.
#5	Place blank stock in VTR's #1, #2, #3, and #4.
#6	At 3:00pm, Anchorage time, the Digitrol II has been pre-programmed to begin recording the regular evening HBO program menu. Without interrupting the NBA basketball game which is going out over-the-air "live", the operator fades into the beginning of the HBO program. Please keep in mind that it is now 3:00pm Anchorage time and 5:00pm, Pacific Standard Time. The Visions receiver is tuned to transponder 20 which relays the HBO material on Pacific Standard Time. Throughout the recording cycle, the microprocessor will place the cue tones on the adjacent audio track at the proper time in order to facilitate the pre-programmed playback. At the end of the first record period of VTR #1, approximately 4:00pm, the Digitrol II will automatically switch to VTR #2 during the vertical interval without recording interruption.
#7	Basketball game ends about 4:30pm Anchorage time. The operator fades the game to "camera black" and switches in the character generator, with background music, which I described previously.
#8	At 5:00pm, the Digitrol II microprocessor, having been pre-programmed to playback the VTR's containing the evening's HBO program material in sequential fashion, begins playback of the first HBO movie of the evening which starts with the playback of VTR #1. At approximately 5:00pm, continuous recording of the evening's HBO material was transferred to VTR #3. At exactly 5:00pm, Anchorage time, the first HBO movie of the evening automatically switched onto the LINE and the character generator was removed automatically.

During the balance of the evening, the recording/playback sequence of HBO continues automatically and unattended as follows:

<u>Anchorage Time</u>	<u>Playback</u>	<u>Record</u>
6:00pm	VTR#2	VTR#4
7:00pm	VTR#3	VTR#1
8:00pm	VTR#4	VTR#2
9:00pm	VTR#1	VTR#3
10:00pm	VTR#2	VTR#4
11:00pm	VTR#3	VTR#1
12:00 midnight	VTR#4	-
1:00am	VTR#1	-

<u>EVENT</u>	<u>DESCRIPTION</u>
#9	The last HBO program for the evening will end at approximately 1:30am Anchorage time. The Digitrol II will sense the end of the movie (playback sequence) and automatically place onto the LINE the character generator, with background music, again.
#10	The operator will remove all cassettes from the VTR's.
#11	Two "Visions Blockbuster" movies are to be shown for the balance of the evening. This product consists of locally originated material procured by Visions ahead of the scheduled playback date for their stand-alone operation. The operator will pre-program the Digitrol II to start the first movie at 2:00am and start the second movie at 4:00am, Anchorage time. The cassette tapes which the movies have been transcribed onto had previously been cue toned for the automatic, stand-alone, playback operation. At this point, the operator goes home and the studio will be unattended for the balance of the evening.
#12	At approximately 5:52am the last Visions stand-alone movie ends and the Digitrol II automatically replaces the movie with the character generator output, with background music, as described previously.

In addition to the recording/playback flexibility described above, the Visions studio incorporates the capability of monitoring each satellite transponder of interest, signal processing by a Microtime 2020 PLUS Time Base Corrector and Image Enhancer, test signal generation, cross pulse monitor, audio record/playback mixing and level control, and titling. Additionally, the studio has the capability of constructing its own promotional messages by utilizing two VO-2850 VTR's with an editor off-line. These promotional messages can be pre-programmed and sequenced with the regular program material as desired.

As mentioned previously, the link between the Visions studio and the mountain MDS transmit site is provided by an 11GHz point-to-point system owned and operated by the MDS common carrier. The system features redundant Farinon

transmitters and receivers with built-in alarms.

The MDS transmission facility contains, besides the Farinon receivers, two Electronics, Missiles, and Communications (EMCEE) 10 Watt transmitters and a single EMCEE 100 Watt amplifier. An automatic transfer/control device provides the ability of switching from one 10 Watt driver to the other 10 Watt unit in the case of malfunction. The output of the 100 Watt amplifier is connected to an Andrew, high gain (16db), cardioid transmit antenna, which is approximately 50 feet away from the amplifier output port, via waveguide. The transmit antenna is down tilted 3° from the local horizontal and elevated approximately 25 feet above ground level in order to best serve the Anchorage community.

