Multimode/Wireless Terminals: The Role of Semiconductor Providers

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Abstract

This document contains a presentation delivered by Edgar Auslander, European Business Development Manager of the SC Wireless Communications Business Unit at the First European DSP Education and Research Conference on September 25, 1996.

Product Support

World Wide Web

Our World Wide Web site at www.ti.com contains the most up to date product information, revisions, and additions. Users registering with TI&ME can build custom information pages and receive new product updates automatically via email.

Texas Instruments
ESIEE
The First European DSP Education and Research Conference
September 25, 1996

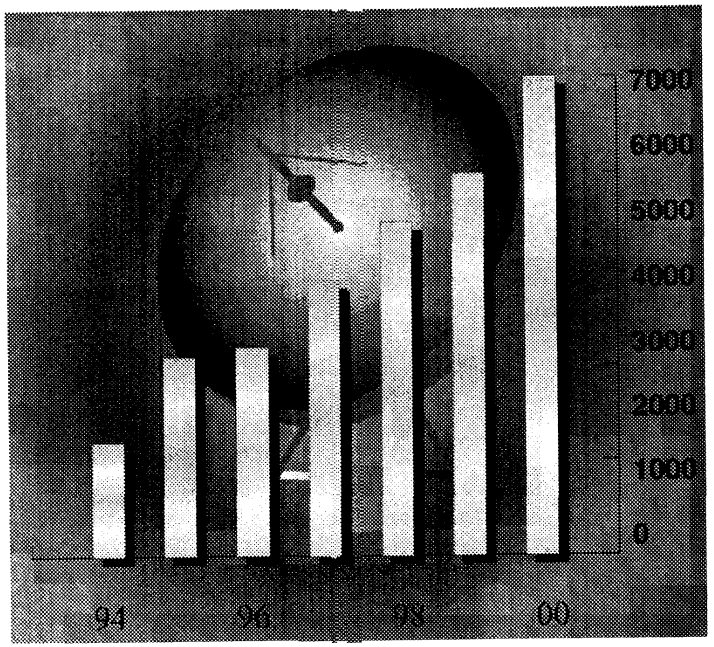
Multimode Wireless Terminals: the Role of Semiconductor Providers

Edgar Auslander

European Business Development Manager
SC Wireless Communications Business Unit
Texas Instruments Incorporated

