THE EVOLUTION OF

smart antennas

TO 3G

Marty Feuerstein
Chief Technology Officer
Introduction

> **SmartCell™**
  - Antenna-only solution using replaceable Personality Module™ and Cell Sculpting™ technology to increase capacity and quality

> **SmartShare™**
  - Antenna sharing product allowing multiple service providers access to premium tower locations, with independent antenna pattern control for each operator
  - Also incorporates Personality Module™ and Cell Sculpting™ technology to increase capacity and quality

> **SpotLight® 2200**
  - Add-on product for CDMA operators to increase network capacity and quality through Sector Synthesis™

> **Adaptive Smart Antenna**
  - Smart antenna embedding adaptive array processing into base station electronics at digital baseband for CDMA2000 and WCDMA
SmartCell
SmartCell Concept

- Single-operator antenna-only solution
  - Passive antenna
  - Non-intrusive to BTS
  - Compatible with 3-through 6-sector

- Replaceable Personality Module finely controls antenna pattern
  - Standard or custom patterns sculpted to fit topology of the sector

- Deployable per sector

- Ideal for complex radio environments
SmartCell Antenna

Personality Module
SmartCell customizes antenna patterns to minimize transmit power by reducing interference, controlling handoff and balancing load.
How SmartCell Works

- Network-based smart antenna solution
- Minimizes overall transmit power for a given grade of service
- Creates dominant servers
  - Emphasizes gains of best serving sectors
  - Reduces gains of interfering sectors
- Improves coverage and quality in high traffic areas
- Reduces interference allowing power control to decrease transmit power
Cell Sculpting Software Tool

Drive Data

User Density Map
Network Data

Cell Sculpting Software

Antenna Pattern for Personality Module

Network Performance Estimates

Inputs to algorithm
Steps in algorithm to produce optimal pattern
In a dense urban high traffic region, the goal is 30-50% improvement in cluster, 20-30% deployed as standalone.
SmartCell Increases Capacity

Typical Network Traffic Profile

SmartCell increases capacity, improves asset utilization, and extends the life of each CDMA carrier frequency.

SmartCell increases CDMA carrier frequency planning thresholds.
SmartShare
SmartShare Antenna Sharing

> Allows access to premium tower location for multiple operators
  - Same or different frequency bands and air interfaces

> Independently optimized antenna patterns for each sharing operator with separate Personality Module

> Customized antenna patterns for maximum capacity and performance through Cell Sculpting

> Quickly and easily change antenna patterns to match network and traffic, without interruption to other sharing operators
SmartShare antennas have multiple sub-arrays to support sharing

- Each sub-array is a separate array of column antenna elements
- Multiple sub-arrays to support different operators
  - Provides high isolation
  - Avoids combining losses
- Variable electrical downtilt
- Minimizes physical antenna configuration at cell site

A PROVEN SOLUTION

SmartShare is a proven solution that enables multiple operators to share a single set of antennas while independently optimizing antenna patterns for their individual networks.
SmartShare Field Trial

Traditional
1 Cellular and 2 PCS

SmartShare
1 Cellular and 2 PCS
SpotLight 2200
SpotLight 2200

- Add-on to existing base stations
  - Lucent
  - Motorola
  - Nortel
- Compatibility with network
- Cost-effective capacity expansion
- Improved network performance
SpotLight 2200

Traditional

Unbalanced Traffic

Smart Antenna

SpotLight 2200

CAPACITY GAINS
50% in 3-sector
90% in 6-sector

QUALITY BENEFITS
60% reduction in dropped calls
30% reduction in access failures

SPOTLIGHT is deployed in 14 of top 20 US markets with 400+ systems sold
Adaptive Smart Antenna
Adaptive Smart Antenna

**Traditional**

**Metawave**

**Standard 3-Sector**

**Adaptive Beam Forming**

*Separate beam tracks each mobile*

**CAPACITY GAINS**

*2.5-3X capacity*
Adaptive Smart Antenna in Base Station

Smart antenna functions performed by a software algorithm, which can reside on the channel element card or another card.

Metawave smart antenna circuit card developed for CDMA2000 1X base station.
Adaptive Smart Antenna

- Capacity gains of 2.5-3X for voice traffic
- Throughput increases of 2.5-3X for data services
  - Significant benefits for high rate data
  - Take advantage of latency & burstiness
  - Combine smart antenna with “spatial scheduling” algorithm
  - Create compatible service groups to improve data rates
> Smart antenna solutions for wireless service providers and tower owners to make the most cost effective use of resources

> Products to increase capacity, quality and coverage at cellular and PCS bands

- SmartCell
- SmartShare
- SpotLight 2200
- Adaptive Smart Antenna
smart antennas