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## General Market Strategy

- **Design IRD for maximum flexibility while holding manufacturing cost in mass consumer electronics market range**
- **License ISDB receiver design to selected manufacturers in US and abroad**
- **License digital demod & custom chip designs**
- **License ISDB to programmers-broadcasters and MSOs**
- **Target TV manufacturers for marketing elements of the ISDB receiver design**
- **Keep royalty rate reasonable, target features for standardization capability**
- **Seek selected joint ventures; adoption by foreign broadcast firms; US manufactured custom silicon, MPEG2**



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# Customers

- **Broadcasters**

- **Ku Band; Narrowcasters, BTV, etc**
- **C Band; Cable Programmers**
- **DBS**
- **Digital Terrestrial Wireless**

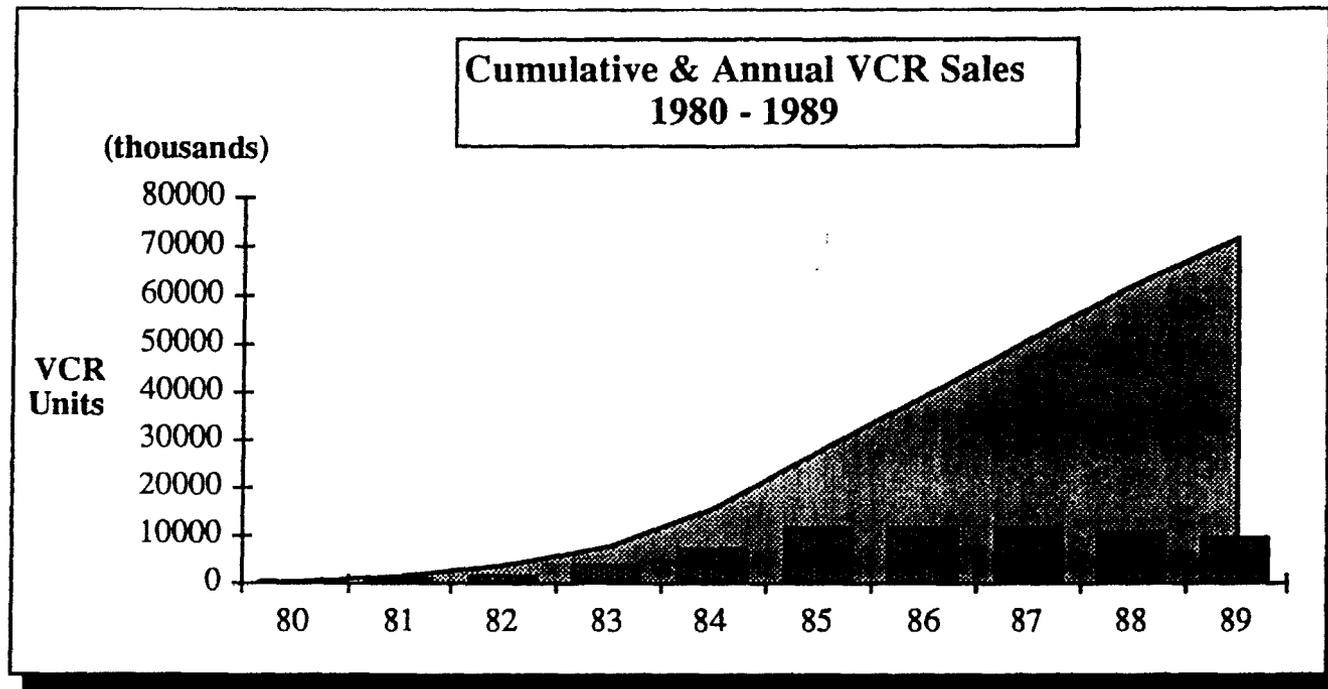
- **Consumer Electronics Manufacturers**

- **US: SCI Systems Inc., Zenith, Scientific Atlanta, etc.**
- **Pacific Rim: Goldstar, Sony, Matsushita, Sanwa, Daewoo, Hyundai, Toshiba, etc.**
- **European: Thomson, Phillips, Siemens, etc**