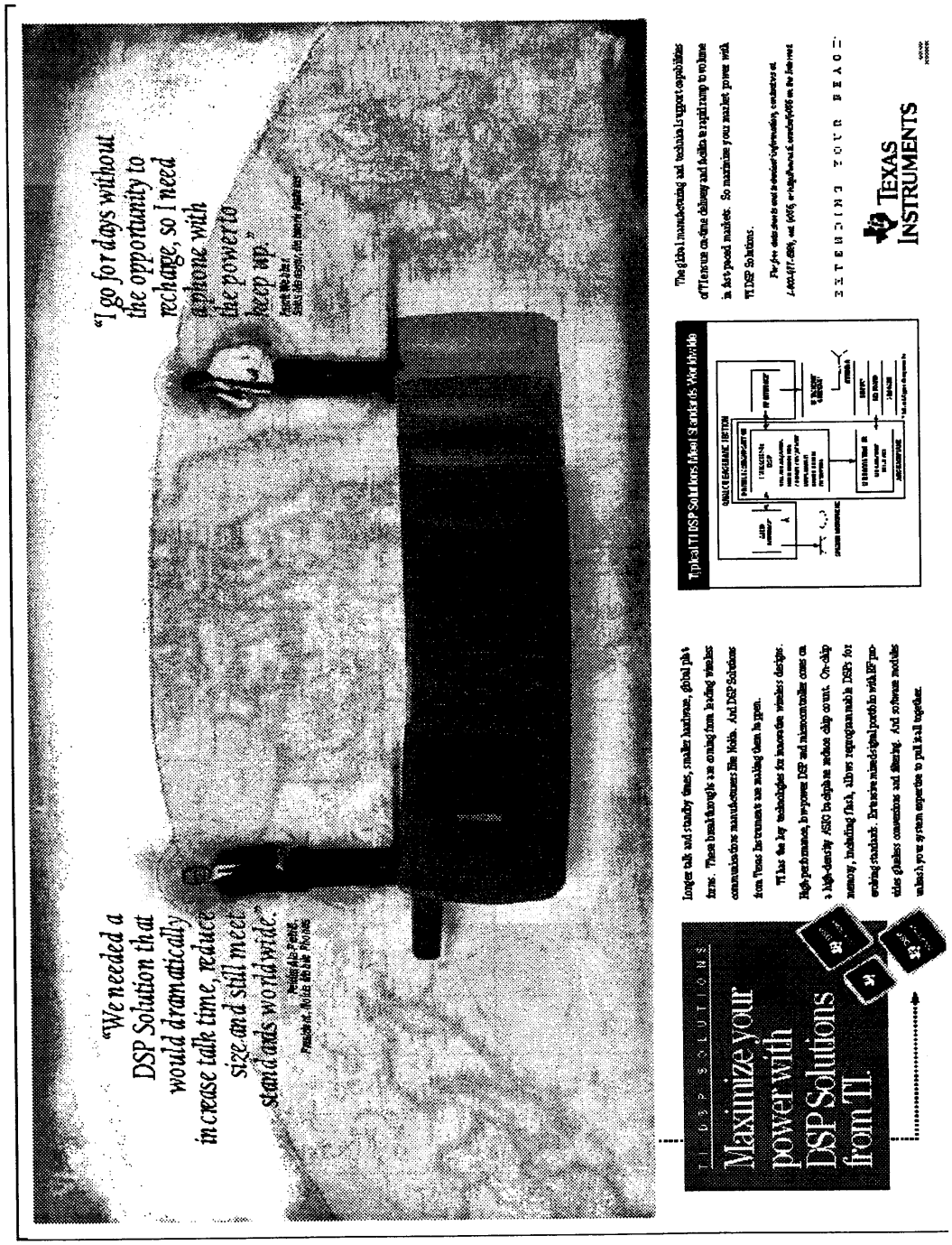
A Market Poised for Growth

- Tremendous growth potential: half the world has never placed a phone call
- Projections include analog & digital cellular, digital cordless phones & pagers
- IC TAM includes DSP solutions for Digital Base band, Analog Baseband and RF Products



Source: TI projections, $ Millions

"In my business, minutes could cost millions. So, I need immediate and confidential communications."
Lynn A. Schreiber,
International Financial Consultant
"With wireless going digital, we needed a components supplier to take us from concept to volume quickly."
Bo Hedfors,
President and CEO, Ericsson Inc.
We're bringing together DSP Solutions that sound good to our customers
And theirs
TEXAS INSTRUMENTS


"We needed a DSP Solution that would dramatically increase talk time, reduce size and still meet standards worldwide."
"I go for days without the opportunity to recharge, so I need a phone with the power to keep up."
TI DSP SOLUTIONS
Maximize your power with DSP Solutions from TI.
Typical TI DSP Solutions Meet Standards Worldwide
TEXAS INSTRUMENTS

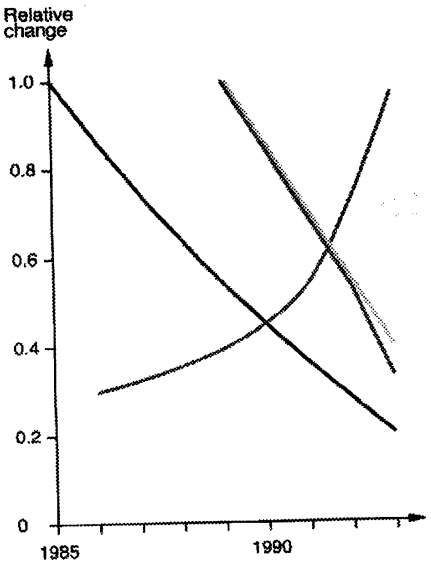
Do You Speak Esperanto ?

- **Analog Cellular**
  - AMPS, TACS, NMT
- **Digital Cellular**
  - GSM, IS54x, IS136, IS95, PDC
- **Analog Cordless**
  - CT0, JCT, CT1
- **Digital Cordless**
  - DECT, PHS, CT2/CT2+, PACS
- **PMR**
  - Tetra, Tetrapol, Rubis, SMR
- **PCS**
  - PCS1900, PCS 136+, PCS CDMA, DCS1800
- **Satellite**
  - Globalstar, Iridium, Leo, Inmarsat ...
- **Wireless Data**
  - ERMES, CDPD, Mobitex, Ardis, IEEE802.11, Pocsag

UMTS? FPLMTS?

