

ROLE OF RADIO IN TECHNOLOGY APPLICATIONS

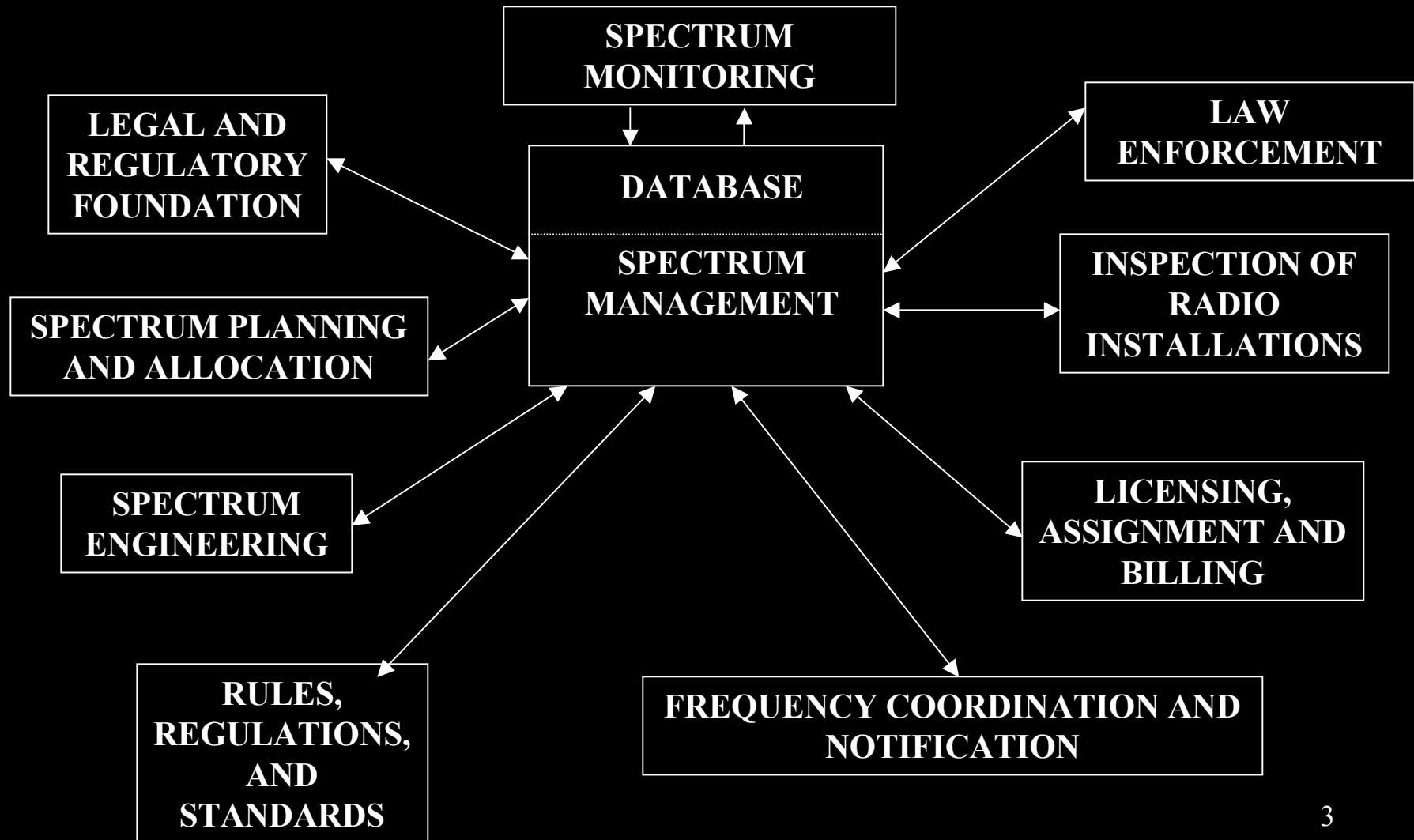


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TOPICS FOR DISCUSSION

- **RELATIONSHIP BETWEEN SPECTRUM MANAGEMENT AND WIRELESS - - PRINCIPLES, FORCES, POLICIES, AND AUCTIONS**
- **INTERNATIONAL CONSENSUS**
- **WIRELESS SYSTEMS**
- **NEW WIRELESS SPECTRUM DEVELOPMENTS**
- **MOBILE WIRELESS**
- **FIXED WIRELESS**
- **GLOBAL POSITIONING**
- **SATELLITE SERVICES AND SHARING WITH TERRESTRIAL SYSTEMS**
- **ACCESS AND MARKETS**

SPECTRUM MANAGEMENT



THE SIX PRINCIPLES OF SPECTRUM MANAGEMENT

- 1. COMPETITION**
- 2. MAXIMUM FLEXIBILITY OF USE**
- 3. PUBLIC INTEREST**
- 4. CONSTRUCTIVE LICENSING AND FEE
POLICIES**
- 5. ADMINISTRATIVE CERTAINTY WITH
MINIMUM DELAY**
- 6. TAKING NATIONAL DECISIONS IN A
GLOBAL MARKET CONTEXT**

1. COMPETITION

- **RELY ON MARKET FORCES TO ENSURE ECONOMICALLY EFFICIENT USE OF SPECTRUM (PERMIT AND PROMOTE COMPETITION)**
- **AVOID MANDATING SPECIFIC SYSTEMS**
- **MINIMIZE REGULATIONS THAT LIMIT COMPETITION, OBSTRUCT INNOVATION, OR IMPEDE EFFICIENT INVESTMENT**
- **INTERVENE ONLY WHEN NECESSARY TO PRESERVE OR PROMOTE COMPETITION (CONSIDER SPECTRUM CAPS TO ENSURE COMPETITION)**

2. FLEXIBILITY

- **MAXIMUM FLEXIBILITY TO RESPOND TO MARKET FORCES (ATTRIBUTES OF PROPERTY RIGHTS)**
 - SPECTRUM AVAILABLE FOR ADDITIONAL PURPOSES
 - ALLOW FOR AUTHORIZATION TRANSFER
- **FLEXIBLE SCOPE AND FREEDOM TO DETERMINE**
 - AMOUNT OF SPECTRUM TO BE OCCUPIED
 - GEOGRAPHIC AREA SERVED
- **ESTABLISH STANDARDS SPARINGLY**

3. PUBLIC INTEREST

- **WHERE THE MARKET IS UNLIKELY TO PRODUCE ESSENTIAL PUBLIC BENEFITS IN ADEQUATE QUANTITIES, MINIMUM INTERVENTION MAY APPLY TO ENSURE THESE BENEFITS ARE ACHIEVED**
 - **SPECTRUM SET ASIDES FOR PUBLIC SERVICES OR BENEFITS**
 - **MARKETS DO NOT FUNCTION EFFECTIVELY WHERE A DOMINANT PRODUCER HAS SUBSTANTIAL MARKET POWER (DIVERSITY)**
 - **INABILITY TO FULLY INCORPORATE COSTS OR BENEFITS INTO CONSUMER DECISION-MAKING**

4. LICENSING AND FEE POLICIES

- **SUPPORT SPECTRUM VALUE**
- **ASSURANCE OF PUBLICLY BENEFICIAL USE (CONSIDER SPECIAL NEEDS, E.G., SMALL BUSINESSES)**
- **EXPEDITE SPECTRUM ASSIGNMENTS**
- **IN GENERAL, COMPETITIVE BIDDING HAS PROVEN TO BE AN EFFECTIVE MEANS BUT THERE MAY BE EXCEPTIONS, E.G., SATELLITE OR TRANSNATIONAL SERVICES**
- **ALTERNATIVELY, FIX FAIR MONETARY COMPENSATION BY FEES**