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# VCR Ramp-up Analogy

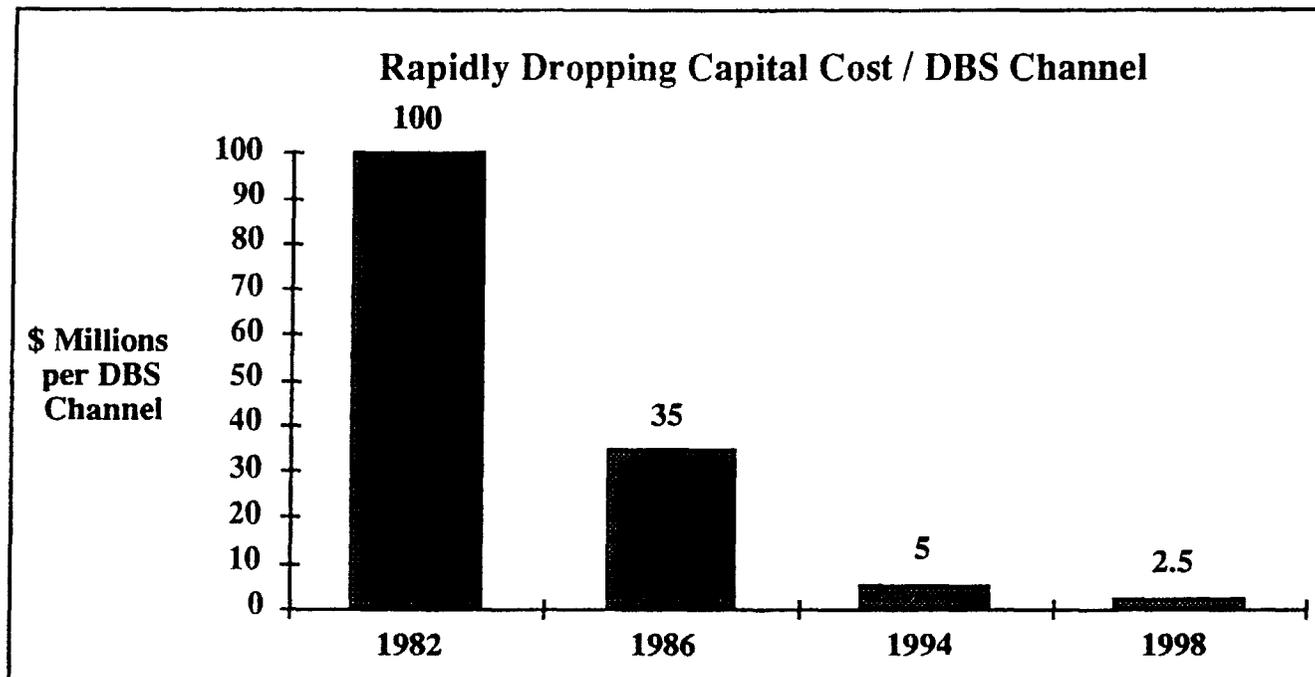


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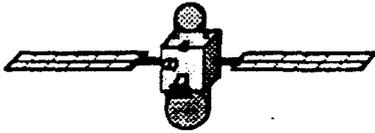
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# Rapidly Dropping Capital Cost / DBS Channel



**Digital Transmission multiplies the productivity of satellite assets**

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## Evolution of US Video Demand Profile

	1970	1980	1990	2000
US TVHH	63.4	80.8	94.2	104.8
Annual Box Office	1.4	2.7	5.3	10.3
Basic Cable	0.35	1.6	10.2	23.9
Pay Cable	0	.78	5.1	7.9
Video Rental	0	0.26	7.7	12.6
Video Sale	0	0.04	2.9	7.9
PPV movie	0	0	.17	2.9
PPV event	0	0	.23	1.4
<b>Total (\$B)</b>	<b>1.75</b>	<b>5.38</b>	<b>31.6</b>	<b>66.9</b>
<b>Expenditure / US HH</b>	<b>28</b>	<b>67</b>	<b>335</b>	<b>638</b>

Kagan Estimate





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## **How Has DBS Changed, 1982-1992 ?**