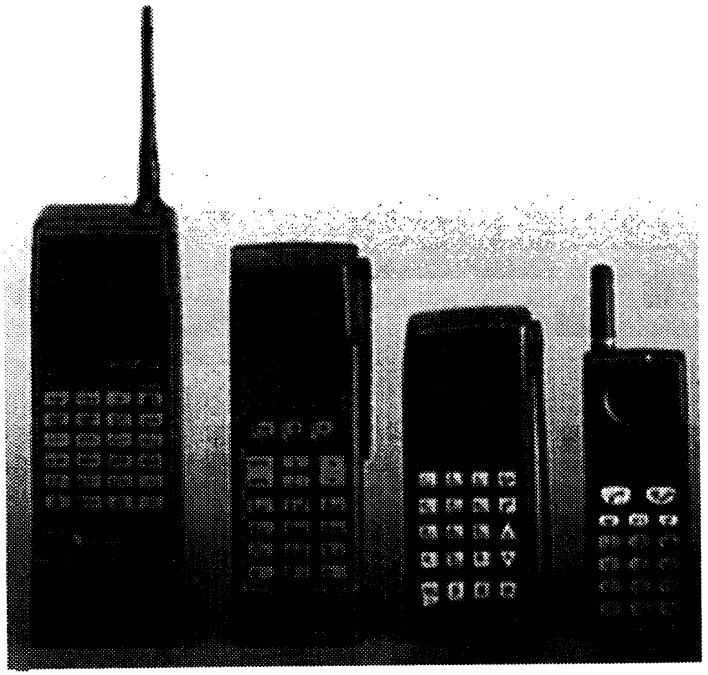
Churchill, with his cigar and his mobile phone

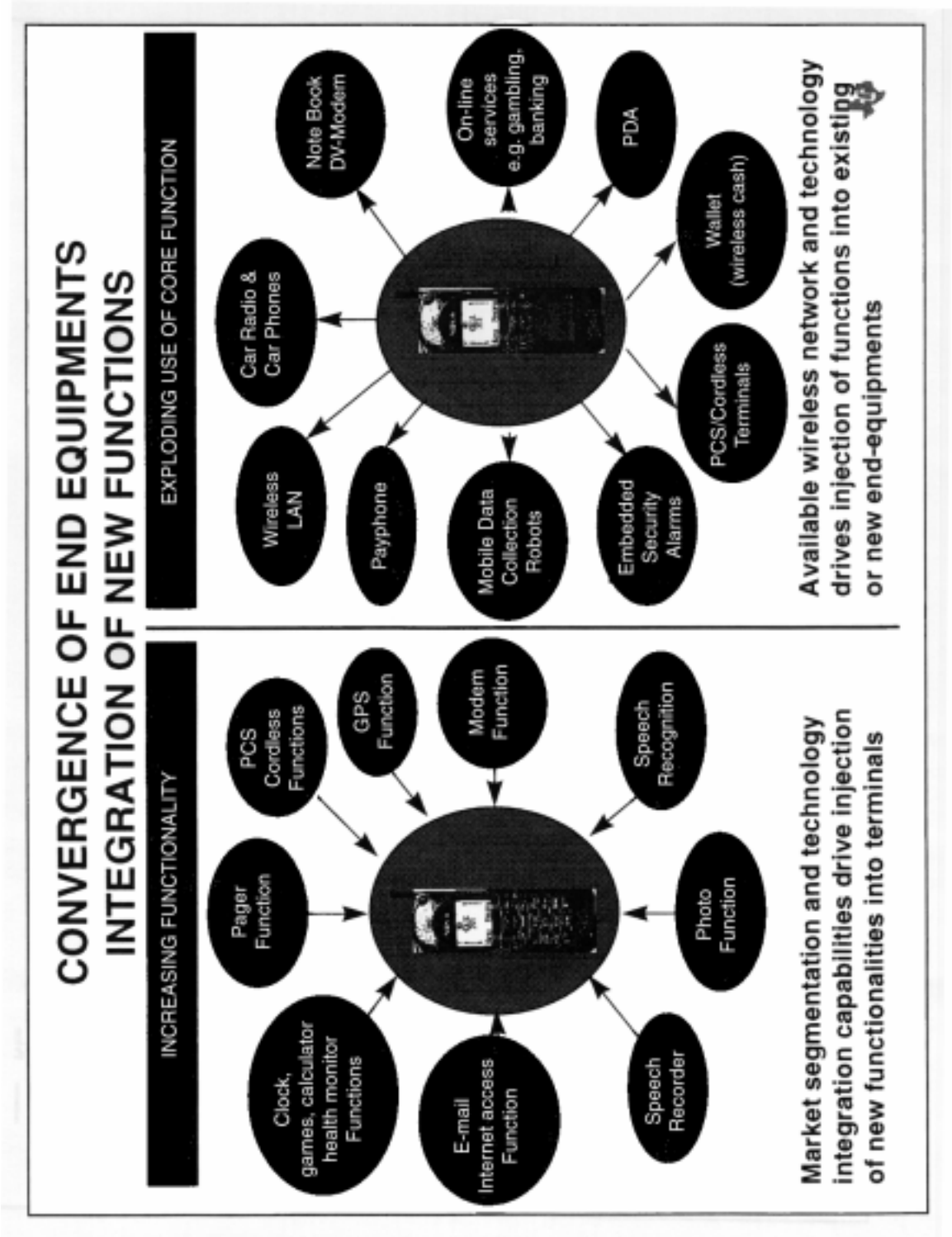
Size, Weight, and Price Decrease while Functionnalities, Talk and Standby times Increase