5. ADMINISTRATIVE CERTAINTY

- **ESTABLISH FIRM GROUND RULES**
 - **INTERFERENCE**
 - **RANGE OF FLEXIBILITY**
 - **ACCOMMODATION OF PREEXISTING USERS**
 - **OTHER RULES AFFECTING RIGHTS AND OBLIGATIONS INCLUDING REASONABLE SERVICE OR TECHNICAL RULES**
 - **AVOID DELAY IN ALLOCATING AND ASSIGNING**
 - **EXPECTATION OF RENEWAL AT TERM END**

6. GLOBAL MARKET CONTEXT

- **ENCOURAGE EFFICIENT WORLDWIDE SPECTRUM USE TO ENSURE SPECTRUM AVAILABILITY**
- **PROMOTE COMPETITION AND FLEXIBLE SPECTRUM USE WORLDWIDE, LIMITED AS NECESSARY TO ASSURE CONSISTENCY AND REASONABLE DEGREE OF GLOBAL INTEGRATION**
- **PROMOTE SEAMLESS, WORLDWIDE NETWORKS**
- **CONNECTIVITY TO WORLD'S CITIZENS, ESPECIALLY DEVELOPING NATIONS**

6. GLOBAL MARKET- continued

- **ENSURE DOMESTIC POLICIES CONSISTENT WITH WORLD SPECTRUM POLICIES**
- **COORDINATE DOMESTIC/INTERNATIONAL POLICIES**
- **COORDINATE WITH OTHER NATIONS (SATELLITES AND TERRESTRIAL)**
- **PROMOTE REVISION OF INTERNATIONAL PROCEDURES THAT CREATE ARTIFICIAL ORBIT/SPECTRUM SCARCITY**

FORCES IMPACTING TELECOMMUNICATIONS

- **INTERNET**
- **GLOBALIZATION (UNIVERSAL SWITCHED NETWORK ACCESS) AND LIBRALIZATION**
- **NATIONAL PRIORITIES (REGULATIONS)**
- **PRIVATIZATION AND INVESTMENT OPPORTUNITIES**
- **COMPETITION and ECONOMICS**
- **TECHNOLOGY and MARKET INNOVATION**
- **PUBLIC AND SOCIAL INTEREST**
- **CONSUMERS' INTERESTS AND MOBILITY**
- **WORLD TRADE ORGANIZATION and INTERNATIONAL TELECOMMUNICATION UNION AGREEMENTS (OPEN MARKETS)**
- **FOREIGN OWNERSHIP/ACCESS (INVESTMENT)**
- **EARTH ENVIRONMENT**

SECONDARY SPECTRUM MARKET POLICIES

- **REMOVE, RELAX OR CHANGE RULES TO PROMOTE SECONDARY MARKET PROCESSES**
- **FLEXIBILITY AND FUNGIBILITY**
- **ENCOURAGE ADVANCES IN TECHNOLOGY TO FACILITATE SOFTWARE-DEFINED AND COGNITIVE RADIOS**
- **ENCOURAGE BROKERS AND SPECTRUM EXCHANGES**
- **LEASING WIRELESS SPECTRUM RIGHTS (CELLULAR, PCS, SMR, LMDS, MICROWAVE)**

AUCTION BENEFITS

- **MOST EFFICIENT AND EFFECTIVE METHOD OF LICENSING SPECTRUM**
- **DECREASES TIME TO SERVICE**
- **TECHNOLOGY REACHES MARKETPLACE MORE QUICKLY (STIMULATES COMPETITION, CREATES NEW JOBS, SPURS ECONOMIC GROWTH)**
- **NEW BUSINESS OPPORTUNITIES ON A FAIR AND EQUITABLE BASIS**
- **SPECTRUM IS PUT INTO HANDS OF THOSE WHO VALUE IT THE MOST**

MITIGATION TECHNIQUES THAT MAY BE USED AT THE TRANSMITTER

- **PRACTICAL HARDWARE AND SYSTEM MEASURES:**
 - **TRANSMITTER ARCHITECTURE**
 - **GUARDBANDS**
 - **RF FILTERS TO REDUCE UNWANTED EMISSIONS**
 - **DESIGN OF THE OUTPUT POWER AMPLIFIER TO AVOID SPECTRAL REGROWTH OF RF SIGNALS INTO ADJACENT BANDS, OR INTERMODULATION**
 - **USE COMPONENTS THAT OPERATE WITH MORE LINEAR CHARACTERISTICS**
 - **DESIGN OF THE MODULATION PROCESS TO MINIMIZE UNWANTED EMISSIONS**
 - **ANTENNA PATTERNS**
- **TRAFFIC LOADING MANAGEMENT**
- **DYNAMIC POWER CONTROL**
- **TIME SHARING**
- **IN THE CASE OF MULTI-SATELLITE SYSTEMS, SATELLITE CONSTELLATION MANAGEMENT**

MITIGATION TECHNIQUES THAT MAY BE USED BY PASSIVE SERVICES

- **SITE SHIELDING AND SITE SELECTION**
- **QUIET ZONES AND COORDINATION ZONES**
- **RECEIVER ARCHITECTURE**
- **ANTENNA PATTERNS**
- **ANALOGUE FILTERING AT EITHER RF OR IF STAGES**
- **INTERFERENCE EXCISION TECHNIQUES**
- **DIGITAL ADAPTIVE INTERFERENCE CANCELLATION**
- **ADJUSTMENT OF SENSITIVITY LEVELS**
- **COOPERATIVE SOLUTIONS**
- **GUARDBANDS**

WIRELESS EVERYWHERE

- **WIRELESS WILL BE IN MULTIPLE BANDS**
- **THERE IS A DIVERSITY OF ACCESS NEEDS AND SERVICES**
- **NO ONE STANDARD**
- **ULTRA WIDEBAND**
- **TECHNOLOGY BECOMES CHEAPER IN THE MARKETPLACE**

MOBILE DATA EVERYWHERE

**THE NUMBER OF MOBILE DATA
USERS WILL TOTAL MORE THAN
ONE BILLION WORLDWIDE IN 2005,
EXCEEDING THE NUMBER OF
WIRED INTERNET USERS,
(ESTIMATED TO BE 75% OF THE
NUMBER OF MOBILE DATA USERS)**

WIRELESS SERVICES

- **ACCESS TO LOCAL AND PERSONAL AREA WIRED NETWORKS**
 - **BLUETOOTH (PAN)**
 - **802.11a (5 GHz at 54 Mb/s)**
 - **802.11b (2.4 GHz at 11 Mb/s)**
 - **802.11g (BOTH BANDS AT 54 MB/s)**
 - **802.16**
- **ACCESS TO HOME TV CABLE**
- **PUBLIC FIXED WIRELESS**
- **SATELLITE ACCESS**
 - **V-SATS (SMALL APERTURE DISHES)**
 - **VOICE**
 - **BROADBAND**

WIRELESS SPECTRUM

* NEW DEVELOPMENTS *

- 220 - 222 MHz
- 2 GHz
- 2.1 - 2.7 GHz
- 2.3 GHz
- 3.65 - 3.7 GHz
- 4.6 GHz
- 12 GHz
- 24 GHz
- 27.5 - 31.3 GHz
- 36.0 - 51.4 GHz

220-222 MHz

- **FLEXIBLE - - FIXED AND LAND MOBILE**
- **VOICE AND DATA (DISPATCH AND PAGING)**
- **200 NARROWBAND (5 kHz) CHANNELS**

2 GHz

- **INTRODUCTION OF MOBILE-SATELLITE SERVICES IN 2 GHz SPECTRUM TO ALLOW NEW, NONGEOSTATIONARY MOBILE-SATELLITE SERVICES TO PROVIDE COMPETITION TO L-BAND GEO AND NGSO MOBILE-SATELLITE SERVICES**

