Growing Innovative Engineers: Students With Startups

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Outline

- Introducing Mobius Microsystems
- Mobius’ technology and products
- Launching Mobius from the WIMS ERC
- Comments and recommendations
INTRODUCING MOBIUS MICROSYSTEMS
Mobius Microsystems

- Technology developed in the WIMS ERC at UM, Ann Arbor
- Founded April, 2004
- Venture-backed (~$26M): Foundation Capital, Menlo Ventures, RPM Ventures
- Fabless semiconductor company: outsourced manufacturing, assembly and test
- First company to develop all-silicon frequency sources capable of replacing quartz-based frequency sources
- 30 issued and pending patents
- Recognized with numerous awards for innovation and business development
MOBIUS’ TECHNOLOGY AND PRODUCTS
Quartz timing is everywhere

5 XTALs on iPhone main board

- 26MHz Cellular radio
- 32kHz Radio sleep mode
- 24MHz Application Processor
  - Video/Audio
  - USB
- 32kHz Power management
- 33.6MHz GPS

Mobius Technology

Comments

Launching
Crystals (XTALs) and oscillators (XOs)

**XTALs and XOs**

**Timeline**

- **1880**: piezoelectricity discovered by the Curies
- **1917**: XTAL resonance explored by Langevin for SONAR
- **1919**: freq. control using XTALs by Nicholson and Cady
- **1919 - present**: XOs proliferate; billions of units distributed annually

Comments

- [Mobius Technology](#)
- [Technology](#)
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- [Comments](#)
Why hasn’t quartz been replaced?

- Quartz is:
  - very accurate and stable (<50ppm or 0.005%)
  - is high-Q and low noise

- In contrast, silicon technologies:
  - vary by 10% in manufacturing alone
  - do not have high-Q components

- Quartz is the last great hold-out for microelectronic integration

- Is it possible that a silicon technology can be developed to replace quartz?

Technology as an IP product

USB to RS-232 bridge cable

Pre-Mobius

Post-Mobius

- First commercial replacement of quartz
- 0.18mm² custom IP macro in 0.35μm CMOS
- Over 10Mμ shipped to date and still shipping
Most accurate solid-state oscillator developed
2.25mm² in 0.25μm CMOS; std. 5mmx3.2mm pkg.
Now qualified and in production; 1st POs this year
Mobius’ wafer leaving the foundry in Taiwan
- Die is <0.9mm² in 0.13μm CMOS; 1.75mA power
- Now sampling and expecting production in Q4 ‘09
Technology as a die product

End product

Controller IC

12MHz XTAL for Timing USB
Mobius’ die product is unique because it can be stacked inside the customer’s package.
LAUNCHING MOBIUS
FROM THE WIMS ERC
Timeline: 12 years to date

**Fundamental research and incubation**

- **1998-2000**: Work with Nguyen on MEMS oscillators
- **2001**: Work with Brown on all-silicon oscillators and developed prototypes. Published work after patents filed. Awards include 1st place design at DAC/ISSCC.
- **2002**: Enroll in patent law and entrepreneurship classes.
- **2003**: Patents developed and filed w/ OTT. License executed.
- **2004**: Entered 11 and won 1st place in 6 business plan competitions ($170k).
- **Mobius’ 1st office est. in Ann Arbor**
- **Raised $1M in seed financing**
Timeline: 12 years to date

Spin-out and seed stage execution

- **2004**
  - IP design win for USB product
  - Design effort initiates

- **2005**
  - Component design win for PCs
  - Design effort initiates
  - Product qual. completes

- **2006**
  - Volume production
  - Evaluation is a success
  - Raised additional $1M in seed financing
  - Moved to CA and raised $8M series-A
  - Several awards including “Largest high-tech job creation” and “Innovation of the year” in MI

Mobius

Technology

Launching

Comments
Timeline: 12 years to date

Series-A execution

2006

Build CA office and recruit management team
Define component product & execute on development

2007

Product qual. completes
Component released

2008

Permanent CEO hired management team is reorganized

Raise $11M series B

Several awards including FSA “Start-up to watch” nominee and EDN “Hot 100 products of 2008”
Timeline: 12 years to date

Series-B+ execution

2008
Engage market with first component and receive feedback

2009
Revise product for lower power and discover die opportunities

2010
Sample

Future?
IPO?
M&A?
Who knows?
COMMENTS AND RECOMMENDATIONS
This is not easy; don’t fool yourself; it’s damn near impossible

Early stage support was through university courses and collaboration with the business school and the office of technology transfer

Later stage, capital and successful execution are all that matter

But, the process is iterative and can be forgiving if the opportunity remains

And it takes a long time
Recommendations

- **Institutions**: support the development of resources for start-up development and tech. transfer

- **Faculty**: support the entrepreneurial interests of your students; the world is changing; get over it

- **Students**: get engaged; even if you don’t launch, learn about the process while in university

- I have published several papers on this process, the resources required and the path to success; please see those for more information
THANK YOU: SPEAKERS ARE AVAILABLE FOR QUESTIONS AT THE BREAK