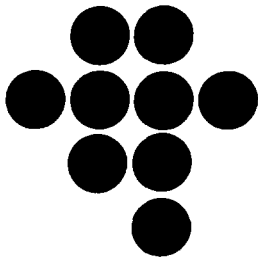


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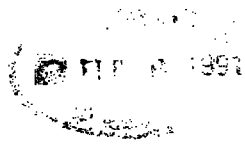


COMMUNICATIONS FORUM

"Direct Broadcast Satellite"

November 1, 1990

Seminar Notes



MASSACHUSETTS INSTITUTE OF TECHNOLOGY
COMMUNICATIONS FORUM

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Prof. Andrew Lippman, M.I.T., Organizer

Thomas Wolzien, NBC Cable

Dr. Vivien Horner, SkyPix Corporation

Dr. Mark F. Medress, General Instrument Corporation

Elizabeth H. Prodromou, M.I.T., Rapporteur

This session of the MIT Communications Forum brought together three speakers for a discussion of issues related to direct broadcast satellite technology and services. The idea of direct-to-home satellite television has been around for many years, but it exists in America primarily for those who do not connect to a cable system. However, the possibility of high power satellites, flat receiver dishes as small as a serving tray, 256 channels on one bird and HDTV have created new opportunities for communications that could exceed the potential of cable. Most plans involve the first widespread use of digital video as a consumer item, a fundamental change to television. The speakers in this panel will address the broadcasting plans and technical innovations for new approaches to DBS that are slated to go on-the-air as early as next year. Prof. Andrew Lippman of the MIT Medi Laboratory introduced the speakers, with some summary opening remarks on direct broadcast satellite (DBS) technology. He noted that, while the Communications Forum periodically has held discussions on HDTV, today's discussion was somewhat different than those in the past insofar as the discussion will point to the convergence between many programming and technological developments. Moreover, despite three speakers who may possibly hold completely different views on DBS television, Prof. Lippman observed that all three discussants planned to emphasize the importance of consumer television. The speakers will talk to the various domains of consumer wants and needs, as well as to the technology and programming issues associated with the consumer DBS market.

The first speaker was Thomas Wolzien, Senior Vice President at NBC Cable. Wolzien began with some brief background on NBC Cable. The company is one of the top ten cable broadcasters in the United States, and currently is working on setting up the country's first high-powered DBS system. The system is a three satellite system with 220 to 240 watt range. The antenna size will be very small, able to be mounted on the window of a house, and therefore will be attractive and accessible to a wide user market of consumers. About seven months ago, NBC Cablevision came to a tentative agreement with the other actors involved in the project, and the four companies involved are now working to close the deal.

Wolzien pointed out that NBC's new DBS technology works on the premise that the viewer is the most important piece in the communications system. Most viewers, despite having access to an average of 34 channels now as compared to an average of three to four channels in the not too distant past, are dissatisfied with what is available on consumer television. Wolzien observed that this basic dissatisfaction stems from the fact the people have very individual interests which are not being served by the current channels, however large the channel volume. He noted that these thirty or so channels are geared to the mass market, so they offer very little in the way of specialized viewer

interests.

According to **Wolzien**, NBC Cable intends that its DBS technology will satisfy the divergent tastes of the viewer. He noted that there are two technological developments which will make this objective a reality. The first is video compression. This technology will reduce the costs of DBS and thereby make distribution accessible to a wide range of groups with varying special interests. **Wolzien** saw video compression as breaking open the distribution and access pipeline for DBS by increasing the number of potential pathways into the home. He went on to say that, because video compression will increase the capacity of cable television as well as DBS and other forms of television services, the technology makes 300 channel capacity likely and opens up the possibility of 1000 channel capacity by the end of the decade. **Wolzien** noted that the second technological development concerns the production method of super VHS. This means that production costs will be lowered, as well.

After outlining the new technology, **Wolzien** addressed the question of what the delays are which remain to be overcome. He pointed out that there need to be a driver into the home in order for this new technology to work. He phrased the question in terms of what it is that will push the consumer to buy a decoder box at an estimated cost ranging from \$300 to \$700. **Wolzien** noted that many people might think that cable provides the possibility for this. But he pointed out that cable is available in only parts of the country, so that growth will be slow and audience accessibility will be limited. Given the fact geography makes it impractical to rely solely on either cable or copper phone lines, **Wolzien** concluded that DBS is the only mechanism for effective coverage of all of the lower forty eight states.

Wolzien then turned to the problem of how to get DBS to meet this objective. He said that Sky Cable (NBC Cable) has looked at this problem as a triangle, with the three points driving the penetration of DBS technology and services into the home. The three points are : (1) the conventional mass market services, based on the existing 30 to 60 channels; (2) pay per view services; and (3) specialized or niche program services. According to **Wolzien**, the NBC philosophy is that, by putting together all three parts of this triangle, they will be able to get enough people interested in any two of the three features to drive the desired home penetration. He noted that the break-even point for Sky Cable is 2.5 million homes. He emphasized that the cables themselves are extremely expensive.

Wolzien turned to the financial issue. He explained that the funding for this sort of DBS system and the associated technologies can come from any one of three possible sources: (1) financial speculators: these are the people who finance the start-up costs and then sell it off to someone else in the

business, hoping to make the sale before the next major, costly technological change; (2) those investors who are in it for the long term: these people, primarily corporate investors, view the project as having the long-term potential to provide their bottom-line expectation of a 20% to 30% rate of return; and (3) the strategic investor: this is the investor who sees the new business as a way to strengthen his current area of expertise. **Wolzien** pointed out that NBC Cable falls into the third category, since it is a programming company that seeks additional outlets for its own existing programming. **Wolzien** noted that NBC already has interests in various sports channels, bravo, and other cable programming stations, and now seeks to ensure additional markets for its programming services.

Wolzien closed by noting that Sky Cable is scheduled to begin service in 1994. He emphasized that the service makes use of state of the art technology, is based on a new marketing and programming approach, and will give the consumer a much broader choice than has ever been available in the past.

The second speaker was Dr. Vivien Horner, Senior Vice President of Development at SkyPix Corporation. Horner began by noting that she agreed with **Wolzien's** broad observations about the prospects for DBS. She also indicated that she agreed in large measure with his analysis of the programming mix that would best serve the consumer's interest.