2.1-2.7 GHz

- **MULTIPOINT DISTRIBUTION (MDS)**
- **MULTICHANNEL MULTIPOINT DISTRIBUTION (MMDS)**
- **INSTRUCTIONAL TV FIXED (ITFS)**
- **82 MHz OF SYMBIOTIC SHARING**
- **SERVICE AND MODULATION FLEXIBILITY - - DIGITAL; TWO-WAY VOICE; DATA; PAGING**
- **TRADITIONAL ONE-WAY VIDEO AND WIRELESS CABLE ARE SHOULD BE PROTECTED**

2.3 GHz

- **WIRELESS COMMUNICATIONS SERVICE (WCS)**
- **30 MHz TOTAL IN SIX, 5 MHz PAIRED, CHANNEL BLOCKS**
- **SERVICE PENDING**
- **MEXICO MAY IMPLEMENT S-DARS IN THE WCS BANDS**

3.65-3.70 GHz

- **NEW SPECTRUM - - PRIMARY FIXED (POINT-TO-POINT AND POINT-TO-MULTIPOINT)**
- **VOICE, DATA, AND VIDEO IN HIGH-SPEED BROADBAND SERVICE**
- **INTERNET ACCESS; TELECONFERENCING**
- **COMPETITION TO LAST MILE**

4.6 GHz

- **GENERAL WIRELESS COMMUNICATIONS SERVICE**
- **FLEXIBLE - - FIXED AND OTHER SERVICE**
- **25 MHz TOTAL IN FIVE, 5 MHz CONTIGUOUS BANDS IN ECONOMIC (GEOGRAPHIC) AREAS**
- **SIGNAL LIMITED TO 55 dB(uV/m) AT EDGE OF DEFINED SERVICE AREA**

12 GHz

- **WRC-1997 ADOPTED FREQUENCY ALLOCATIONS FOR ADDITION OF NONGEOSTATIONARY FIXED-SATELLITE SERVICE SHARING WITH THE BROADCASTING-SATELLITE AND THE FIXED SERVICES, BASED ON PROTECTION CRITERIA AGREED AT WRC-2000 (ISTANBUL)**

24 GHz

- **DIGITAL ELECTRONIC MESSAGING**
- **POINT-TO-MULTIPOINT USE**
- **TWO-WAY VOICE AND TEXT --
POTENTIAL FOR HIGH-CAPACITY
FWA**
- **TOTAL OF 400 MHz IN TWO, 200 MHz
BANDS, 500 MHz APART**
- **TRANSITION FROM 18 GHz**

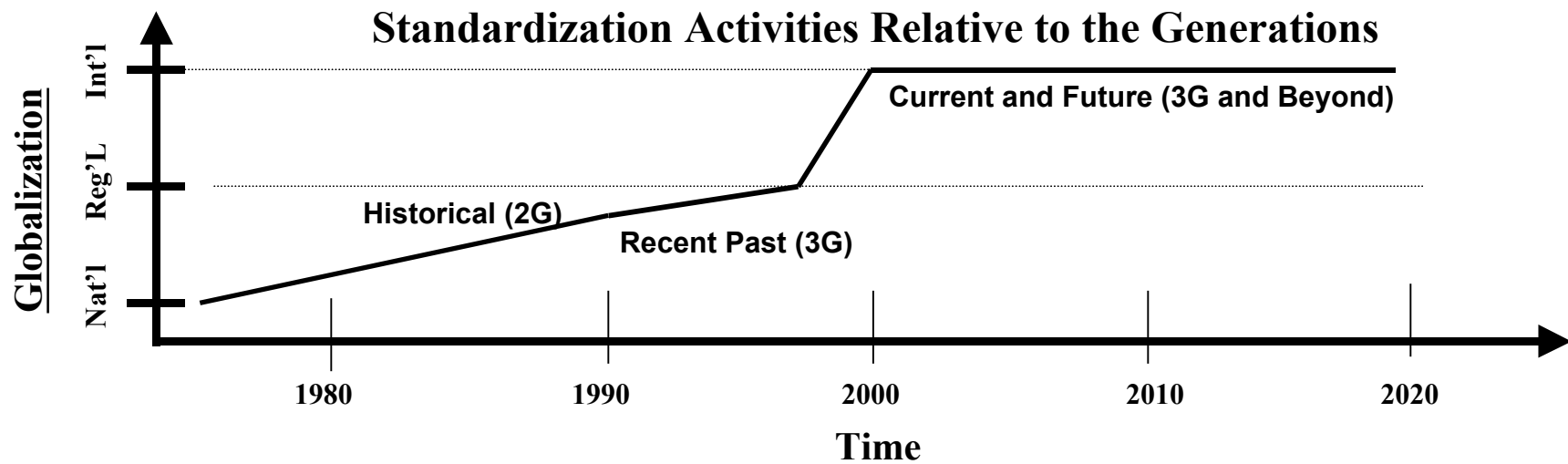
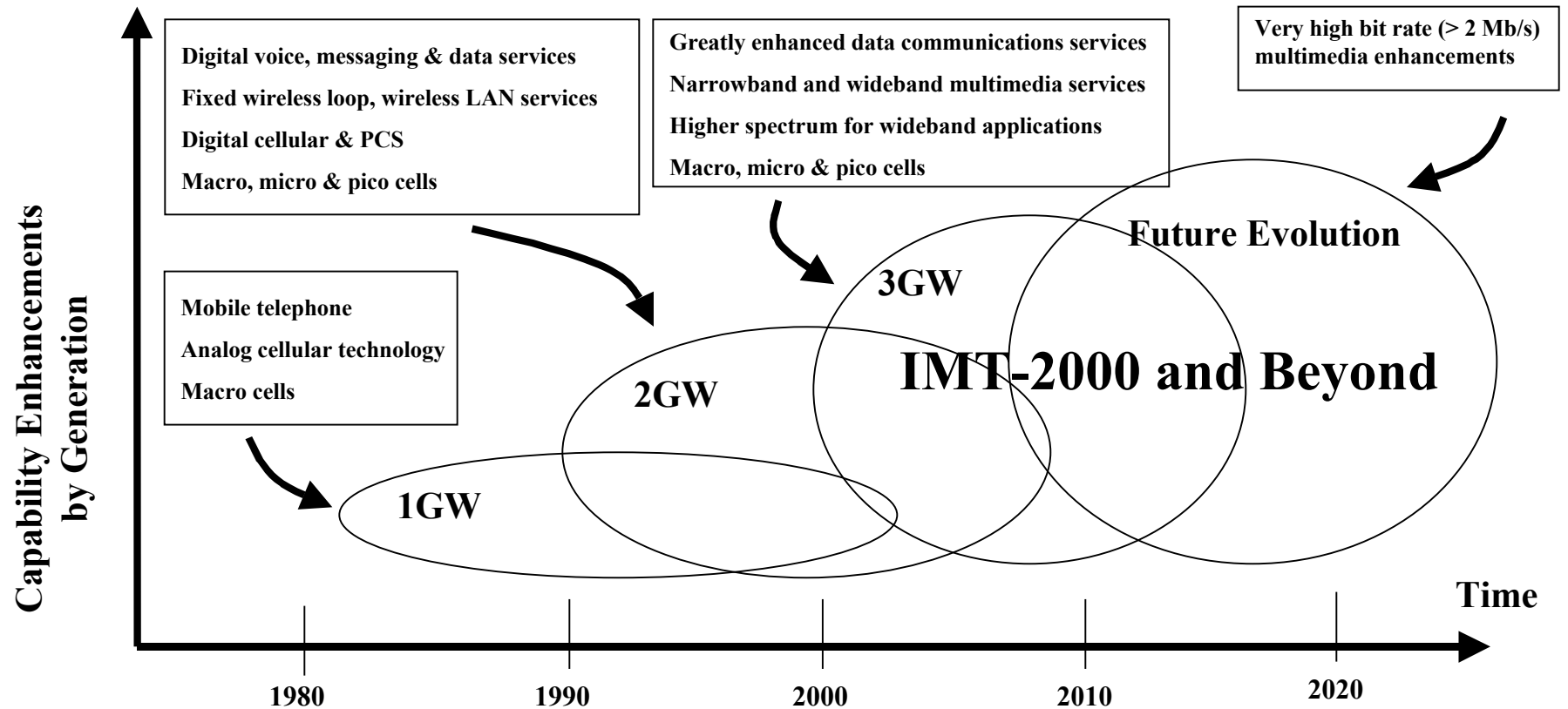
27.5-31.3 GHz

