

# Crossbow Open Mote Developments

## Crossbow Technology

# A Second Chance at Graduate School ?

- Well Not, Exactly
- Our Goals Are:
  - Long-Term Development of Sensor Networks as a Business
  - Do-it-right: Our First Try was a BIG Failure
  - Promote Open Development Cycle to Spur Hard Problems to Get Solved
    - » Lifetime, Reliability, and Ease-of-Use
  - Be-prepared: "Commercial Markets" are demanding ...

# Mote Hardware Development

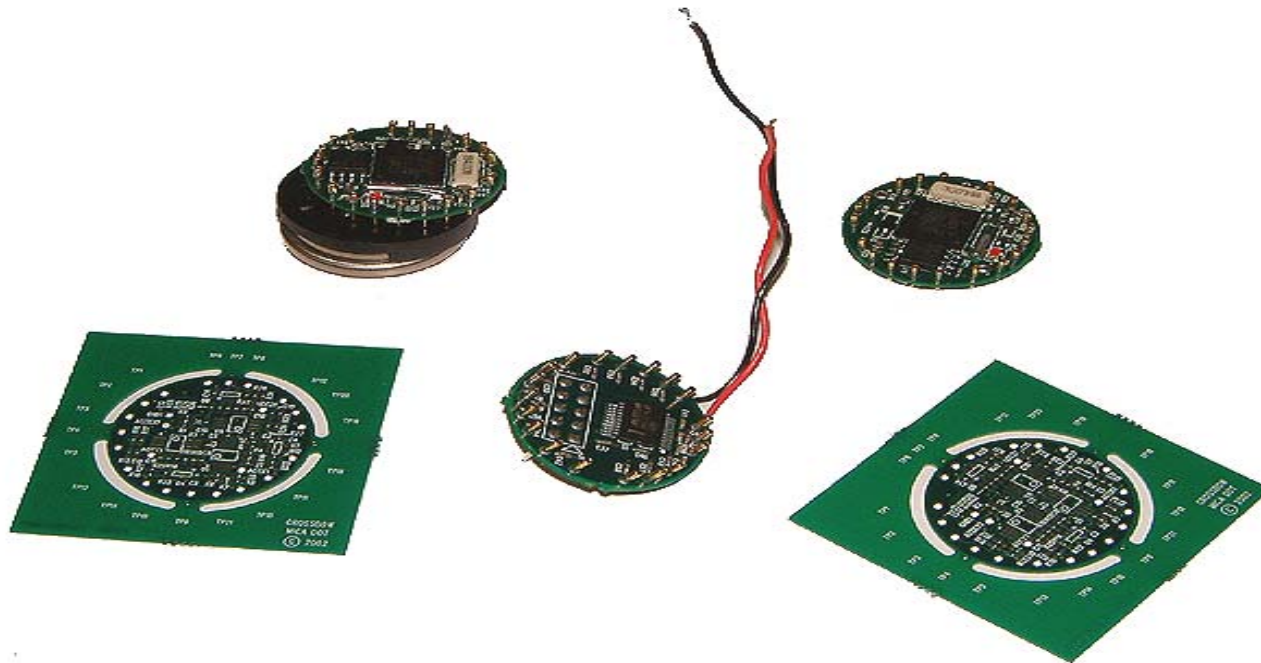
- **Second Generation Mica Motes**
  - Mica2 (2.25"x1.25")
  - Mica2Dot (1" diameter)
  - New Programming board
- **Sensor Boards**
  - Weatherboard
  - General Interface Board (UCLA)
  - DOT Accelerometer sensor boards
  - DOT General Purpose sensor board
- **Commercialization of Intel Stayton**

# Mica2/Mica2Dot

## New Radio (Chipcon 1000):

- Better noise immunity
- Better range
- FM modulated (vs Mica AM)
- Linear RSSI
- Digitally programmable output power (no pot)
- Built-in Manchester encoding
- Support 400Mhz and 900Mhz bands
- Software programmable frequency hopping within bands

# Mica2Dot



# Mica2/Mica2Dot

## Other Changes/Additions/Improvements:

- No little guy coprocessor (has its own bootloader)
- 7.3728Mhz crystal to support higher UART baud rates (Mica2)
- Coax antenna connector for external antenna (Mica2)
- Low profile on/off switch
- No boost regulator, < 10uA sleep, active current reduced as well

# New Programming Board

## Changes/Additions:

- Programs both Mica2 and Mica2Dots
- Viewable Mote leds
- 51 pin sensor board connector on bottom (optional population)
- Mote processor reset switch

# Sensors: Weather Monitoring (UC Berkeley: Joe Polastre, Alan Mainwaring)

- IR Thermopile
- Humidity
- Barometric Pressure
- Ambient Light
- Optional ADXL202
- All sensor have internal ADCs.
  - will help with calibration

# Sensors: General Purpose Interface (UCLA - Mohammad, Deborah)

- Screw Terminal I/O Connections
- 8-Channel 12-bit ADC
  - Configurable 0-2.5V, 0-3, 0-5V
  - Configurable Divider for other ranges
- 8-Channel Digital I/O including 1 relay
- NiMH Charge Circuit (Prototype)

# Sensors: Mica2Dot Bridge Conditioning

- **Special Purpose**
  - 3-axis interface for external accelerometers (bridge completion).
  - Programmable auto-balance
  - Programmable hi-pass/lo-pass filters
- **General - Two Boards**
  - ADXL202, 2-axis, sensor & battery board
  - Board with Holes

# Intel Stayton (Lakshman, Roy Want)

- Embedded platform running Linux
- Intel 400Mhz Xscale processor
- 51 - pin Interface for MICA or MICA2
- Ethernet, USB, PCMCIA, Serial
- Future base station for GSK
- Shipping to start in Q2.

# Software: NetProgramming Development (In Progress)

Rob S, Alan B.

- No Little Guy
- Resident bootloader.
  - Resides at top of memory (4K)
  - Preloaded by Crossbow before shipping
- Remote Download ..
  - Loads code capsules to serial memory.
  - Retransmits lost capsules.
  - Verifies that battery voltage is OK before proceeding.

# Software: Chipcon Radio Stack (Mike G., Jason H, Phil B)

- Chipcon radio drivers for both 400 and 900Mhz bands
- Supports Chipcon Manchester encoding
- Supports Chipcon power-down modes

## Software: High Speed ADC

- Supports streaming ADC data to 128 at max rate
- This rate is 20KHz at 10-bits
- Up to 50KHz at 8-bits