Horner began by describing some of the characteristics of the digital compression video technology which SkyPix will utilize under exclusive license in the U.S. for entertainment services to the home. Northwest Starscan, L.P., the parent of SkyPix, developed this technology, which will have many other applications as well. Among the features: full motion, full color, stereo video signal, delivering 480 lines of resolution at the set; frequency response, 0-19,000 db flat (digital); data rate of 3 mbs; SCPC (multi-site or single uplink); each channel 2 MHz of bandwidth, QPSK; incorporates a proprietary ant-copy feature.

Horner next described the SkyPix service and the hardware in the home, which consists of a satellite dish measuring from 22" to 36", depending on geography, a receiver/decoder and a remote control. The device is also connected into the household phone line. Suggested retail for all necessary equipment is \$695.

Turning to the question of what to put on all these channels, **Horner** remarked that she had part of the original program planning task force for Warner Cable's interactive Qube system. **Horner** explained that, in that case, the system had a capacity to deliver thirty channels when nothing was available to cable except distant broadcast signals and HBO. She noted that Qube had asked precisely the same question then - what to put on

all of those channels - but within two to three years, they found that thirty channels could barely hold all the available programming. Horner observed that today there are approximately 98 separate satellite services available to cable systems.

Horner explained that SkyPix had opted to start with eighty channels of programming at launch in order to keep the size of the dish small and relatively unobtrusive, a key factor in making the system attractive to consumers. In pointing out differences in program concept from what Wolzien described for Sky Cable, she said that SkyPix programmers did not think of the system as being made up of channels. Since SkyPix programming is menu-accessed by the viewer, the physical location of a program within the system is of concern only to the operator. Conceptually, SkyPix programming is thought of in terms of filling a grid. This system allows for maximum flexibility in offering high progile programming at frequent intervals, many kinds of niche programming simultaneously in desirable time slots, and the capacity to change anything quickly, based on viewer interest. Horner remarked SkyPix will offer the first opportunity for affordable narrowcasting.

According to Horner, because there is no monthly fee for the SkyPix services, pay-per-view is expected to be the bread and butter of SkyPix's business. Horner said that SkyPix will reserve roughly fifty channels for pay-per-view movies, sports, and special entertainment events, expanding and contracting the number of channels in use at any one time in response to available product and view interest. She went on to say that master contracts have been negotiated with six of the eight major studios (the other two are in process) and with about 45 other film suppliers. She observed that the studios SkyPix as a way to go directly to the viewer with their product. Horner emphasized that, for the studios, the SkyPix arrangement represents a way of tapping into revenues which would ordinarily go to vide rental stores, and thus provide the studios with a chance to recapture some of the revenue now lost to them.

Elaborating on the fifty channels or pay-per-view offering, Horner explained a bit about how these channels would operate. On some channels, there would be recent releases and blockbusters with start times of approximately fifteen minutes. Other recent film releases, expected to be of somewhat less interest, would be shown at half-hour intervals. And finally, older movies - classics and "library product - would be scheduled at two-hour intervals, or fitted into the schedule as appropriate. This scheduling provides the viewer with a choice of about thirty to forty movies at any given time, and allows the films of most likely to interest to be available almost on demand.

Horner emphasized that SkyPix does not think of itself as

being like cable (there will be no monthly charge for SkyPix), but more like a video store in the sky. You pay to watch what you're interested in. Movies will be offered on a sliding price scale, with the charges automatically billed to the viewer's credit card. She also pointed out that the SkyPix programmers will have instant overnights via a poll of billing records. They will know when demand tends to fall off and will therefore be able to adjust program schedules to accommodate other product (for example, during football season, when viewer attention might be more focused on a range of games than on movies).

In addition to all of the above features, Horner mentioned that SkyPix is considering an optional subscription package of fifteen to sixteen channels, which would include superstations from around the country, as well as a few satellite-delivered channels currently serving the cable community. This package would cost the subscriber about \$12.50 per month. Horner explained that SkyPix originally had discounted the idea of cable channels for a couple of main reasons: the company didn't wish to position itself as an "instead of cable" service, and there was some doubt about whether satellite services (largely owned by cable MSO's) would be interested in being carried by DBS, a potential competitor. However, Horner noted that SkyPix's high media profile since its first public announcement in late August prompted several of the satellite services to contact the company to explore carriage. Hence, SkyPix is presently reconsidering the overall program package and is having conversations with a number of the existing services.

Horner noted that as part of the menu-access system, many features of customer service are viewer controlled. For example, the viewer can authorize or disauthorize any service using the remote control buttons. If a subscriber goes out for the evening and does not want the pay-per-view services available to the babysitter, all pay-per-view can be temporarily disabled and restored at will. Or, a subscriber who has authorized the monthly subscription package and is going away for the summer can cancel the service during his absence and reinstate it if he wishes upon return, all without having to make a telephone call to customer service.

Horner made some brief remarks on other DBS services under development at SkyPix. These are essentially a series of different configurations of programming which utilize other features of the system: automatic ordering and billing, pay-to-record, "metered programming, and the like. Among these are home shopping, cartoons sold by time block, home video previewing services for special interest (from fly fishing to aerobics to home repair, and children's programming. Horner explained that the purpose of such options is to provide program depth and variety to the subscriber, as well as to give broader market exposure to niche video programs of high quality.

Horner closed by noting that the digital capability of SkyPix is by no means limited to video, and that in the future other types of services, from computer software downloading to educational programs to video games, would be brought on line. Discussions with potential suppliers of several of these services are already underway. **Horner** ended by reiterating that the SkyPix technology clearly is not constrained to any particular satellite, or even to satellite at all, and that potential receiver sites extend well beyond the home.

She ended her presentation with a short video clip, a recent network news spot on SkyPix.

The third speaker was **Dr. Mark F. Medress**, Vice President of New Business Development in the VideoCipher Division of General Instrument Corporation. He stated that his presentation would expand on the two previous discussions by concentrating more on the technology side of DBS developments.

Medress began with a summary of the newest DBS technology offered by VideoCipher. This technology, known as DigiCipher, is a digital compression and transmission system. **Medress** explained that VideoCipher is a hardware supplier all over the United States and internationally as well. He went on to remark that, in terms of the issues related to DBS services, the big issue has always been dish size and equipment cost and, on these points, he noted that VideoCipher's view may differ somewhat from that offered in the two previous presentations.