The figure depicts the fast reduction in volume, weight and price (current level) for Ericsson's mobile phones during the last few years and the corresponding increase of battery life

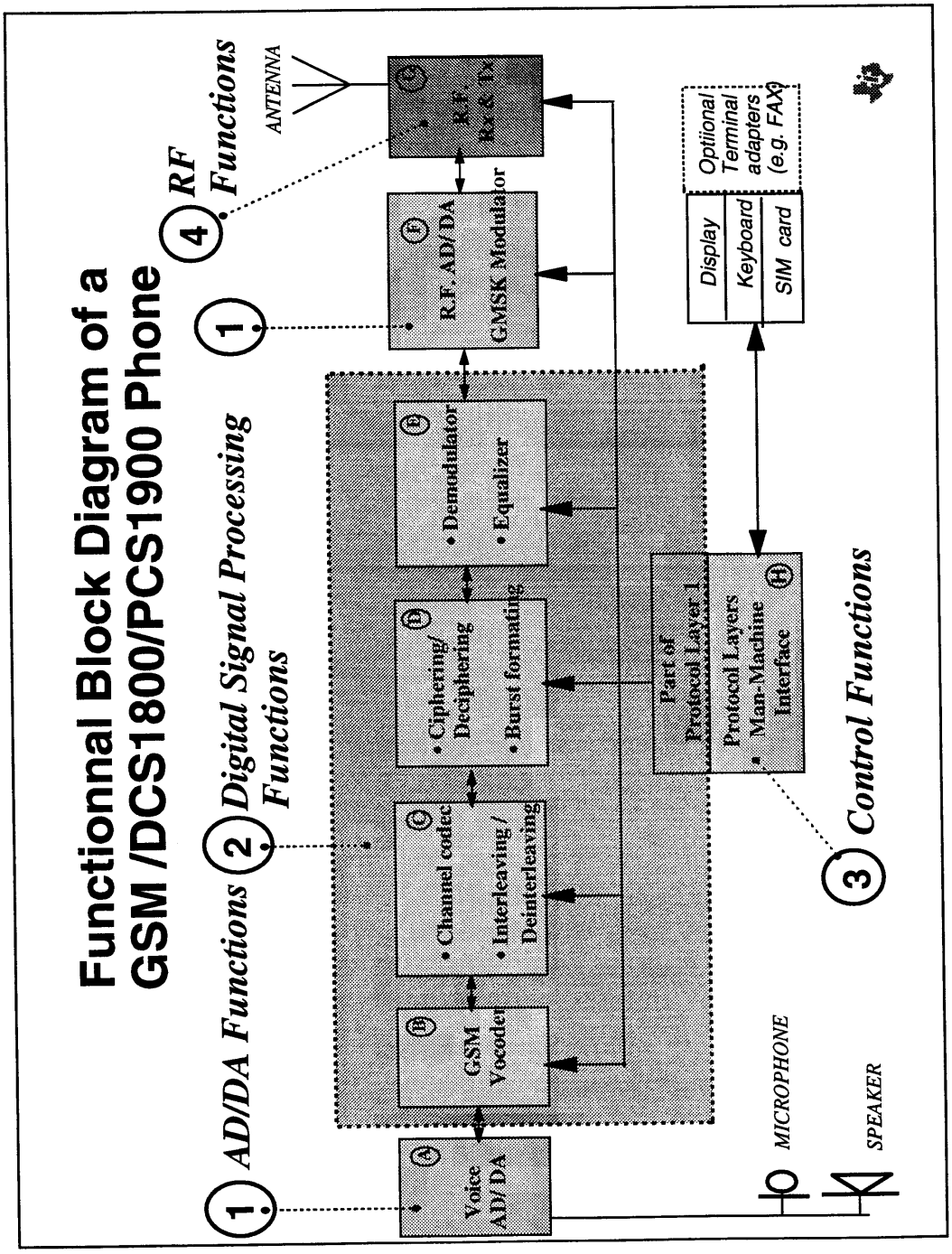
Weight
Volume
Talk time
Price




CONVERGENCE OF END EQUIPMENTS
INTEGRATION OF NEW FUNCTIONS
INCREASING FUNCTIONALITY
EXPLODING USE OF CORE FUNCTION
Pager Function
PCS Cordless Functions
GPS Function
Modem Function
Speech Recognition
Photo Function
Clock, games, calculator health monitor Functions
E-mail Internet access Function
Speech Recorder
Car Radio & Car Phones
Note Book DV-Modem
On-line services e.g. gambling, banking
PDA
Wallet (wireless cash)
PCS/Cordless Terminals
Wireless LAN
Payphone
Mobile Data Collection Robots
Embedded Security Alarms
Market segmentation and technology integration capabilities drive injection of new functionalities into terminals
Available wireless network and technology drives injection of functions into existing or new end-equipments

Wireless Coms: What's Next?

Users and Operators Needs
Drive Next-Generation Systems
OEMs
DSP Solutions
TI DSP SOLUTIONS
CONSUMERS
LOW COST
SMALL SIZE
LONG BATTERY LIFE
OPERATORS / SERVICE PROVIDERS
MORE CHANNELS IN LIMITED BANDWIDTH


Functionnal Block Diagram of a
GSM /DCS1800/PCS1900 Phone
1 AD/DA Functions
2 Digital Signal Processing Functions
3 Control Functions
4 RF Functions
ANTENNA
A Voice AD/ DA
B GSM Vocoder
C • Channel codec • Interleaving / Deinterleaving
D • Ciphering/ Deciphering • Burst formating
E • Demodulator • Equalizer
F R.F. AD/ DA GMSK Modulator
G R.F. Rx & Tx
Part of Protocol Layer 1
H Protocol Layers • Man-Machine Interface
Display
Keyboard
SIM card
Optiional Terminal adapters (e.g. FAX)
MICROPHONE
SPEAKER

Discussion Topics

- Why are multimode terminals valuable in the wireless world?