The MDS low-cost receivers being utilized by Visions have been obtained from several different manufacturers. Depending upon the manufacturer, each receiver has its own physical characteristics and technical performance differences as well. Most sources provide a low-cost receiver featuring a "free-running" oscillator which, characteristically, drifts as the ambient temperature changes. These type of receivers utilize some type of manual tuning device located at the subscriber's television set. Another manufacturer, however, provides a crystal-controlled MDS antenna/down-converter at a similar low price which is particularly attractive because of the natural hostile environment which prevails in Alaska. Although Anchorage itself does not experience radically cold temperatures, the mast mounted down-converter will encounter temperatures as low as -30°F occasionally during the winter season. Of course, on the other hand, the temperature during the summer (July & August) seldom exceeds 65°F. It was easily determined that the down-converter would be exposed to daytime/nighttime temperature variations of 30° on a regular basis.

Whomever the manufacturer, the antenna/down-converter is required to provide the following:

- . . enough gain/receiver sensitivity to deliver a quality signal
- . . the receiver be quickly and easily mounted to either the existing Yagi mast or a mast which the installer provides
- . . be of a profile that will not offend the esthetic value of a residential neighborhood

Additionally, because of the cold temperatures, minimum sunlight during the day in the winter time, and the high cost of skilled labor, it is necessary that the receiver be designed in such a manner to permit rapid attachment to the structure as well as swift interconnection from the receiver output to the television set. Visions is experiencing an average of 5 private home installations per day per installer during the winter months. Except for multi-family

dwellings and non-standard installations, all installers are dispatched singularly without helpers. An average time for a standard installation is 45 minutes; once the installer has the antenna mounted, he connects the output of the down-converter to its power supply located at the subscriber's television set or some other convenient location. Next, the installer orients the antenna in order to obtain the maximum signal strength. In the case of the "free-running" oscillators, the installer will go through the procedure of both "coarse" and "fine" tuning the picture.

The ability of MDS to serve the private home marketplace within those cities out of the Top Fifty is a necessary ingredient required to produce a viable operation for the Pay TV entrepreneur because of the relatively small multiple family/hotel marketplace which are normally found in these smaller cities. The Visions idea of serving the moderate size city with a high quality programming package via MDS is not only unique but mandatory. The churn must be kept to a minimum in order for the system operators in smaller marketplaces to be viable. It is hoped that the highest quality of programming available today, accompanied with a competitive price structure for the service, will result in high retention rates.

Earlier in this paper I mentioned that part of the programming mix was to consist of WTCG/Channel 17. Visions has yet to offer any portion of WTCG to its subscribers, as of the date of this paper, because of the lack of the necessary permission from the Commission to serve Alaska. The result of this regulatory delay caused Visions to procure additional stand-alone product during its initial start up period. Also, during the installation of its earth station, in October, 1977, because of its centrally located position, which I mentioned previously, local Anchorage news media provided Visions with excellent coverage of the delivery of the conical horn antenna by ship from Seattle and the subsequent antenna raising activities. This early public exposure, although beneficial from a marketing point of view, created some discussion at the Alaska Public Utilities Commission (APUC) as to whether the MDS operator as well as the pay programmer, Visions, fall into the category of a "public utility", as defined by Alaska law and, if so, whether both companies should be regulated. Although the question, as of the date of this paper, had yet to be put aside, the APUC investigations and discussions relative to the matter did not prevent Visions from going on-the-air for revenue purposes on 1 December, 1977.

With a mass media advertising campaign consisting of radio spots and newspaper ads the weekend preceeding 1 December, 1977, Visions began installing subscribers at an initial rate of 10 per day. By the end of February, 1978, Visions had installed 1,500 subscribers and enjoyed a waiting list of well over 1,000; the delivery rate of receivers did not complement the number of early subscribers.

It will be another six months before a significant amount of data will be available to determine the success of the Anchorage venture. However, by conventional standards, Visions has succeeded in establishing a viable pay operation in Anchorage, Alaska; from satellite to the subscriber via MDS.