- **Cost per delivered channel of full motion color video service has dropped by a factor of 20**
- **Enough video programming available now, more will become available**
- **Demand for a broad array of video and other services is increasing**
- **Digital encoding significantly increases program security**
- **Cost of sophisticated ground equipment in mass market "consumer electronic" range**



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## DBS Market Demand

- **There are 94 million TV households in the US, growing at approximately one million per year**
- **35 million of these have no cable services**
- **Surveys consistently report 9% of cable customers will switch to DBS in the first year of its availability; additional 25% likely to switch over 5 years**
- **Many rural areas will never have cable services**
- **Approximately 3 million C-band dish users -- add-on or switch to DBS**
- **DBS will provide basic services for less than average cable fees**
- **DBS will provide classes of services not available today**
- **Every DBS subscriber will need a receiver**



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# HDTV and Computers

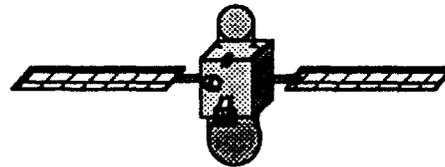
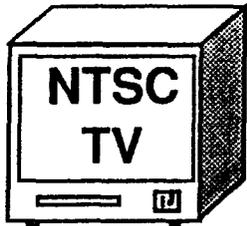
- All proposed HDTV systems require at least partial digital transmission.
- Digital DBS can easily be made compatible with any proposed HDTV system.
- All proposed HDTV systems require large digital memories, a substantial digital signal processing, and sophisticated programmable control.
- Personal computers are rapidly moving into desk-top video, high-resolution displays, signal processors, and television interfaces.
- The technology is similar.





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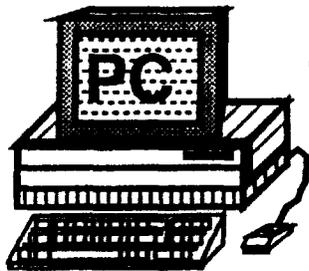
# Converging Technologies: Expanded Services & New Markets



Converging  
Technologies

**Digital DBS  
Receivers**

Expanded  
Spectrum of  
Services



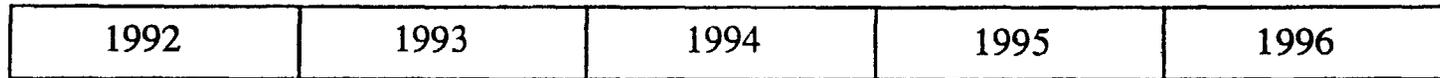
**New low-cost services  
(e.g., Education)**

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# Product Entry Timing



\* Launch

Ku-band Transponders  
Improves Productivity

10,000 2nd year  
Add-in Board  
Niche Market

Incorporation into fully-digital  
TV sets and other devices;  
possible standards

Digital DBS System:  
Education, TV Entertainment,  
Music, Electronic Publishing,  
Data, Telecommuting, HDTV,  
Others

500,000 3rd year  
Broad consumer market

growing to 1,000,000+ in  
subsequent years

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# Graphics Subsystem

- **Requirement**

- Intuitive, Graphic User Interface for selection requests, billing info, operational assistance, exploratory navigation, and use of new services

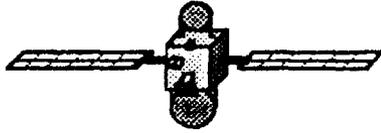
- Windowing and overlay capability for different standards in text, graphics, animation, and video

- Visual feedback for user input/control devices

- Response to both user and received control events, interactive and real-time multitasking operations capability

- **Method**

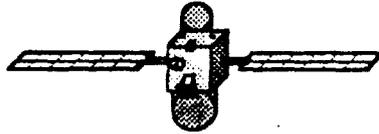
- Maximize use of local primitives in ROM such as Quickdraw, Postscript, and proprietary methods



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## Access Control

- **Supports individual keys for each receiver and each service**
- **Uses DES-derivative encryption algorithm**
- **Supports impulse PPV market potential**
- **Can disable pirate units**
- **Very fast system rekey capability--minutes vs days by present methods**
- **Complete, virtually untamperable viewing record for billing, copyright separations, and piracy detection**
- **Verification/authentication via smart card or phone**
- **Patent protection for verification/authentication system**