- Which combinations make the most commercial sense?
- What are the impacts and efficiencies of combining multiple modes in a single handset?
- What options can semiconductor manufacturers offer to mitigate the multimode impact?

During the day:
Different environments, different services needed

- At Home
  - Private indoor access point
    - low-power transmitter and very good audio quality
- On the way to the Office
  - Public cellular system adapted to vehicle speed
    - Medium to high power transmitter, good audio quality is acceptable
- At the Office
  - Company facilities access to Wireless PBX
    - low-power transmitter, good to very good audio+data

Key Combinations

- Public/Private Combinations
  - GSM Based Combinations
    - GSM 900 plus DECT
    - DCS 1800 plus DECT
    - PCS 1900 plus DECT
    - PCS 1900 plus ISM cordless
    - PCS 1900 plus AMPS
  - Other Technologies
    - AMPS based "Telego" service
    - IS 136 Home Basestation
    - IS 95 Home Basestation

One Concept, Three Motivations

Small Cells and Large Cells: Why?

- **(User)**

1. **Air time free (private) or not (public)**

Public /Private Systems Allow Users to Manage Airtime Costs

- Multimode terminals allow users to use cordless service without airtime charge and public cellular when out of cordless coverage

One Concept, Three Motivations

Small Cells and Large Cells: Why?

- **(User)**

1. Air time free (private) or not (public)

- **(Service Provider)**

2. Extend service area

- **(Both)**

3. Ultimate (global) coverage

Small Coverage/Large Coverage Combinations

New services based on high capacity, small cell technology can offer expanded coverage via multimode phones that "roam" to the established large cell service once the user has crossed out of the home system.