- **LOCAL MULTIPOINT DISTRIBUTION SERVICE (LMDS)**
- **LOCAL ONE-WAY AND TWO-WAY WIRELESS TELEPHONY, HIGH-SPEED VIDEO AND DATA (BROADBAND) ON COMMON CARRIER OR NON-COMMON CARRIER BASIS - CELLULAR TV**
- **CONNECTING INTERNET/PSTN**
- **COMPETITOR TO LEC AND TV CABLE**
- **1.3 GHz PER U.S.A. LICENSE**

36.0-51.4 GHz

- **V-BAND: CERTAIN BANDS DECIDED IN FOR FSS, FIXED, AND MOBILE SERVICES**
- **HIGH ALTITUDE PLATFORMS**
- **COMMERCIAL BROADBAND FWA, VIDEO, DATA**
- **5.6 GHz ADDITIONAL TO EXISTING 2.4 GHz = 8 GHz TOTAL FIXED WIRELESS**

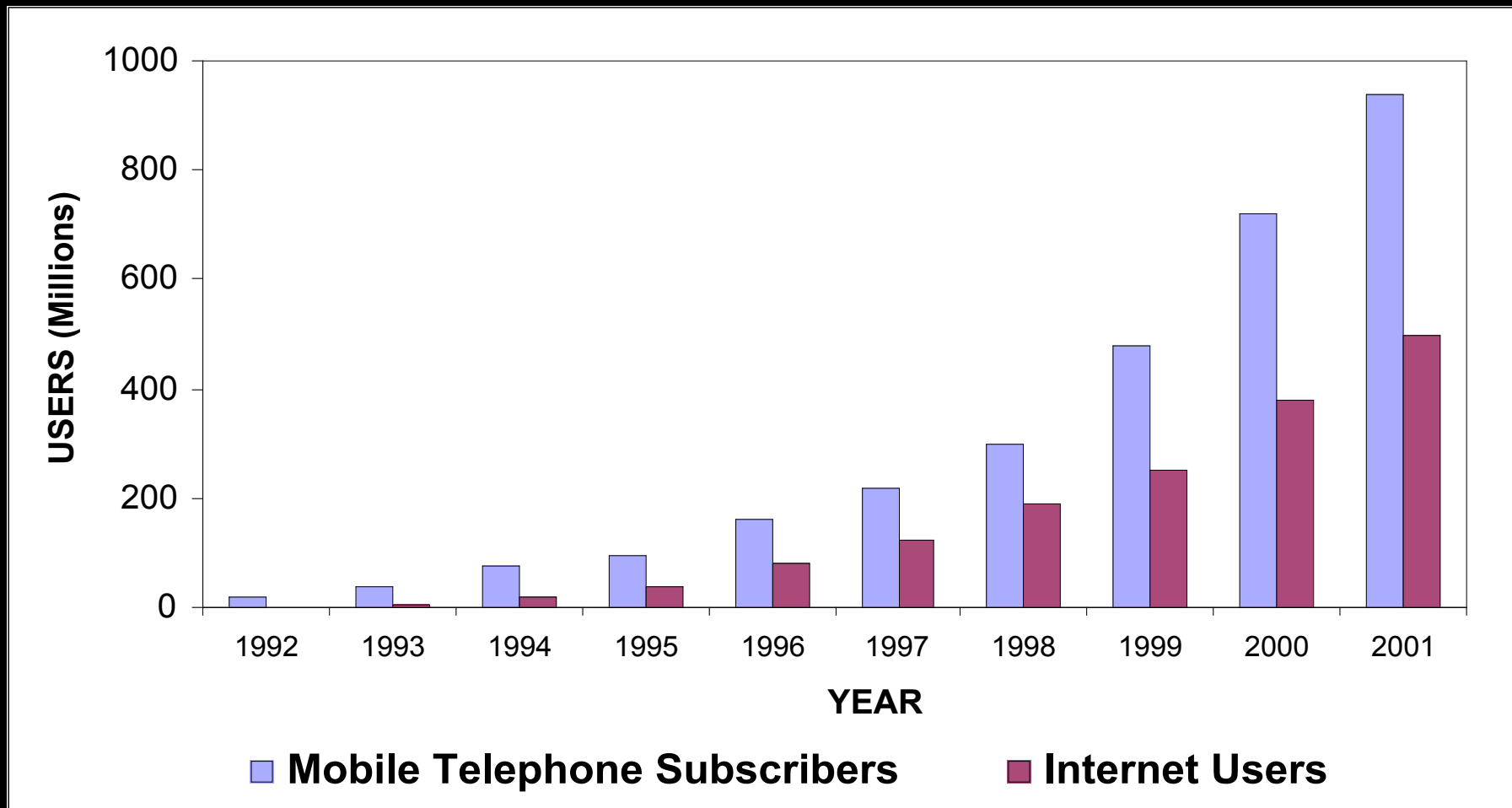
Generations of Terrestrial Commercial Wireless Systems



ITU-R WORKING PARTY 8F

- **WP8F IS THE GLOBAL FOCAL POINT FOR THE CONTINUING VISION OF NEXT GENERATION WIRELESS SERVICES AND SYSTEMS, ACTING AS A FORUM FOR USER REQUIREMENTS AND AS A CATALYST FOR TRANSLATING THOSE REQUIREMENTS INTO TECHNICAL REALITY**
- **WP8F HAS THE CHALLENGING TASK OF SUPPORTING THE NEAR TERM NEEDS OF THE IMT-2000 MARKETPLACE WHILE EXPLORING WHERE WE MIGHT GO IN THE WIRELESS WORLD OF THE FUTURE**

DIGITAL MOBILE SUBSCRIBERS AND INTERNET USERS (WORLDWIDE)



Source: ITU World Telecommunication Indicators Database.

FIXED WIRELESS ACCESS

- **WHAT IS FWA?**
 - **BROADBAND, BROADERBAND, NARROWBAND, VOICE, DATA, INTERNET, VIDEO, TELEMEDICINE, TELE-EDUCATION, CONNECTIVITY, . . .**
- **DATA OVER FWA; MEGABYTES AND EVEN GIGABYTES/SECOND**
- **DEFINITIONS**
 - **WIRELESS ACCESS**
 - **MOBILE WIRELESS ACCESS**
 - **NOMADIC WIRELESS ACCESS**
 - **BROADBAND WIRELESS ACCESS**
 - **END USER AND END USER CONNECTION POINT**
 - **HAPS**
 - **MULTIPOINT SYSTEMS**
- **FWA IS NOT AN ALLOCATION OR SPECTRUM DESIGNATION**

FIXED WIRELESS ACCESS

- **FWA WILL BE IN MULTIPLE BANDS**
- **THERE IS A DIVERSITY OF FWA NEEDS AND SERVICES**
- **NO ONE STANDARD BECAUSE FWA CUSTOMERS DON'T MOVE AROUND**
- **TECHNOLOGY BECOMES CHEAPER IN THE MARKETPLACE**

