Presentation Overview

- Market Opportunity & Evolution
- Mass-Market Battlegrounds
- Sensor Market Requirements
- Examples

- Remote/wireless sensors & handheld sensing platforms share similar needs
Handhelds - A Growing Mass-Market

- Over 350M ARM CPUs shipped in first half of 2003
  - majority of these CPUs in cellular telephones, PDAs, and other wireless devices

- Yet, cellular telephone penetration was just 16% in China in 2003
Industrial Markets Adjust

- Industrial handhelds were fixed-function
  - logistics
  - warehousing
  - retailing
- Now, they are becoming programmable
  - Symbol, Intermec, Trimble
- Homeland security and other new markets are increasing opportunities for small, battery-operated sensing solutions
Mass-Market Meets Vertical-Market

As the handheld and wireless technology markets continue to innovate, opportunities in instrumentation and sensor markets will grow.
Industrial/T&M Markets Adopt Mass-Market Handheld Technology

Even “fixed-function” T&M handhelds will be based on mass-market architectures
Fixed-Function Industrial Devices

- “Embedded” computing markets undergoing a renaissance, due to Internet, wireless, and handheld technology
- Use of mass-market technologies will continue to grow
- OEMs “control” platform, so industrial features are easier to implement
Programmable Industrial Devices

- Lots of industrial devices based on Palm and Windows CE
- OEMs and technology providers still fighting to control platforms
- Programmable industrial and T&M devices have unique needs
- Many key industrial and T&M technology providers waiting for “shakeout”
Mass-Market Technology Battlegrounds

- Operating Systems
- CPU Architectures
- Peripheral Interfaces
- Wireless
- Form Factors
Operating Systems

- Palm OS traditionally has been market leader
  - Lead is slipping
  - Limited ability to create new device types
- Microsoft’s Pocket PC and Windows CE are coming on strong
- Symbian, Java, and Linux are contenders

Analysis: This is war!!!
CPU Architectures

- ARM is becoming the de facto standard
- Pocket PC is only on ARM
  - Other CPU cores were dropped
- Latest PalmOS is based on ARM
  - partnerships with ARM, Intel, and TI

**Analysis:** Standardization on ARM may make development easier
Peripheral Interfaces

- PC Card (long legacy)
- Compact Flash (PC Card replacement?)
- Palm Universal Connector (Palm)
- Springboard (PalmOne) - future?
- iPAQ Expansion Connector (HP) - future?
- SDIO (becoming more popular)
- USB 2.0, Firewire, Ethernet, ExpressCard

Analysis: Range of standards suits diverse needs but encourages fragmentation
Wireless

- 2.5G and 3G cellular
- 802.11b
- Bluetooth
- New technologies (802.11a/g, UWB, Zigbee)

- **Analysis:** Intense mass-market interest will fuel lots of innovation and volatility; wireless security is of great interest
Form Factors

- PDA
- Cell-phone (“convergence” devices)
- Web Tablet
- Wearable Computer
- Wireless Terminal

*Analysis: Each form factor has benefits for different applications*
Key Sensor Market Requirements

- As shakeout in OS, CPU, Peripherals, and Wireless occurs, sensor and T&M markets need:
  - DAQ peripherals
  - Signal conditioning and connectivity
  - Software development tools
DAQ Peripherals

● Many of today’s peripherals not suited for handhelds
  - too big
  - too power hungry
  - too fragile

● Analysis: As “winning” standards and tools evolve, industry leaders will develop a new generation of peripherals
Signal Conditioning & Connectivity

- Lots of rugged devices now
- No uniform method for attaching signal conditioning modules and connectors
- **Analysis:** Market fragmentation and unique needs may result in proprietary solutions
Software Development Tools

- Developers want to use familiar desktop tools
  - LabView
  - HP-VEE
  - Softwire
- Handheld form factor poses challenges
- Analysis: Convergence around a limited number of CPU and OS architectures will lead to tool migration
What’s Happening Now

- Lots of embedded “fixed-function” sensing and instrumentation devices are adopting mass-market technologies
- “Early adopter” plug-and-play products are appearing
Datastick Systems

- **DAS-1245**
  - Plugs into Palm Universal Connector
  - 4 A/D channels
  - up to 400 samples/sec
  - Software for PalmOS
Imagiworks

- Imagiprobe
  - Based on Palm OS
  - Plug-in for serial sync port
C-Cubed

- **DATAQ CF2**
  - Compact Flash card for Pocket PCs
  - 4, 24-bit A/D channels
  - 2, 12-bit D/A channels
  - up to 38,400 samples/sec
  - 170mW power consumption
PocketPower Meter
- Springboard A/D card for Handspring Visor
- Troubleshoot fiber networks
- Measures light at several wavelengths
Aceeca

- Meazura
  - Ruggedized Palm device
  - Industrial peripheral connectivity via MZIO slot
Pacific Microinstruments

- Mobile SPC Suite - Java-based acquisition and display of monitoring info for cell phones
- PLC Pilot - PLC software for Palm Pilots
SoftWIRE Technology

- SoftWIRE visual development software for PDAs
- Graphical development environment based on Visual Basic
National Instruments

- LabView 7, PDA Module
- Develop on a PC and emulate device
- Execute and debug on handheld
- Some DAQCard support
In Summary, Lots of Activity...

- Handheld and wireless are driving innovation in today’s technology markets.
- Embedded and fixed-function sensing and instrumentation devices are increasingly based on mass-market technologies.
- Lots of rugged programmable handhelds are appearing.
...But Still A Ways To Go

- A new generation of peripherals is needed
- Development tools starting to migrate
- Signal conditioning and connectivity problems must be solved

- As handheld and wireless mass-markets evolve, the vertical-markets will follow!!!