One Concept, Three Motivations

Small Cells and Large Cells: Why?

- **(User)**

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2. Extend service area

- **(Both)**

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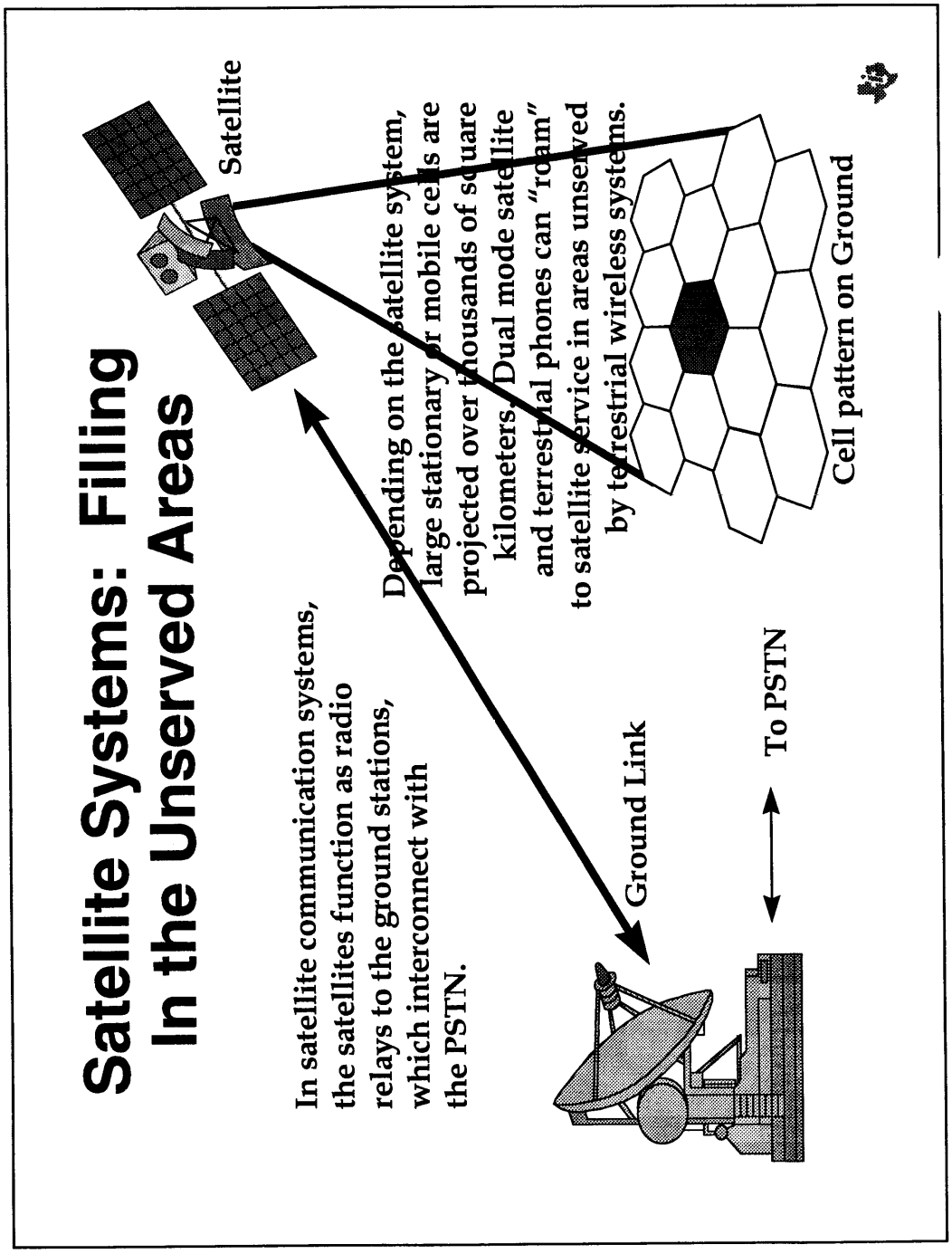
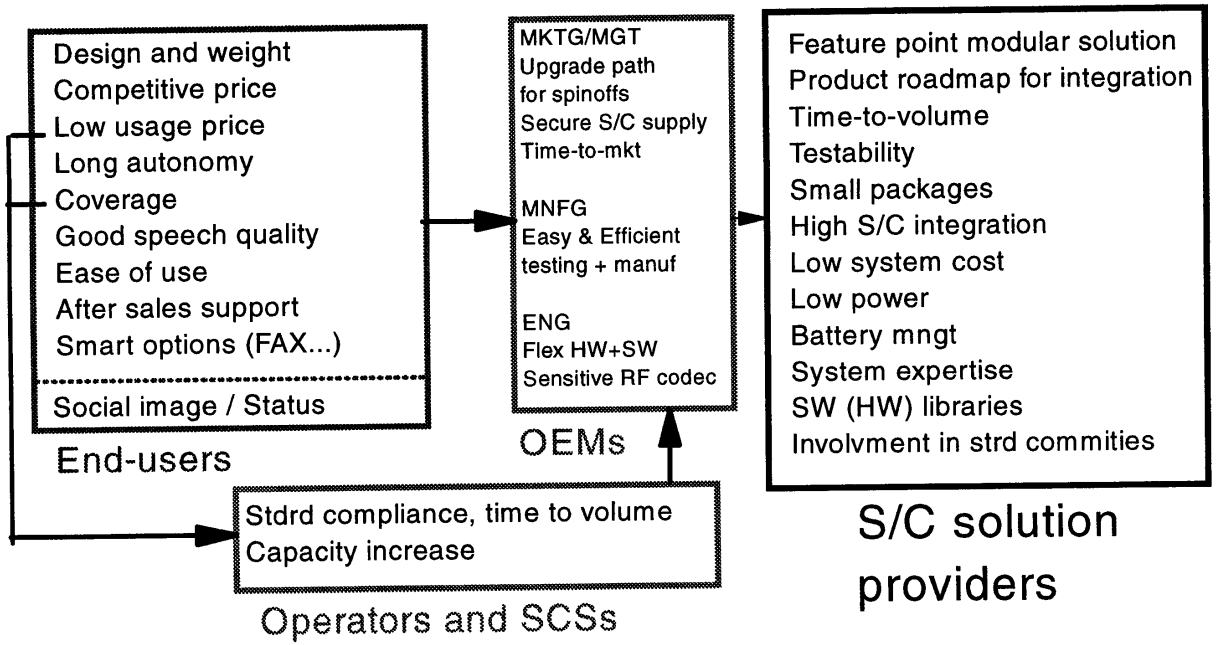