(Transparency)

Medress emphasized that all three DBS options represented in today's discussion have a strong chance of succeeding in their objectives, if they make the consumer the focus of delivery and if the consumer has access to equipment that is easy to buy and to operate.

Medress noted that VideoCipher has many versions of DBS technology, a variety of which is currently in use by cable programmers, CBS, and Japanese and European services, to name but a few. He explained the VideoCipher provides encryption or scrambling equipment for television channels. In terms of the VideoCipher II equipment, **Medress** noted that services as varied as HBO, Cinemax, Playboy and the Disney Channels all use this technology.

He went on to point out that the important part of the satellite delivery system is design. Every channel has a scambler and a computer, and approximately one hundred different signals are scrambled with VideoCipher equipment every day.

The technology, according to **Medress**, is an integrated

CATV/DBS scrambling system which creates a common encrypted message stream. He called it a unique idea in that, as the viewer switches from channel to channel, he is constantly exposed to all of the messages meant for his decoder.

He noted that VideoCipher also has an impulse pay per view capability which is about a year and a half old. Medress described this option as similar to the one described by Horner. Moreover, he emphasized that this option can be protected with a password. It generates a bill and works like a long distance phone service in this sense.

According to Medress, VideoCipher is getting buy rates of 250% to 300% in their pay per view programming.

All of the above structure is currently in place and operating. Medress explained that the current structure is the framework in which VideoCipher is introducing DigiCipher. In terms of the origins of the new technology, Medress said that VideoCipher was concerned with how HDTV would be brought by satellite to the home viewer. He remarked that the existing HDTV technology did not seem satellite friendly, so VideoCipher decided to develop an all-digital technique to compress the signal for high definition television and transmission to the same size dishes now used for standard FM transmission of analog t.v.. Medress noted that, in the process, VideoCipher realized that it would be possible to make the same sort of technology for standard television, resulting in multiple signals on one transponder.

He commented the the technology became a reality because VideoCipher has many people with a strong background in digital compression and transmission, as well as good people in-house who design all of VideoCipher's own chips.

Medress outlined the key benefits of the DigiCipher system as follows: amongst other things, it has two HDTV channels per transponder, or two to ten NTSC channels per transponder; it presents extremely high quality NTSC and HDTV viewing; and it has a unified system for satellite, cable and broadcasting applications. He emphasized that, from the outset, VideoCipher took the perspective that it wanted to develop such a unified system. He went on to describe DigiCipher as having a seamless interface for CATV/SMATV pass-through. He pointed out that VideoCipher is especially enthusiastic about the fact that the new consumer digital tape recorder will be able to store all the signal information.

According to Medress, VideoCipher has invested \$30 million over three years in order to integrate all the security mechanisms necessary to deal with the issue of piracy. He said that VideoCipher is now working on a security element that can be mailed to the consumer and periodically changed by the consumer.

Medress also noted that VideoCipher is making the DigiCipher equipment backward compatible with VideoCipher equipment. He also pointed out that VideoCipher has designed the new equipment so that it works with the same size satellite antenna as does standard television.

Medress explained the VideoCipher's threshold for error on the new technology is to get to the point where there is no more than one error of transmission in 24 hours; this would be considered perfect transmission, particularly in comparison to the threshold of analog technology.

(Transparency: DigiCipher Compression Chart)

Medress observed that there is a similar set of facts and features about the HDTV version of DigiCipher. It uses the same techniques as with the satellite and cable services. He reiterated that the important point is that this technology (the HDTV technology) can be used across all different kinds of media, and that it has all of the same advantages as DigiCipher for television.

(DigiCipher System Block Diagram). **Medress** described the DigiCipher System by using an illustrative transparency. He showed that the main pieces of the technology are an encoder for each transponder and a computer with connection to a DBS Center; he noted that the signal can be transmitted to both the home receiver or to the commercial receiver which can output a digital data stream. **Medress** explained that the technology allows for sending two to five programs on one cable channel, so that this actually expands the capacity of the cable system.

Medress noted that VideoCipher has submitted DigiCipher in its HDTV mode for consideration as a standard by the FCC. He commented that, if this happens, then the DigiCipher technology will be built right into the television set. **Medress** stated that VideoCipher plans to make the technology such that, although it might have been bought for multichannel NTSC, it will work immediately with HDTV when that service technology becomes a reality. He explained that this compatibility of the two technologies will be possible via a digital interface mechanism.

In terms of the schedule that VideoCipher has for the DigiCipher technology, **Medress** commented that VideoCipher already has completed full simulations. He also noted that DigiCipher is completing real time hardware for multichannel NTSC, and that the group plans to start the sale of the relevant equipment by 1992. In terms of the HDTV technology, **Medress** explained that the time-frame here is more dependent on the FCC decision. He remarked, however, the VideoCipher will have the breadboards and hardware demonstrations ready for testing by the FCC in 1991.

Medress closed with a video tape demonstration of the new DigiCipher technology for NTSC. The tape was meant to compare the original quality with the new four and ten channel compressions for the transponder.

Medress' closing remark was that the aim of the new technology was to make the source and the compressed images virtually indistinguishable.

Question and Answer

The first question asked the speakers to comment on the differences in DBS services in Europe and the United States.

Wolzien responded that there are, in fact, differences between DBS services here and in Europe. Most essentially, high power DBS has a lot more space to cover, as opposed to the requirements facing mid power DBS. Yet there is a motivation for going from low power to high power. The size of the antenna decreases and, therefore, the size of the market opens up because the smaller antenna size makes it easier to get into urban viewing areas.

The next question asked the speakers what compression algorithm their respective companies are using.

Wolzien began by answering that, as a programmer, NBC wants the largest possible distribution that it can get. In this sense, NBC is not interested so much in where the program comes from. He pointed out, then, that this rationale argues against proprietary software. **Wolzien** noted that, on the other hand, the consumer will be less likely to spend \$500 to \$700 on a box that can access only one programmer. He commented that this reality is pushing NBC to watch closely what will happen with consumer response to the new DBS technology and services that come onto the market.