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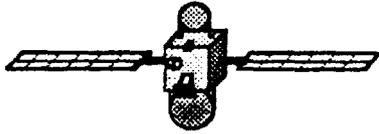
# Fast-Sync Digital Demodulator

- **Requirement**

- Support remote uplinks to access market for geographically dispersed niche services
- Maintain basic symbol synchronization for TDMA blocks *II*
- Refine/remember symbol sync & reacquire carrier sync quickly from short preambles

- **Method**

- A proprietary, digitally-implemented symbol demodulator is patentable



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# Operating System Software

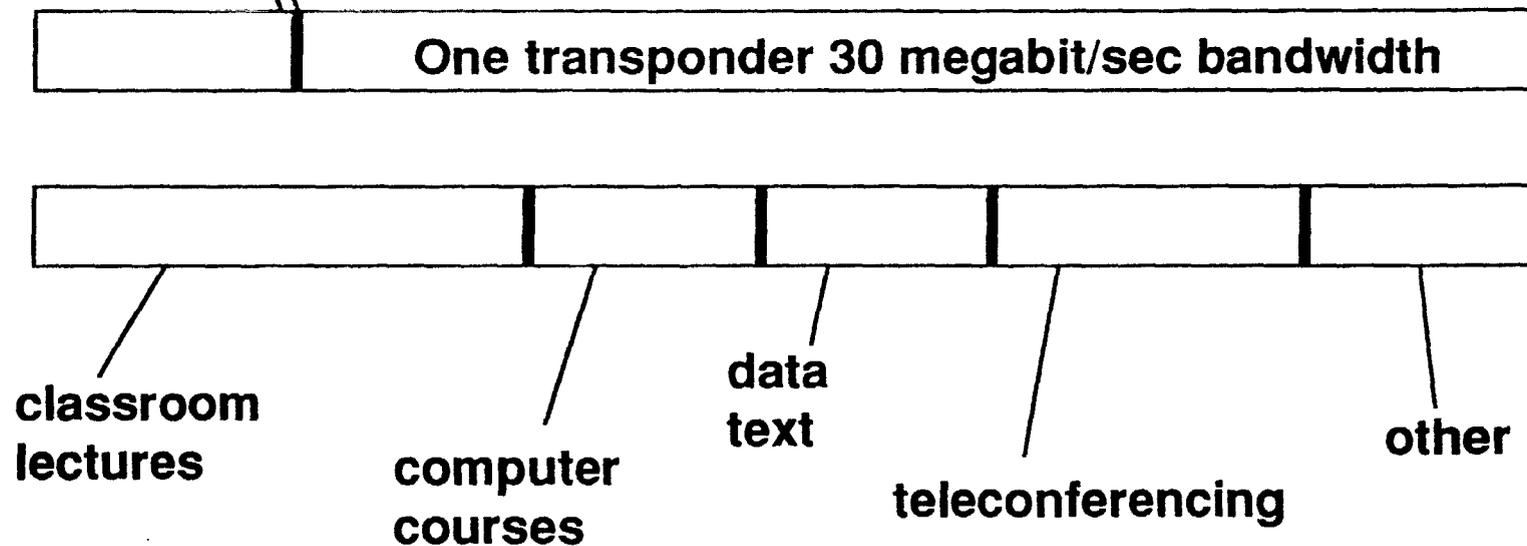
- **Assignment of individual services to particular transponders and (uplink) service groups; or MSO headend computers**
- **Assignment and management of service transmission times and / or time windows**
- **Maintenance of service-index transmission and receiver database allowing receiver to locate authorized, requested services**
- **Dynamic allocation of service resources and individual (uplink or MSO) capacities, with integral billing**
- **Identification and selection of desired services**
- **Controls "Graphical User Interface" and its links to operating and service requests** 

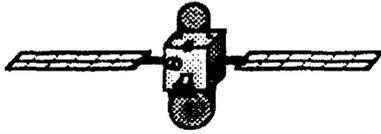


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# Capacity of One Transponder