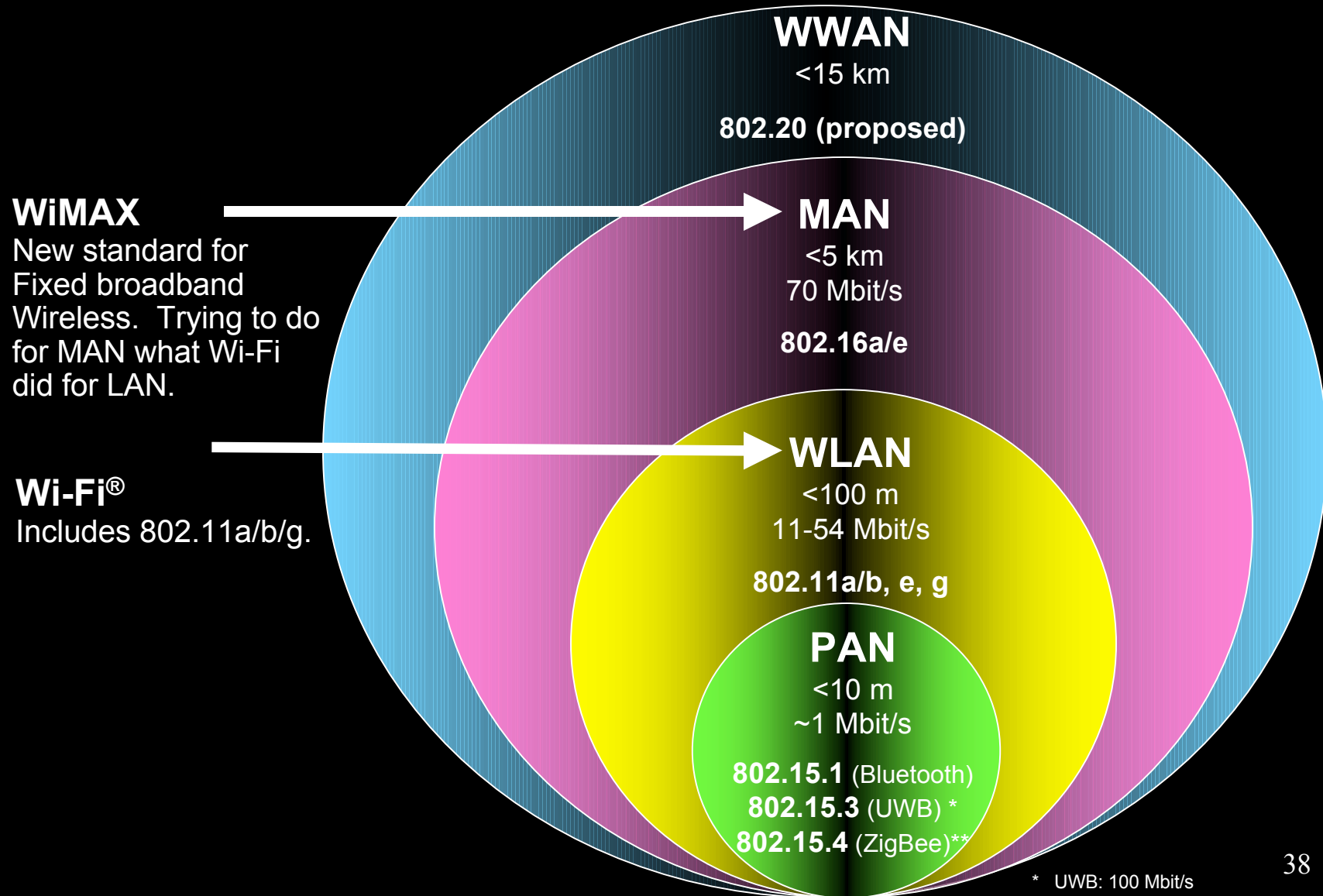
FWA VISION

- **PROMOTE COMPETITION**
- **DEREGULATE AS COMPETITION DEVELOPS**
- **PROTECT CONSUMERS**
- **ENSURE BROAD ACCESS TO COMMUNICATIONS SERVICES AND TECHNOLOGY**
- **FOSTER INNOVATION**
- **ADVANCE COMPETITIVE GOALS WORLDWIDE**

FWA FACTORS

- **NEED TO TRANSMIT LARGER VOLUMES OF INFORMATION, E.G., BANDWIDTH**
- **INCREASED SPENDING BY SMALL AND MID-SIZED BUSINESS**
- **DESIRE TO INTEGRATE VOICE AND DATA**
- **NEED FOR GREATER INTEROPERABILITY**
- **A REQUIREMENT FOR COST-EFFECTIVE SOLUTIONS TO BUSINESS PROBLEMS**

IEEE STANDARDS VIEW OF WIRELESS NETWORK TECHNOLOGIES



* UWB: 100 Mbit/s
** ZigBee: 250 kbps

GLOBAL POSITIONING

GPS

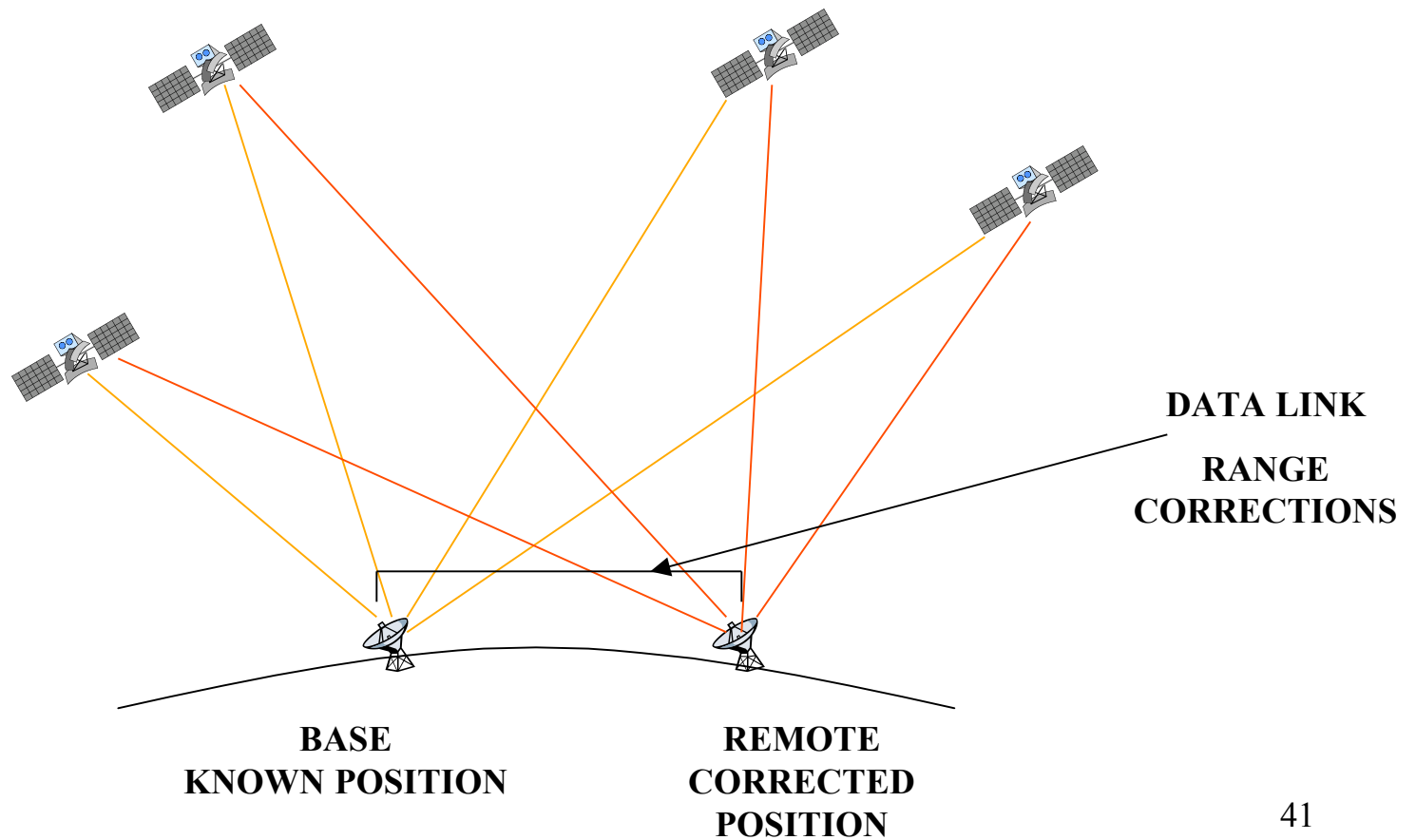
- 18 NGSO SATELLITES AT 20,000 km
- 20 MHz SPREAD SPECTRUM SIGNAL (BPSK MODULATION)
- POSITION TO +/- 10 m IN 3 DIMENSIONS
- TIME/FREQUENCY STANDARD
 - TIME TO ~340 NANoseconds
 - FREQUENCY TO 10^{-14} WITH ATOMIC CLOCK
- AVAILABLE ON A WRISTWATCH (\$500)
- 2000 GLOBAL MARKET OF \$8 BILLION