The same questioner asked **Medress** about the FCC consideration of VideoCipher's proposal for HDTV technology. He interpreted **Medress'** remarks to mean that the FCC will likely adopt VideoCipher's algorithm as a standard for use in the public domain.

Medress responded that VideoCipher's digital compression algorithm is semi-proprietary. That is, he noted that VideoCipher uses a unique approach that has innovative ways to deal with motion compensation. The company has applied for four patents on this digital compression algorithm technology. However, **Medress** pointed out that VideoCipher, in making the decision to submit the application to the FCC, also was making the decision to license the technology in the event that it is chosen as a standard. According to **Medress**, VideoCipher has no

problems with such licensing possibilities.

Horner responded that her understanding of the SkyPix algorithm is that it is proprietary. She stated that, moreover, she does not know what the algorithm is. She emphasized, as well, that the relevant point about SkyPix is that the company sees itself as being in the entertainment business, and plans to use its three year head-start on the DBS programmings services to get a leg up on the competition. She reiterated that SkyPix is an entertainment business, not a hardware business.

The next question asked about the price of the encoder. **Horner** responded that SkyPix's whole package will carry a suggested retail price of approximately \$699.

The same questioner clarified the question as being about the cost of the encoder equipment. **Horner** answered that, in her estimate, the encoder is a \$40 million to \$50 million piece of equipment.

Wolzien answered that NBC wants to keep the decoder as cheap as possible, so that means jamming the price onto the other end, namely, the encoder. He emphasized that a low decoder price is the only means of getting the consumer to invest in the product.

Medress responded by noting that the DigiCipher encoder and decoder are meant to be compatible with the VideoCipher technology. He concurred with **Wolzien** that the place to put the cost burden is at the encoder end of the technology.

The next question asked about plans to deliver multi-media and interactive services as part of the new DBS services.

Horner observed that it would probably be next to impossible to break into the American viewing home by offering only those kinds of services. In this sense, she described the decoder box as a sort of "Trojan horse": the point is for the company to get the box into the home, get the viewer using the video services and then, already having built in the capacity for the box to offer other services, add these on at a later stage of the game.

Medress remarked that he shared **Horner's** point of view. He said that VideoCipher's business focus has been on delivering 15 megabytes of data, through the combination of video and associated video services described throughout the presentations. However, he agreed that, in the future, the technology and the services could be augmented to include virtually unlimited options.

The next questioner observed that the three presenters seemed to be making a distinction amongst themselves on the basis of hardware versus entertainment in terms of what the market prospects were. The questioner noted, however, that the

presenters also seemed to imply that who gets into the market first is what is important. The questioner asked about whether these distinctions are compatible, and also asked for comments on how to prevent piracy in showing first run movies. Finally, the questioner asked **Medress** whether or not General Instrument had any plans to move into the provision of software.

Horner addressed the piracy issue. She explained that the SkyPix technology included an encryption system, DES, and a regular change in the key. She observed that this set-up is about as secure as is allowable in the transmission industry. She also noted that there is a proprietary patent and an anti-copy feature to the receiver. Although a viewer can get authorization to copy off-air, this person cannot try to sell these copies on the market. She explained that the number of the encoder that made the copy is embedded in the copy. **Horner** emphasized that this feature is what makes SkyPix attractive to the major movie studios, since it offers them a real possibility of catching the pirates.

Medress responded that there will be virtually identical anti-taping technology capability for both DigiCipher and VideoCipher. He also answered that it is unlikely that General Instrument will become a software provider.

The next question asked for general comments on the FCC and the relationship between the individual presenter companies and the FCC. The questioner also asked how the upcoming FCC decision on existing DBS filings will affect the three companies' business.

Wolsien remarked that Hughs Aircraft has already filed for the 601 bus with modifications for high power usage, so that the NBC does not anticipate any further filings.

Medress remarked the VideoCipher is not a satellite operator, so that the company has not made any FCC filings in that realm.

Horner answered that they haven't needed to make filings in this regard.

The next questioner asked for comments on the R&D associated with the previously mentioned objectives of developing a one thousand to one compression standard.

Medress answered that VideoCipher is actively involved with data compression R&D, as evidenced by all the work that went into producing the current algorithms. But he noted that the company sees the kind of data compression technology based on the motion compensated video compression now available is the best that will be possible for commercial applications in the next ten years to

come. He answered that he could not offer any meaningful answer on the possible time frame for one thousand to one compression capacity.

Wolzien pointed to the interesting difference between the different types of technologies discussed in today's talk. He described one as a sliding scale technology available to select the kind of quality that the viewer wants; he said that this speaks to the differences between HDTV, teleconferencing, etc. **Wolzien** also noted that, in a perfect world, the technology would be a riosat, sitting on a transponder, which could be flicked on depending on the needs at the time.

Medress said that he concurred with **Wolzien**. He also noted the the DigiCipher satellite receivers automatically detect what mode is being transmitted. But despite this sort of multiple detect switch, he agreed that DigiCipher still did not have the same thing as a heostat, but came very close to this capability.

The next question was raised by the moderator, and asked what will happen over time in the area of compression. He observed that compression is an interesting area. He commented on the fact that standards groups are meeting all over the world in an effort to come up with a standard for compressed rates, but that the existing technologies make it unlikely that these groups will do better than what's out there now in terms of fixing a standard. He also noted that people look to content processing for a breakthrough in the area of compression standards, and he suggested that there is a trend underway towards sophisticated analysis where the encoding and decoding will match. He concluded by emphasizing that the impetus behind this trend isn't necessarily from the compression business but from the content analysis people.

Medress answered that he agreed with the moderator's observations. He added that, in his view, the same principle is at work in speech compression as in video compression. He remarked that he sees the process as an interesting and challenging one.

The next question concerned the phone companies and their claims that they will be able to offer the same services as the DBS companies. The questioner asked whether DBS is a preemptive strike against the phone companies or whether it is an intermediate technology that will last about ten to fifteen years, as cable television did.

Wolzien responded that DBS is the latter. He opined that what differentiates DBS will be the niche services it can offer. He maintained that, even when the RBOCs get the whole country wired, the only way to get an economic marketplace will be through DBS. He submitted that the real question is whether the

different DBS players will play to their strengths or whether they will simply stay the same and kill each other off over time.

The same questioner asked how the DBS companies can justify what they are doing in a time when pay cable is suffering.