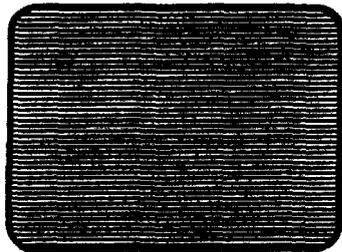
- 30 megabits per second
- One classroom lecture uses 250 kilobits per second  
120 such lectures are possible on one transponder





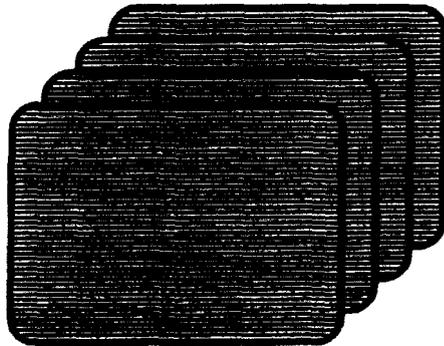
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# Video Compression



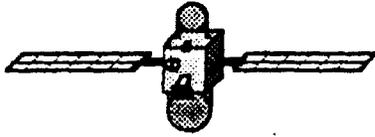
## ◆ Intra-Frame Techniques

- Prediction
- Estimation
- Transforms
- Quantization
- Entropy



## ◆ Inter-Frame Techniques

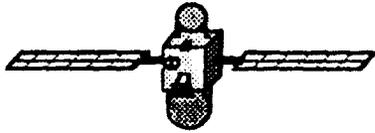
- Prediction
- Subsampling
- Conditional Replenishment
- Motion Compensation



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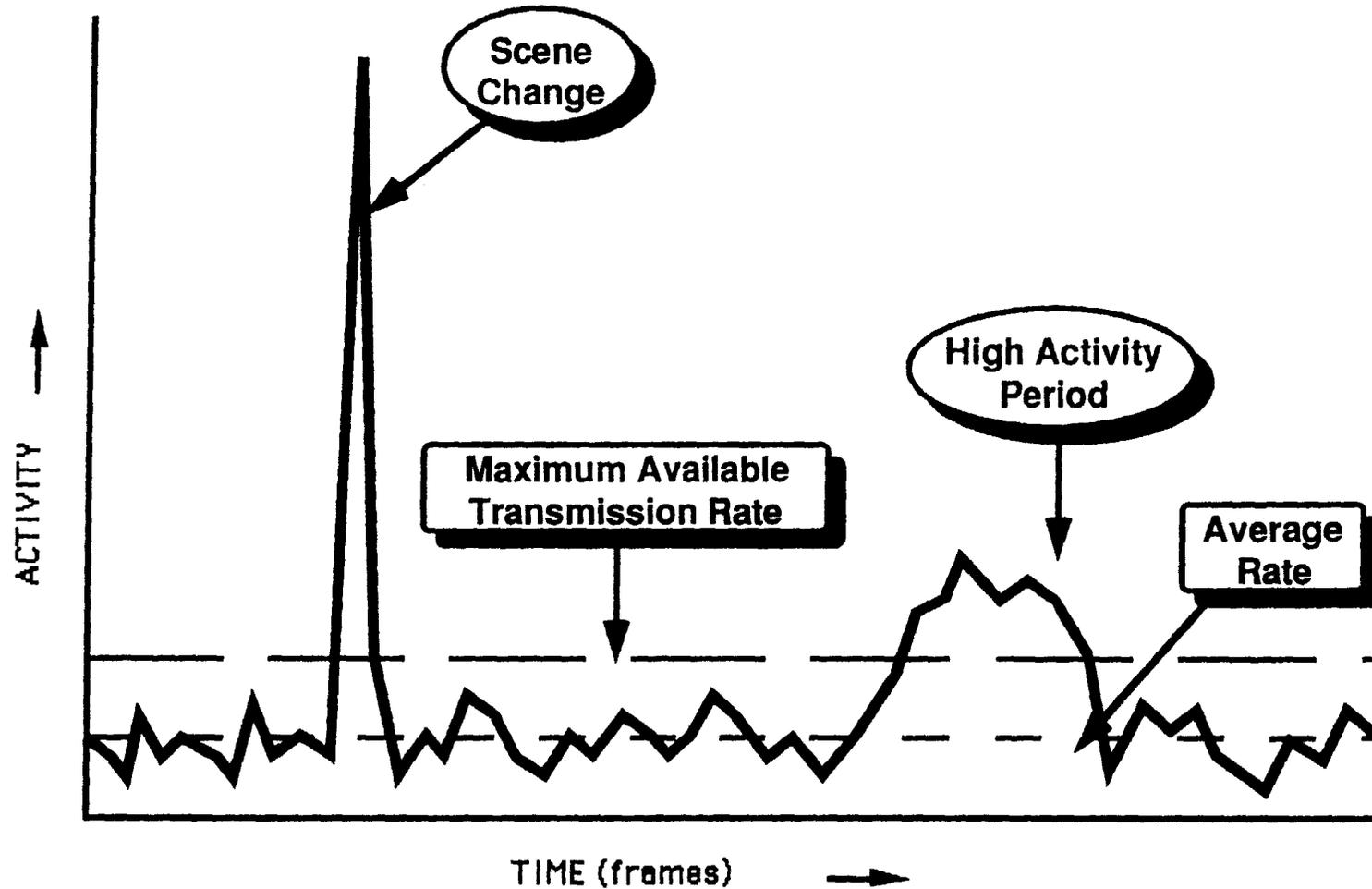
## **A Flexible Transmission Subsystem: ISDB**

