The Real Marketplace

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Agenda

- Introduction
- Market
- Solution
- Case Study
- Vision
Introduction
History and Mystery

1995 - 2000
2000 - 2005
2005 - 2006
2006 - now
MARKET
The Golden Triangle
Cellular

- LBS Phone
  - Off board map database

- Navigation Phone
  - On board map database
  - Mio Leap K1
    - 1.7” for phone
    - 2.6” for navigation

- Tracker Phone
  - Data logger
  - Safety

<table>
<thead>
<tr>
<th>K units</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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</thead>
<tbody>
<tr>
<td>Cellular</td>
<td>153,071</td>
<td>234,571</td>
<td>342,107</td>
<td>460,135</td>
<td>589,715</td>
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</table>
PND

- Low cost PND
  - Basic function
  - 3.5” LCD

- Feature rich PND
  - Digital TV
  - Bluetooth Hands Free
  - FM Traffic Info
  - 4.3” and up

- Connected PND
  - Cellular
  - LBS

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<tbody>
<tr>
<td>PND</td>
<td>24,300</td>
<td>33,300</td>
<td>40,000</td>
<td>47,500</td>
<td>56,400</td>
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</table>
Portable CE

- MID/UMD
- PDA
- PMP (Portable Media Player)
- Handheld Gaming
- Digital Camera

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<tr>
<td>Portable CE</td>
<td>243</td>
<td>2,812</td>
<td>19,559</td>
<td>33,542</td>
<td>51,937</td>
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Mobile PC

- **Netbook/MiniNB**
  - 2-3 lbs
  - 7-10” screen
  - Low price
  - Cloud computing

- **UMPC/SubNB**
  - < 3 lbs
  - < 11” screen

- **Notebook PC**
  - > 12” screen

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<tr>
<td>Mobile PC</td>
<td>54</td>
<td>3,433</td>
<td>7,110</td>
<td>12,901</td>
<td>20,359</td>
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GNSS Signals

Source: Günter Hein, FAF Munich
Key metrics

- **Performance**
  - TTFF (cold, warm, hot, aided)
  - Sensitivity
  - Static position accuracy
  - Navigation (heading, drifting, pinning)

- **Price**
  - Chip
  - RBOM (TCXO, SAW, antenna)

- **Power**

- **Size**
  - Combo (Bluetooth/FM/WiFi)
  - SiP (System in Package)
Limitations and Possibilities

- How well does GPS work indoors?
  - Is -160dBm good enough?
- What is the usage model
  - Push to Fix: E911, LBS
  - Continuous: Navigation, tracking
- Does AGPS really help?
  - Where is assisted information coming from?
- Other technology to complement GPS
  - Cell ID and TDOA
  - WiFi AP
  - TV Tower
  - Sensors
  - RFID
Case Study
Navigate Urban Canyon

Multi-path combined with altitude change

L.A. - Wilshire & Grand
Navigation Performance

Atheros GPS Solution

Other GPS Solution
Vision
Vision

- PNT for *everyone, everywhere* at *any time*
- GPS/GNSS: PVT
- Cell ID/WiFi/TV/RFID:
- Sensors: V
- Cost
- Coverage
- Integrity
- Accuracy
Thank You!