Wolzien responded that pay cable is suffering because people have other ways to get what pay cable providers like HBO offers. He said that the DBS companies hope to eliminate this situation and send the video stores the way of HBO cable providers.

The same questioner asked if any of the three companies would offer something free to the viewers.

Horner answered that the pre-viewing channels will be free, but that the point is that people have to get over thinking that there is anything free on television. She pointed out that, in the case of network television, the advertisers who support network t.v. build the costs of their advertising into the consumer price.

Wolzien answered that there might be a place for free national channels, although he remarked that the question would then arise over how one could get to these channels. He also noted that there will probably be some space for free advertising.

The next question referred to the current battle in the U.K. between BSB and Sky. The questioner observed that the features of this battle might offer some useful lessons to DBS providers here. He mentioned, among other things, that the BSB-Sky battle shows that quality of picture is not an issue, choice in the form of channel volume is an issue, who's into the market first is an issue, and confusion spells delay in consumer behavior.

Medress thanked the questioner for the observations. He then went on to say the VideoCipher is carefully watching the British battle, but that the outcome will be hard to predict. He also noted that VideoCipher had supplied BSB with its encryption technology.

Wolzien answered by remarking that Rupert Murdoch has been a part of the NBC operation.

Horner also thanked the questioner for the useful observations, but went on to say that the U.K. is not the U.S. She noted that the whole television system is different here and that this difference also suggests important other differences.

The final questioner commented on the last Communications Forum discussion, in which one of the speakers had described DBS, with all of its problems and delays, as having the highest

acceptance of any technology in history in Europe. The questioner asked for remarks on this point.

Medress agreed that this was true. He noted that the acceptance rate has been equally high in Japan, despite the fact that Japan has only two channels and few programming choices. He noted that two million people there have already payed \$800 each to get the technology. **Medress** remarked that the specifics of the Japanese DBS services also point to market differences and to the fact that choice, however limited, makes a difference to the consumer.

DIGICIPHERTM

DIGITAL TELEVISION COMPRESSION AND TRANSMISSION SYSTEM

12 SEPTEMBER 1990

GENERAL INSTRUMENT

BROADBAND COMMUNICATIONS

JERROLD DIVISION - CATV EQUIPMENT

VIDEOCIPHER DIVISION - SATELLITE ENCRYPTION SYSTEMS

COMM/SCOPE - COAXIAL AND FIBER OPTIC CABLE

DATA SYSTEMS

**WAGERING DIVISION - RACETRACK AND LOTTERY
COMPUTER SYSTEMS**

DEFENSE SYSTEMS - RADAR WARNING SYSTEMS

COMPONENTS

POWER SEMICONDUCTOR DIVISION - RECTIFIERS

VIDEOCIPHER DIVISION SCRAMBLING SYSTEMS

- **NORTH AMERICAN MARKET**
 - **VIDEOCIPHER I: COMMERCIAL SATELLITE TV DISTRIBUTION**
 - **VIDEOCIPHER II: COMMERCIAL/CONSUMER SATELLITE TV DISTRIBUTION**
 - **VIDEOCIPHER II PLUS:
NEXT GENERATION VERSION OF VCII**
- **INTERNATIONAL NTSC MARKET**
 - **VIDEOCIPHER IJ: EXPORTABLE VERSION OF VCII**
 - **VIDEOCIPHER PLUS: EXPORTABLE VERSION OF VCII PLUS**
- **INTERNATIONAL PAL/SECAM MARKET**
 - **EUROCYIPHER: ACCESS CONTROL FOR D/D2-MAC**

GENERAL INSTRUMENT

PROGRAMMERS THAT HAVE SELECTED THE VIDEOCIPHER II SYSTEM

PAY PROGRAMMERS

- * HBO
- * CINEMAX
- * COMEDY CHANNEL

- * SHOWTIME
- * THE MOVIE CHANNEL
- THE "HA" COMEDY CHANNEL

- * THE DISNEY CHANNEL

- * SELECTV
- * STARION PREMIERE CINEMA

- * STARDUST

- * PLAYBOY

- * FIRST CHOICE (CANADA)
- * FAMILY CHANNEL EAST (CANADA)

PAY-PER-VIEW PROGRAMMERS

- * VIEWER'S CHOICE (2)

- * REQUEST TV (2)
- * GUEST CINEMA (2)

- * CABLE VIDEO STORE

- * RENDEZVOUS
- * DRIVE-IN CINEMA

BROADCASTERS

- * PUBLIC BROADCASTING SERVICE
(FOR HIGH QUALITY STEREO AUDIO DISTRIBUTION)

BASIC PROGRAMMERS

- * CNN
- * HEADLINE NEWS

- * WTBS
- * TNT

- CNBC

- * MTV
- * VH1
- * NICKELODEON
- VIACOM/CONUS NEWS

- * ESPN

- * WWOR
- * WSBK
- * KTLA

- * WGN
- * WPIX
- * KTVT

- * LIFETIME

- * CBN CABLE NETWORK

- * USA NETWORK

- * PRIMETIME 24 (SBN:3)

- * NETLINK USA (6)

- * ARTS & ENTERTAINMENT

- * AMERICAN MOVIE CLASSICS
- * BRAVO

- * NASHVILLE NETWORK

- * WEATHER CHANNEL

- * FINANCIAL NEWS NETWORK

- * LA SETTE (3:CANADA)