- **Configuration, parameters, translation tables, and microcode will be downloaded from satellite to update algorithm as required**
- **Basic processing elements usable with MPEG-2 and other evolving video compression standards**
- **Dynamically variable image resolution, update rates, video placement, and video extant**
- **Individually addressable user IRDs, facilitate targeted advertising**
- **Extendible to HDTV**



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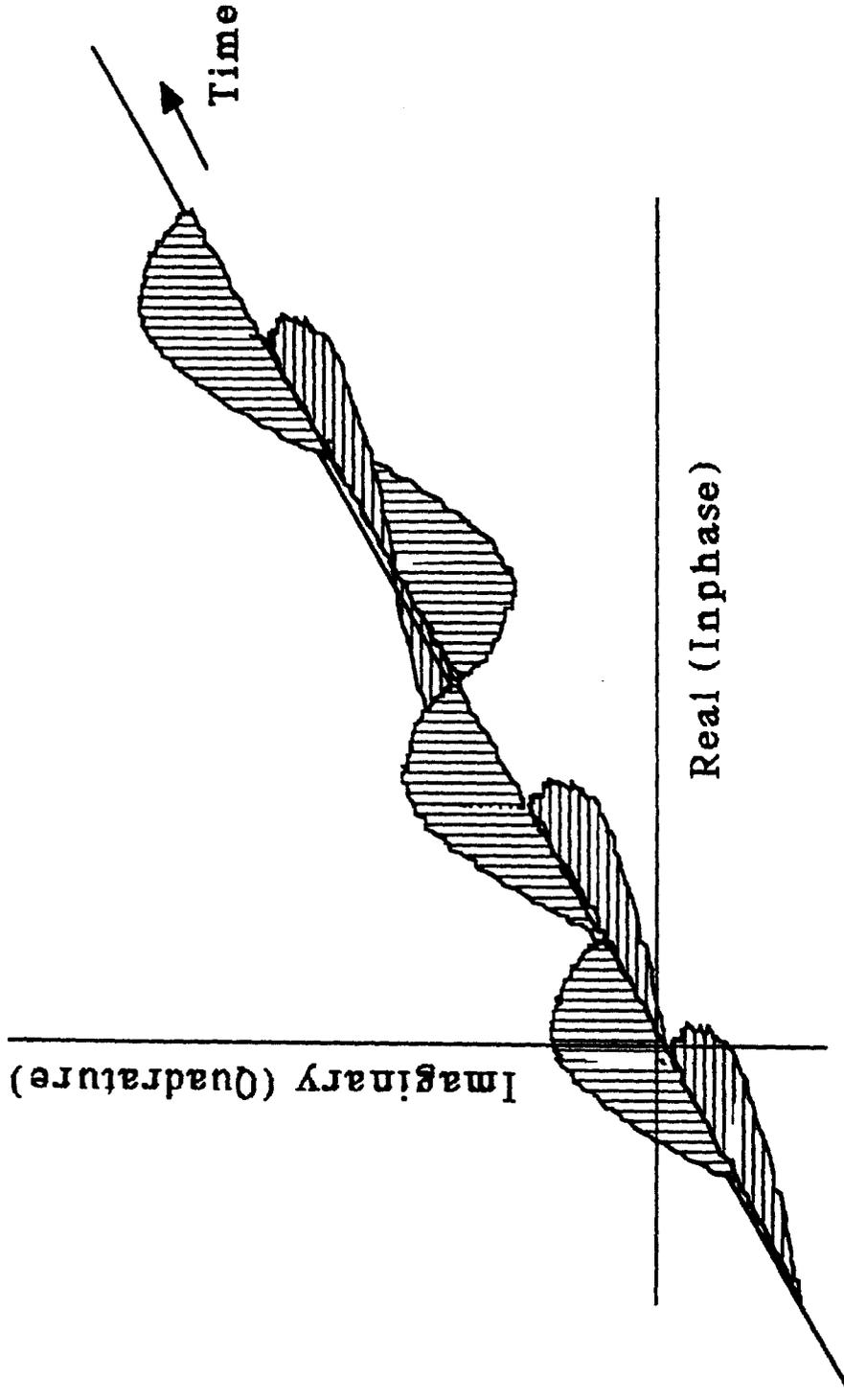
# Variability of TV Data Rate