GLOBAL POSITIONING

GLONASS

- 24 NGSO SATELLITES AT 19,000 km
- FDMA EMISSION (BPSK MODULATION)
- POSITION TO +/- 30 m LAT/LONG AND +/- 60 m ALTITUDE
- TIME/FREQUENCY STANDARD
 - TIME TO ~700 NANoseconds
 - FREQUENCY TO 10^{-13} WITH ATOMIC CLOCK

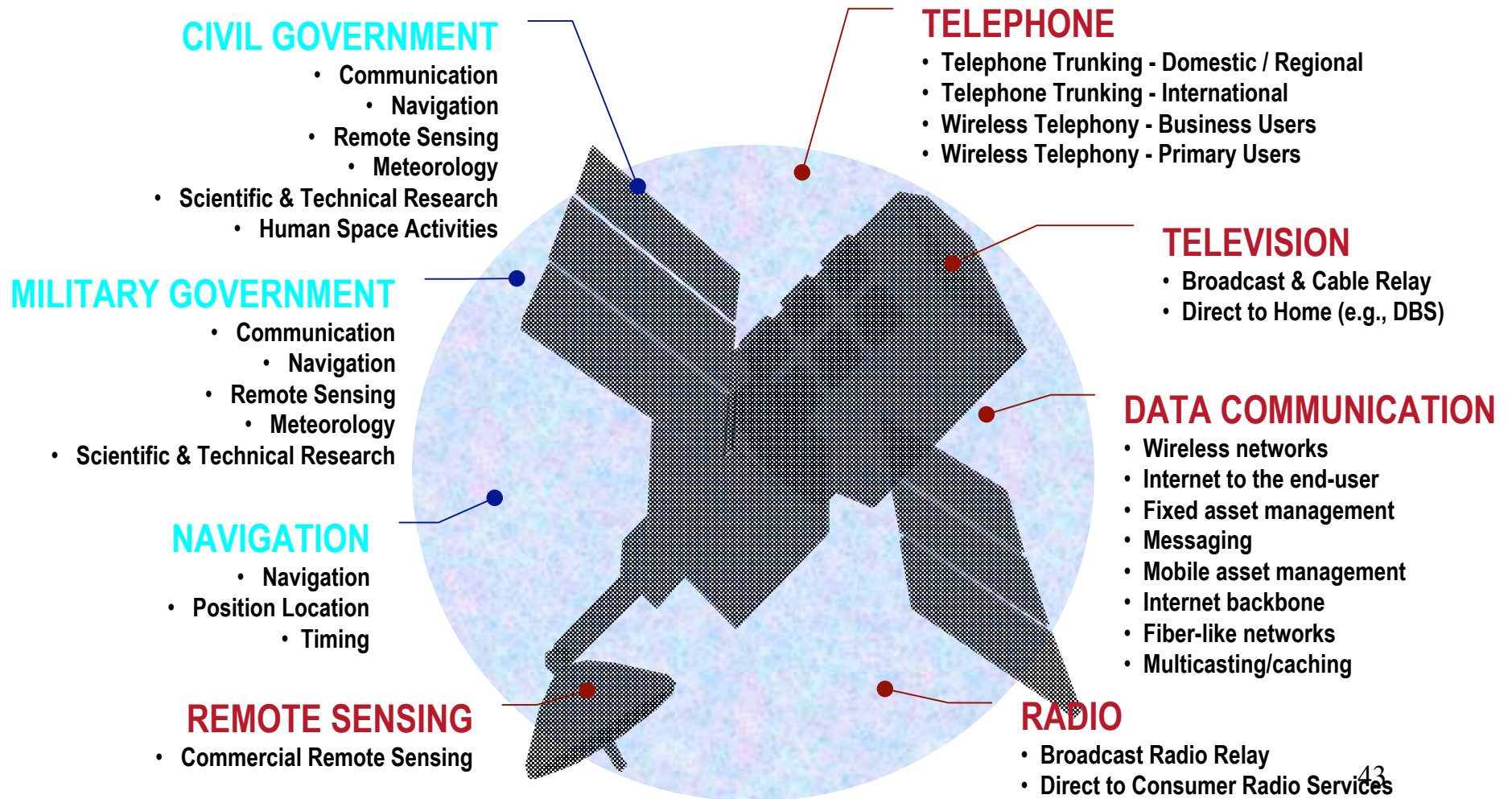
DIFFERENTIAL POSITIONING



DIFFERENTIAL AND COMBINED GPS/GLONASS POSITIONING

- **ENHANCED AVAILABILITY IN OBSTRUCTED ENVIRONMENTS**
- **BETTER POSITIONING TO CENTIMETER ACCURACY**
- **USEFUL FOR MARITIME AND AERONAUTICAL NAVIGATION**