Satellite Systems: Filling In the Unserved Areas
Satellite
In satellite communication systems, the satellites function as radio relays to the ground stations, which interconnect with the PSTN.
Depending on the satellite system, large stationary or mobile cells are projected over thousands of square kilometers. Dual mode satellite and terrestrial phones can "roam" to satellite service in areas unserved by terrestrial wireless systems.
Cell pattern on Ground
Ground Link
To PSTN

The Careabouts and their Impact



The needs for multimode terminals and their impacts

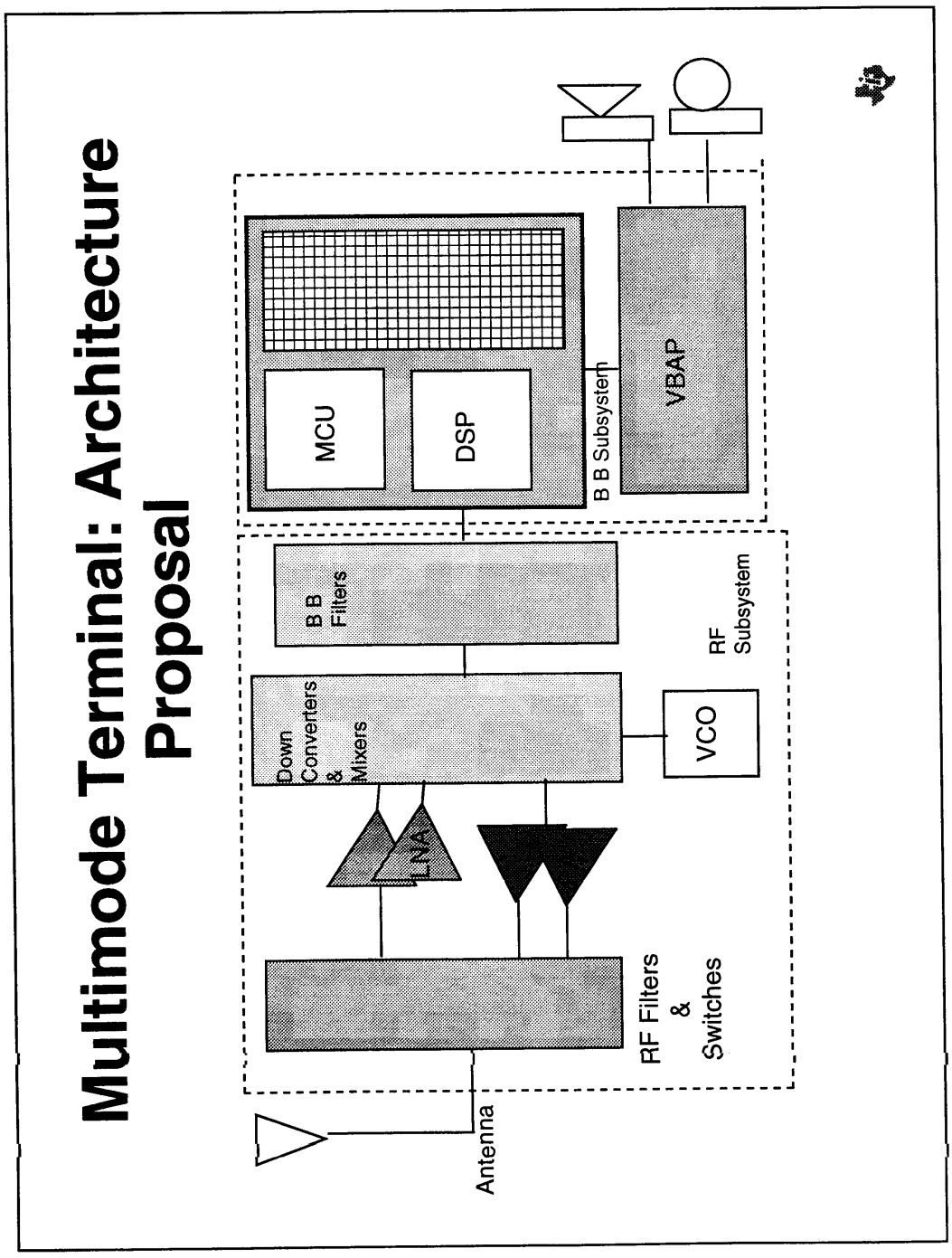
- THE NEEDS:
  - Diversity of standards
  - Indoor, Outdoor, Private, Business
    - Different environments, different services,
    - Different access technologies
- THE IMPACTS:
  - Soft Terminals
  - Soft Basestations
  - Integration of interoperability
    - Roaming,
    - Handover at different speeds
    - Billing
    - Authentification
  - Type approval issues
  - Frequency licensing issues
  - Economics

Preserving competitive price, form-factor and...

Technological area	Issues for multimode
Antenna	multi-band integration
Radio	Multi-band Multi-bandwidth
Baseband	Soft platform, DSP+MCU+ASIC integration, Support of multiple vocoders, modulation schemes, etc.
MMI	Ease of use of multimode Transparency to user
Algorithms	Power savings and ctrl Best access technology selection and download
Software	Multi-standard management

Flexible Handset Architecture Approaches

- Multimode design strategy requires *hardware reuse* where possible
  - RF subsystems need to accomodate broad ranges or dual band operation
  - RF and Voice Band Codecs can be unaffected with proper system design
  - Digital Baseband must accomodate software for each mode (more memory)
  - Microcontroller must process a superset of system commands and must be capable of "preferring" one service over the other


Multimode Terminal: Architecture Proposal
MCU
DSP
B B Subsystem
VBAP
B B Filters
Down Converters & Mixers
VCO
RF Subsystem
LNA
RF Filters & Switches
Antenna

Example Implementation - GSM plus DECT

- Typical DECT is simple with a few integrated components
- GSM utilizes DSP and Microprocessor
- Multimode terminal uses GSM processors to implement DECT functions
- While some integration is possible, it is mainly a dual radio with a single baseband
- Microcontroller must automate the preference for DECT when it is available
- Final result is slightly more complex and more costly than GSM alone

Summary and Conclusions

- Multimode terminals do have a place in the current wireless communications marketplace which will grow in the next few years
- The combinations that make sense will be ones where the ecomomic value to end customers overcomes the increased cost introduced by multimode operation
- Product planning that takes advantage of DSP and advanced microprocessor abilities to support multimode operation in software will mitigate the impact of multimode terminal inefficiency and reduce the barrier to successful product introduction