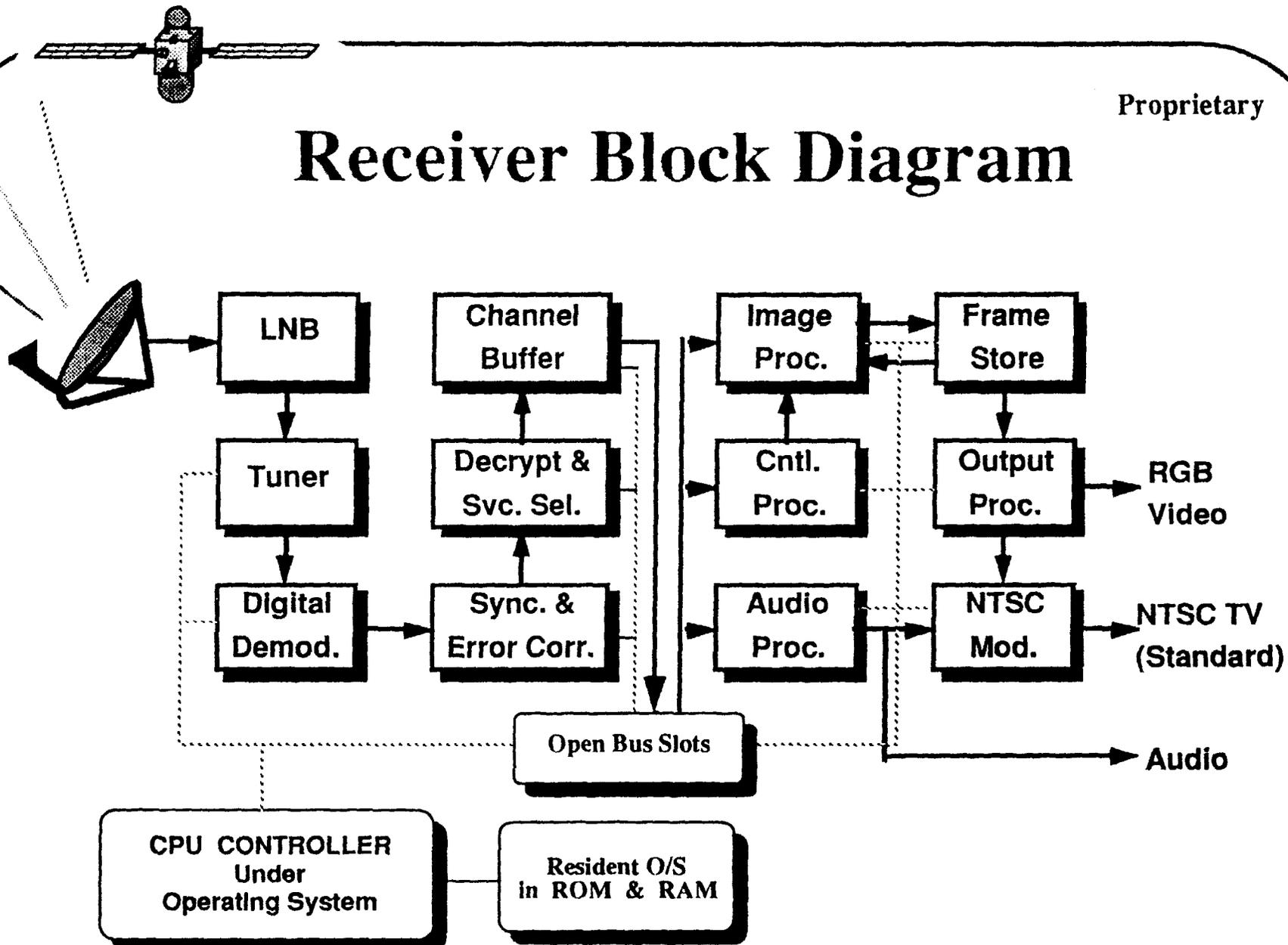
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# Offset QPSK Modulation