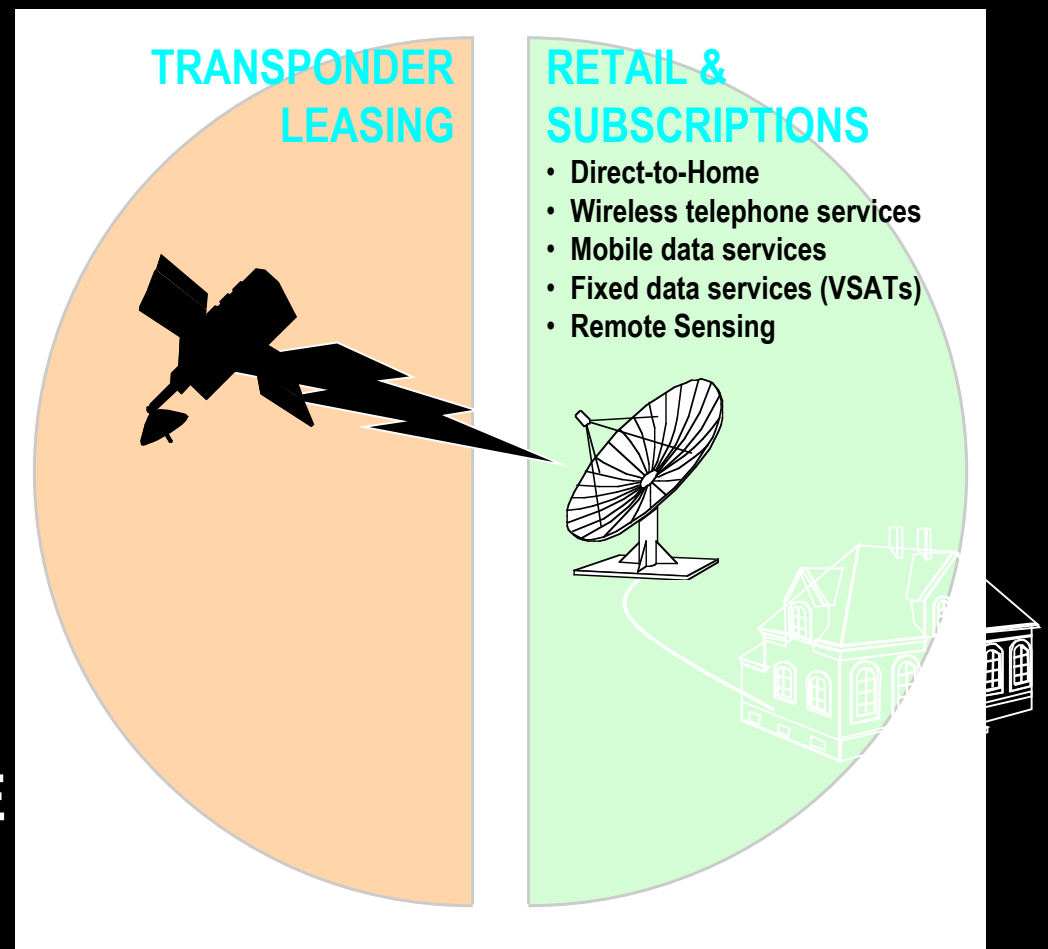
SATELLITE SERVICES OVERVIEW



SATELLITE SERVICES - A TALE OF TWO MARKETS

**TRANSPONDER
LEASING
DOMINATED THE
SATELLITE INDUSTRY
FOR OVER 20 YEARS**

**RETAIL &
SUBSCRIPTION
SERVICES DELIVERED
DIRECTLY TO END-
USERS DOMINATE THE
SATELLITE SERVICES
SECTOR TODAY**



SATELLITES ARE AN ENABLING TECHNOLOGY

- **SATELLITES ARE THE MOST COST EFFECTIVE AND EFFICIENT WAY FOR TV AND RADIO BROADCASTERS TO DELIVER PROGRAMMING**
- **SATELLITES ENABLE NEWS, SPORTS AND ENTERTAINMENT CHANNELS TO BRING A DIVERSITY OF PROGRAMMING TO CONSUMERS**
- **SATELLITES ENABLE CABLE TV COMPANIES TO RECEIVE PROGRAMMING AT THEIR HEAD-ENDS FOR DELIVERY VIA CABLE TO THEIR CUSTOMERS.**
- **SATELLITES CARRY TERRESTRIAL WIRELESS SERVICES SUCH AS PAGING TRAFFIC TO LOCAL NETWORKS AROUND THE COUNTRY.**

SATELLITES ARE A UNIQUE WIRELESS TECHNOLOGY

- **SATELLITES PROVIDE AFFORDABLE “INSTANT INFRASTRUCTURE” BY EXTENDING AND COMPLEMENTING TERRESTRIAL NETWORKS.**
- **SATELLITES ARE THE ONLY WIRELESS TECHNOLOGY THAT CAN PROVIDE UNIVERSAL CONNECTIVITY WITHIN THEIR COVERAGE AREAS.**
- **SATELLITES ARE COST-INSENSITIVE TO DISTANCE SERVING BOTH RURAL AND URBAN MARKETS AT THE SAME PRICE.**
- **THE FLEXIBLE ARCHITECTURE OF SATELLITE NETWORKS MAKE THEM EASY TO DEPLOY AND RE-DEPLOY IN A VARIETY OF CONFIGURATIONS**
- **SATELLITE CAPACITY PROVIDES VIRTUALLY ANY TELECOMMUNICATIONS SERVICE THAT CAN BE PROVIDED BY TERRESTRIAL TECHNOLOGIES.**

INTERNATIONAL SATELLITE REGULATORY ISSUES

- **SINCE A SINGLE SATELLITE CAN SERVE MANY COUNTRIES, SYSTEMS REQUIRE HARMONIZED FREQUENCY ALLOCATIONS AND ASSIGNMENTS ACROSS REGIONS AND AROUND THE GLOBE.**
- **WITHOUT WIDESPREAD MARKET ACCESS, SATELLITE SYSTEMS LOSE THEIR GREATEST STRENGTHS AND RISK THEIR COST EFFECTIVENESS.**
- **SPECTRUM AUCTIONS**
- **IT IS DIFFICULT FOR SATELLITE SERVICE PROVIDERS TO CALCULATE THE COSTS AND TIME IT WOULD TAKE TO PARTICIPATE IN SPECTRUM AUCTIONS IN EVERY COUNTRY THEY SERVE.**

SATELLITE FREQUENCY BANDS

- **L BAND 1-2 GHZ MOBILE SERVICES**
- **S BAND 2.5-4 GHZ MOBILE SERVICES**
- **C BAND 3.7-8 GHZ FIXED SERVICES**
- **X BAND 7.25-12 GHZ MILITARY**
- **Ku BAND 12-18 GHZ FIXED SERVICES**
- **Ka BAND 18-30.4 GHZ FIXED SERVICES**
- **V BAND 37.5-50.2 GHZ FIXED SERVICES**

EUROPEAN DTH

- **LARGEST DTH MARKET IN THE WORLD**
 - **APPROXIMATELY 25 MILLION DTH HOMES**
 - **20 MILLION WESTERN EUROPE**
 - **5 MILLION EASTERN EUROPE**
 - **GROWTH CONTINUING**
- **ASTRA & EUTELSAT DRIVING THE MARKET**
- **HUGE ANALOG BASE, DIGITAL ARRIVING**

LATIN AMERICAN DTH

- **DOMESTIC SYSTEMS IN OPERATION**
 - BRAZIL, MEXICO, ARGENTINA
- **NEW DIGITAL PLATFORMS GROWING FAST**
 - DIRECTV LATIN AMERICA
 - NEWS CORP/TELEVISA/GLOBO/TCI

ASIA-PACIFIC DTH

POTENTIAL MARKET IS HUGE

- 2.7 BILLION PEOPLE, 400 MILLION TV SETS**
- 8.5 MILLION DTH HOMES & GROWING FAST**

SUPER-REGIONAL & REGIONAL SYSTEMS

- ASIASAT, PAS, APSTAR, ETC. SERVE VAST AREAS**
- PALAPA, THIACOM, JCSAT, KOREASAT, ETC.**

DIGITAL DTH SYSTEMS ON THE WAY

DTH IN THE MIDDLE EAST

- **SPECIALIZED DIGITAL PLATFORMS
LAUNCHED**
 - **ORBIT**
 - **SHOWTIME**
- **SIGNIFICANT CULTURAL BARRIERS EXIST**
 - **TOTAL BAN ON DTH IN SOME NATIONS**
 - **DIGITAL MMDS LAUNCHED IN SAUDI
ARABIA**

V-SAT SERVICES

- **CORPORATIONS USE V-SATS FOR INVENTORY MANAGEMENT, POINT OF SALE DATA COLLECTION, CREDIT-CARD VALIDATION AND E-MAIL DELIVERY**
- **DELIVERING DATA FROM MULTIPLE LOCATIONS TO HUBS, DELIVERY CENTERS AND CORPORATE HQS SAVES BILLIONS OF DOLLARS PER YEAR IN LEASED LINE TELEPHONE COSTS**
- **FOR CONSUMERS, V-SATS ENABLE SERVICES SUCH AS “PAY-AT-THE-PUMP” FOR GASOLINE AND SECURE ATM WITHDRAWAL FROM BANKS**