- DISCOVERY CHANNEL

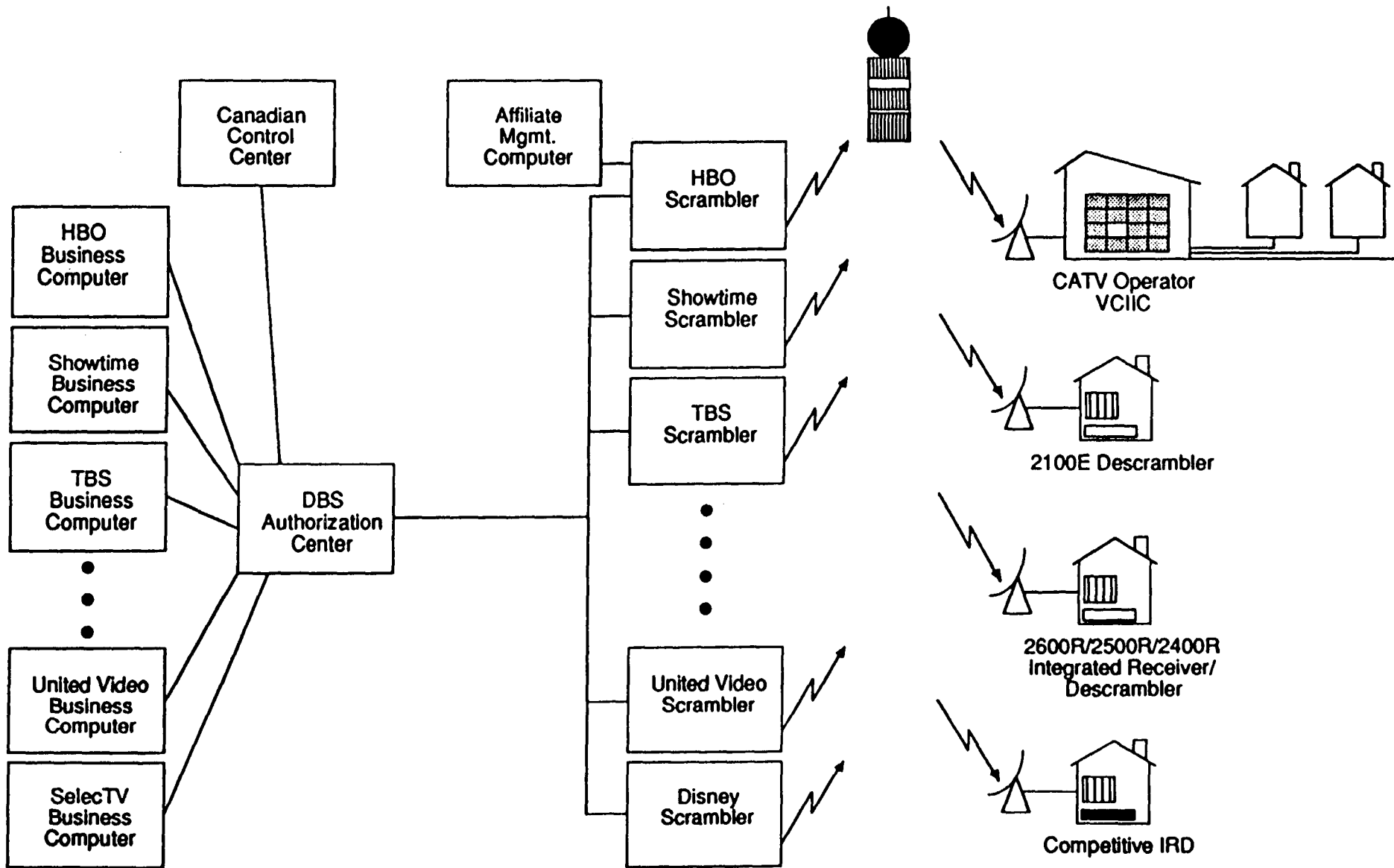
REGIONAL SPORTS NETWORKS

- * HSE
- * PRIME TICKET
- * SPORTS CHANNEL (7)
- * MIDWEST SPORTS CHANNEL
- * PACIFIC SPORTS CHANNEL

- * HOME TEAM SPORTS
- * PRIME SPORTS NORTHWEST
- * PRIME SPORTS NETWORK
- * SUNSHINE NETWORK
- * PRO AM SPORTS
- * MADISON SQUARE GARDEN

*CURRENTLY SCRAMBLED (8/6/90)

Integrated VideoCipher® II CATV/DBS Scrambling System



BACKGROUND

- **HDTV WORK BEGAN ABOUT 2 YEARS AGO**
- **DIGITAL SYSTEM SELECTED AS BEST APPROACH**
- **EMPHASIS SHIFTED TOWARD STANDARD NTSC TELEVISION**
- **STRENGTH IN 4 KEY TECHNICAL AREAS**
 - **DIGITAL COMPRESSION**
 - **DIGITAL PROCESSING/TRANSMISSION**
 - **ACCESS CONTROL/SUBSCRIBER MANAGEMENT INFRASTRUCTURE**
 - **CUSTOM VLSI DESIGN**
- **DEMONSTRATION SYSTEM DEVELOPMENT PROGRAM**
- **PRODUCT DEVELOPMENT PROGRAM**

Key Benefits of DigiCipher™ System

- 2 HDTV channels per transponder
- 2 to 10 NTSC channels per transponder
 - 4 for video sources
 - 10 for film sources
- Very high quality NTSC and HDTV
- Unified system for satellite, cable and broadcast
- Seamless interface for CATV/SMATV pass-through
 - no transcoder at cable headend
 - all media use HDTV decoder in TV set
- Inexpensive VHS/8mm based digital VCR
 - technology currently exists
 - no HDTV decoder in VCR
- No transmission or recording impairment
- Most secure video encryption
- VideoCipher II Plus access control with upgradeable security
 - Uses DBS Authorization Center and IPPV System
- Backward compatible with VideoCipher II Plus
- Lower cost than analog or hybrid HDTV systems
- No satellite receive dish size penalty compared to FM-NTSC
 - Threshold defined as one uncorrected error per day

Transmission capacity of satellite transponder vs. 6MHz cable/broadcast channel

- **Cable/broadcast channel**
 - 6 MHz bandwidth
 - 16 QAM modulation
 - 15 Mbps information capacity

- **Satellite transponder**
 - 24 MHz or greater bandwidth
 - Same threshold as FM-NTSC
 - 30 Mbps information capacity

DIGICIPHER™ NTSC OPERATING MODES

STANDARD DISH MODE*			SMALL DISH MODE +		
SIGNALS PER TRANSPONDER (C, FSS, BSS)	SIGNALS PER 6MHz CABLE CHANNEL	AUDIO CHANNELS PER VIDEO SIGNAL	SIGNALS PER TRANSPONDER (C, FSS, BSS)	SIGNALS PER 6MHz CABLE CHANNEL	AUDIO CHANNELS PER VIDEO SIGNAL
2	1	12	1	1	6
4	2	6			
6	3	4	2	2	3
8	4	3			
10	5	2	3	3	2