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# Receiver Block Diagram

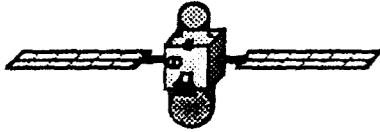




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## **ISDB Flexibility Enables Commercial Service Expansion**

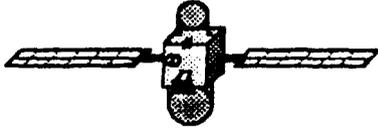
- **A bit is a bit-- A lot of bits is anything you want it to be.**
- **Multiple services can be multiplexed statically or dynamically.**
- **Hard encryption can provide highly effective subscriber access control.**
- **Future service enhancements can easily be added to an open bus architecture**
- **Totally new categories of broadcast services are possible beyond entertainment TV**
- **Includes digital cable applications**



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## **Digital Cable/DBS Facilitates New Services**

- **Transmission of computer software, quickly, accurately, and efficiently**
- **Transmission of CD quality music --ultra high fidelity audio**
- **Electronic publishing in a wide array of niches**
- **Flexible graphics and animation**
- **Interactive services via PSN**
- **Easy cooperative use with micro computers, etc.**
- **Best method to distribute HDTV signals**
- **National radio**
- **Targeted advertising**
- **Many others**

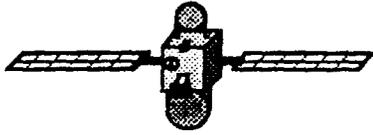


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## **ACE Technology: Integrated Services Digital Broadcast**

- **Integrated Open-Architecture Receiver Design**
- **Adaptability to Digital Cable Applications**
- **Digital Demodulator Design**
- **[Operating Systems] for Transmission and Reception**
- **Local Graphic and Animation Primitives**
- **Broadcast System Design and Engineering Management**

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# The Future is Digital

- **Advantages in diminished noise and distortion.**
- **New media are available for digital services (light fibers, DBS, recordable Compact Disks, Digital Audio Tape).**
- **Digital demodulator chips are economically feasible.**
- **Digital compression and signal processing is maturing and economically feasible.**
- **Digital Transmission offers unprecedented services flexibility.**



# ACE Concept and Overview

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- **Because**

- **Microcomputers and TV technology are converging rapidly**
- **Digital signals delivery create an era of rapid change**

- **ACE targets**

- **A fully integrated digital-to-analog personal satellite ground station and conversion device for use with TV, microcomputers, and other devices**
- **Provide turnkey solution for digital systems in US and abroad**
- **Incorporate design into future, fully-digital TV, for cable or DBS**