PUBLIC SECTOR V-SAT USERS

Sector Sites		Rural Telephony: 2,000

DECLINING V-SAT EQUIPMENT COSTS



1st Generation: \$10,000-20,000 C-Band Data Only

1980



2nd Generation \$5,000-10,000 C/Ku-Band Voice+Data

1990



3rd Generation \$1,000+ C/Ku/Ka-Bands Multimedia

2000



MSS GEOSTATIONARY SYSTEMS

• INMARSAT	9 SATELLITES	GLOBAL
• AMSC/MSAT	1 SATELLITE	U.S./CANADA
• SOLIDARIDAD	2 SATELLITES	MEXICO
• N STAR	1 SATELLITE	JAPAN
• OPTUS	2 SATELLITES	AUSTRALIA
• ACTel	1 SATELLITE	AFRICA
• ACeS	1 SATELLITE	ASIA PACIFIC
• SATPHONE	3 SATELLITES	MID-EAST/AFRICA*
• ASC	2 SATELLITES	AFRICA/ASIA*

* proposed systems

LITTLE LEO MSS SYSTEMS

- ORBCOMM 36 SATELLITES
- E-SAT 6 SATELLITES
- FINAL ANALYSIS 26 SATELLITES
- LEO One 48 SATELLITES
- VITA 3 SATELLITES

MSS MARKETPLACE FAILURES

- **MSS IS A SMALL SEGMENT OF THE GLOBAL SATELLITE INDUSTRY**
- **IRIDIUM, ICO, AND GLOBALSTAR WERE A SUCCESS FROM A REGULATORY STANDPOINT IN BOTH THE U.S. AND INTERNATIONALLY**
- **THERE ARE INEVITABLE FAILURES IN THE WIRELESS TELECOMMUNICATIONS MARKETPLACE**
- **HIGH-PROFILE TERRESTRIAL WIRELESS FAILURES INCLUDE COMPANIES SUCH AS NEXTWAVE (PCS) AND TELETV (LMDS)**
- **DBS WAS A DRAMATIC MARKET FAILURE THE FIRST TIME IT WAS INTRODUCED IN THE 1980s (COMSAT)**

SATELLITE BROADBAND APPLICATIONS FOR BUSINESSES & CONSUMERS

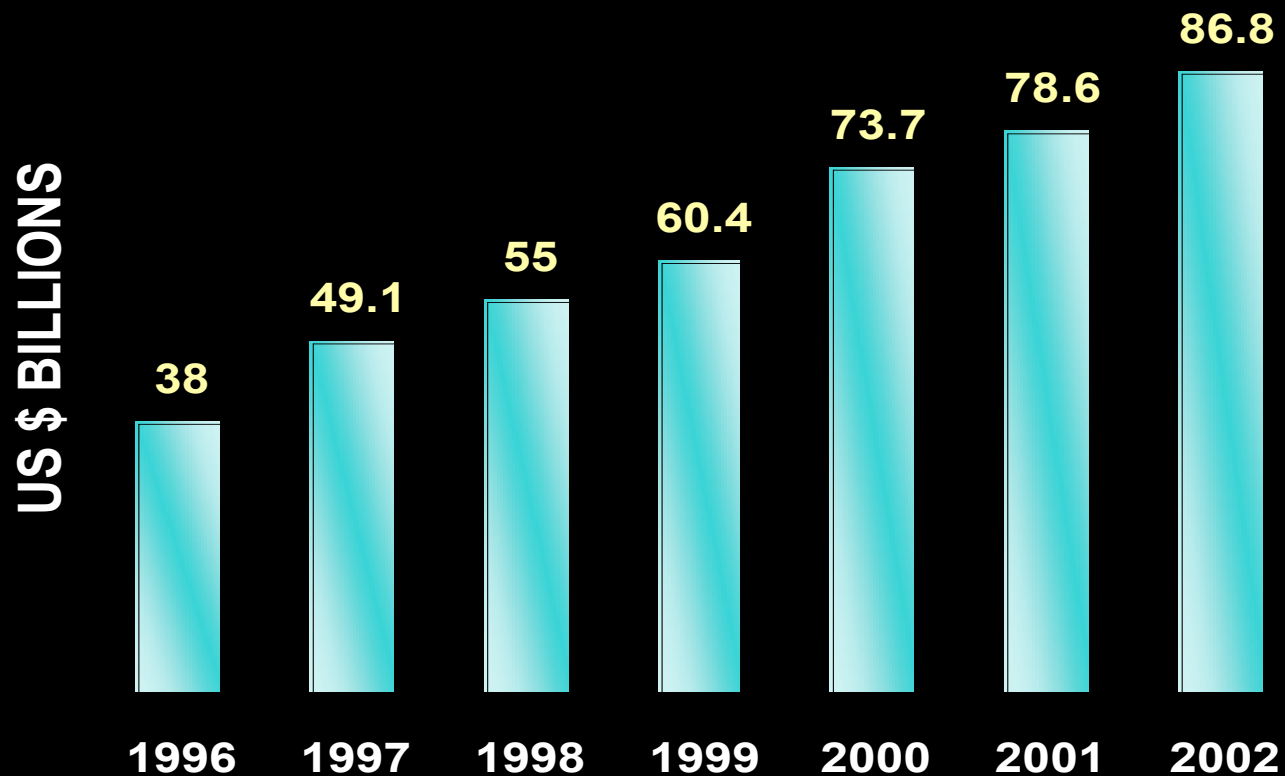
- **INTERNET ACCESS**
- **VIDEOCONFERENCING**
- **HIGH-QUALITY VOICE**
- **E-COMMERCE**
- **TELECOMMUTING**
- **DISTANCE LEARNING**
- **TELEMEDICINE**
- **CORPORATE NETWORKING**
- **MULTIMEDIA**
- **STREAMING CONTENT**

BSS / FSS SHARING (SKYBRIDGE)

- **BSS SHARING WITH NGSO FSS OPERATIONS IS FEASIBLE**
- **TERRESTRIAL MVDDS CAN OPERATE AT 12.2-12.7 GHZ ON NON-HARMFUL INTERFERENCE BASIS**
- **TECHNICAL AND SERVICE RULES IN PLACE**
- **INTERFERENCE TESTING MANDATORY**

SATELLITE INDUSTRY IS GROWING

WORLD SATELLITE REVENUE: MANUFACTURING, LAUNCH, GROUND, AND SERVICES



Source: SIA

SATELLITE SUMMARY

- **SATELLITES COMPETE WITH TERRESTRIAL SYSTEMS ACROSS A BROAD RANGE OF SERVICES – TV, RADIO, TELEPHONY, BROADBAND**
- **SATELLITES ARE THE ONLY TECHNOLOGY THAT CAN SERVE RURAL AND URBAN AREAS AT THE SAME LOW COST**
- **SATELLITES ENABLE MANY OTHER TERRESTRIAL COMMUNICATIONS AND ENTERTAINMENT SERVICES**
- **SATELLITES PROVIDE DEVELOPING COUNTRIES WITH A LOW-COST CONNECTION TO THE INTERNET**
- **SATELLITE TECHNOLOGY CAN HELP BRIDGE THE DIGITAL DIVIDE**

ACCESS IN THE WORLD

- **ACCESS ON AN EQUAL FOOTING WILL FOSTER STRONG ECONOMIES**
- **UNIVERSAL ACCESS CRAFTS NATIONS, LINKS CONTINENTS, LINKS PEOPLE**

**OUR WORLDWIDE COMMON GOAL
IS TO BRING COMPETITION TO
TELECOMMUNICATIONS WHILE
PRESERVING UNIVERSAL ACCESS**

History teaches us that when the regulator and operator are independent, competition is more robust, there is greater confidence in the market, higher levels of investment, increased incentive for innovation, and more rapid expansion.