*SAME DISH SIZE AS FOR STANDARD ANALOG FM TRANSMISSION;

INCLUDES SIX 9600 BAUD RS-232 DATA CHANNELS PER TRANSPONDER (THREE PER CABLE CHANNEL)

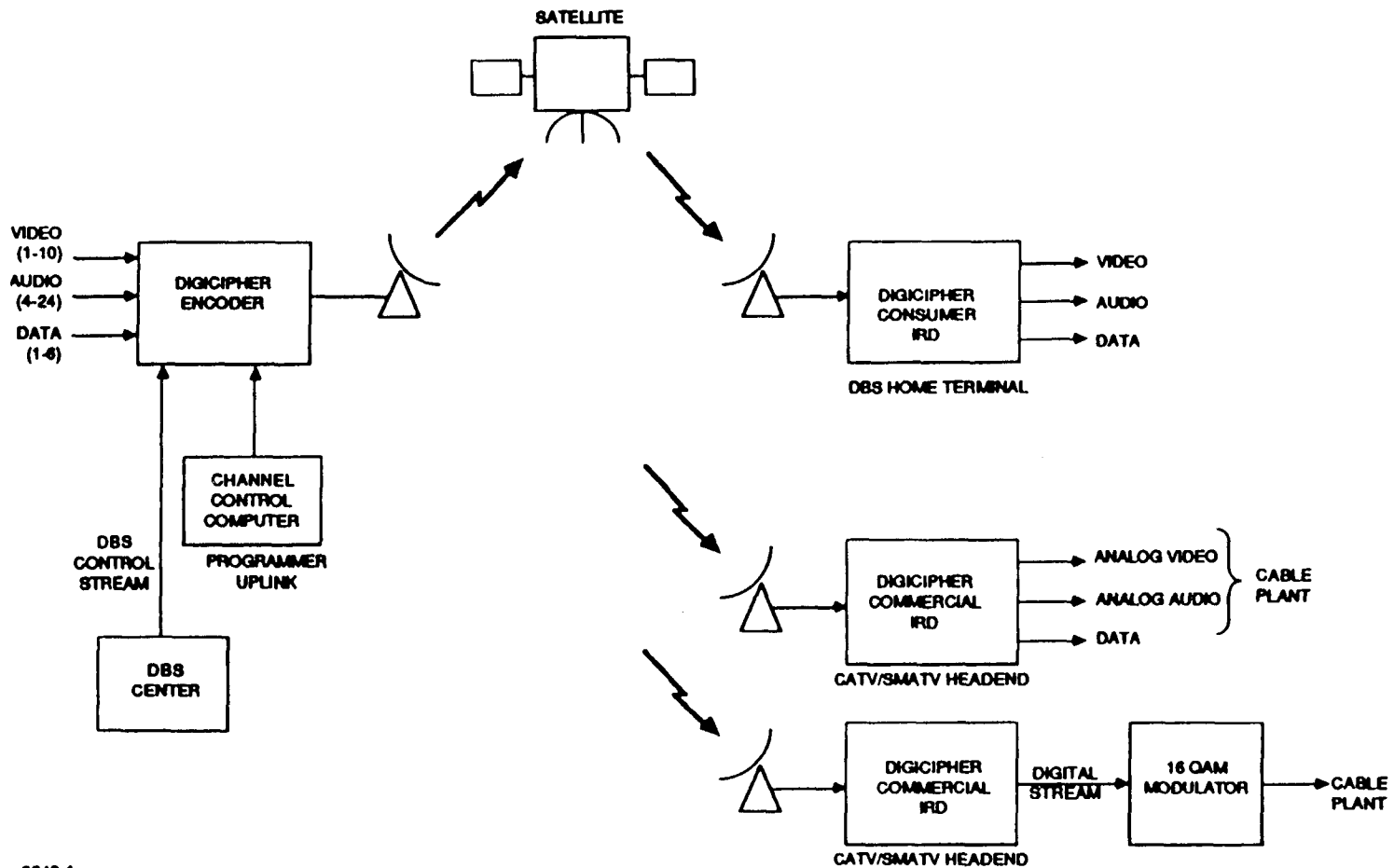
*RESULTS IN DISH DIAMETER REDUCTION UP TO A FACTOR OF 2;

INCLUDES THREE 9600 BAUD RS-232 DATA CHANNELS PER TRANSPONDER (THREE PER CABLE CHANNEL)

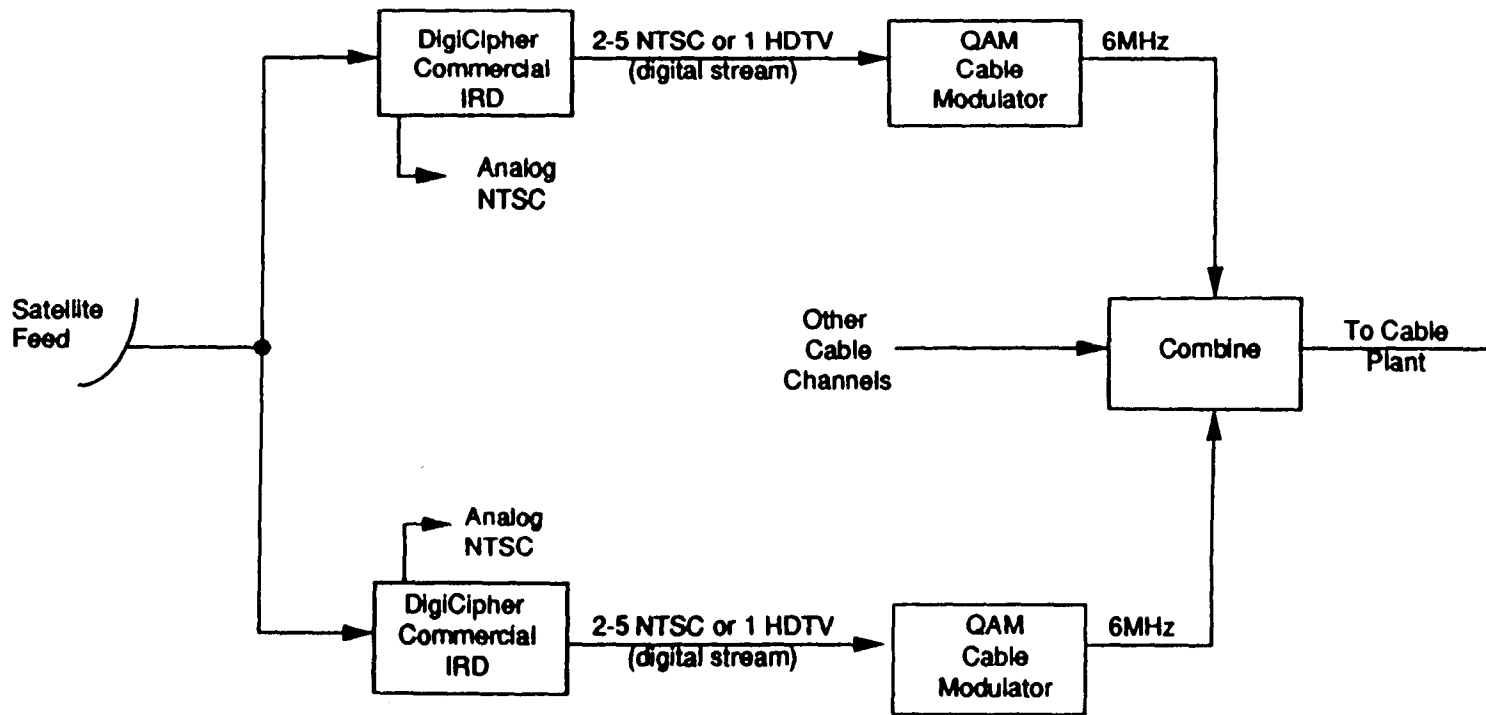
DigiCipher™ Satellite HDTV System

- Same digital TV compression system as proposed for Broadcast and Cable
- Different modulation for different media but common compression processing
 - Satellite
 - Cable/Broadcast
 - VCR
 - Fiber
- Provides for cost effective HDTV via non-broadcast media
- Does this without significantly penalizing higher capacity media
- Benefits for DBS but also cable delivery of satellite distributed HDTV - seamless interface
- Common compression algorithm and transmission system with DigiCipher™ multi-channel NTSC system
- Same threshold C/N as FM-NTSC via satellite - NO INCREASE IN RECEIVE DISH SIZE
- Performance at threshold is one uncorrected error per day

DIGICIPHER SYSTEM BLOCK DIAGRAM

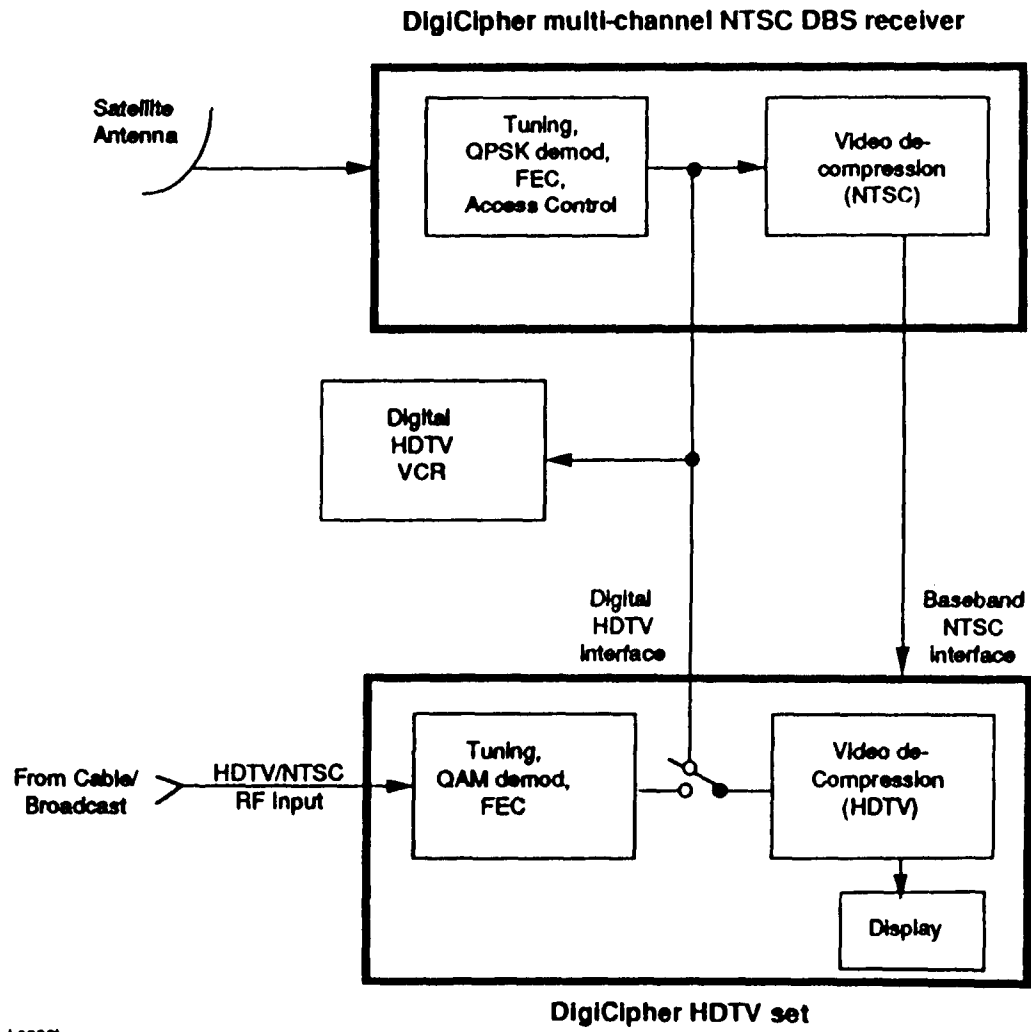


DigiCipher™ Satellite/Cable Seamless Interface



Jah0830a

DBS home terminal for DigiCipher™ HDTV and multi-channel NTSC



DigiCipher™ Schedule

- Simulations now

- Multi-channel NTSC

Breadboards:	Late September
Hardware-based demonstration:	November
Product for satellite TV delivery:	Early 1992

- HDTV

Breadboards:	February
Hardware-based demonstration:	2nd Quarter, 1991
ATTC/CableLabs test slot:	Late 1991
FCC Decision:	2nd Quarter, 1993