

# **How to Successfully Transfer MEMS from a University Lab to a Commercial Foundry**

**Alissa M. Fitzgerald, Ph.D. | 1 May 2012**



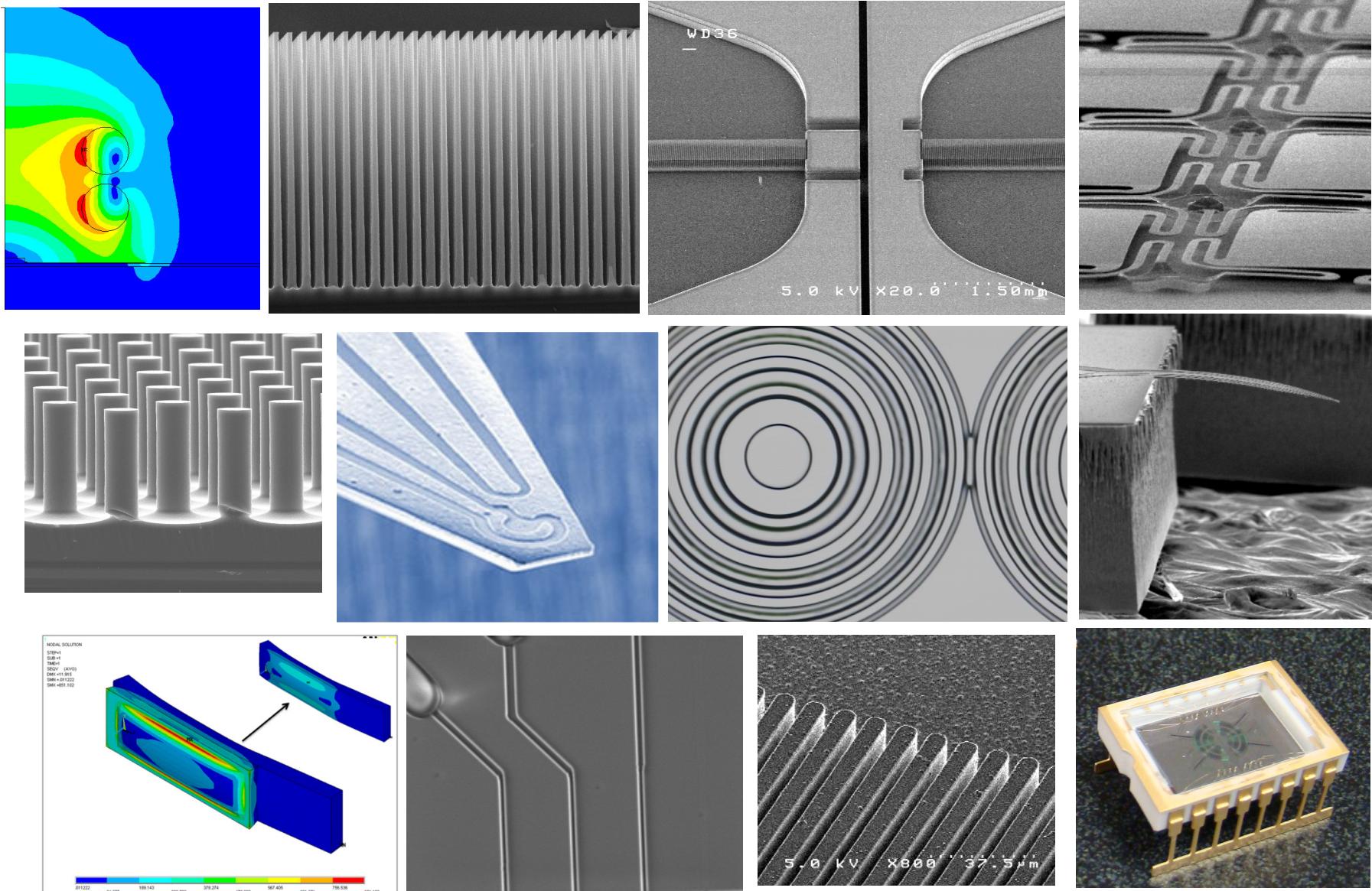
**AMFITZGERALD  
& ASSOCIATES**

# Overview

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- **About AMFitzgerald**
- **Are you ready?**
- **Choosing a foundry**
- **Transfer**

# Mission: Your Partner in MEMS Product Development



# Company background

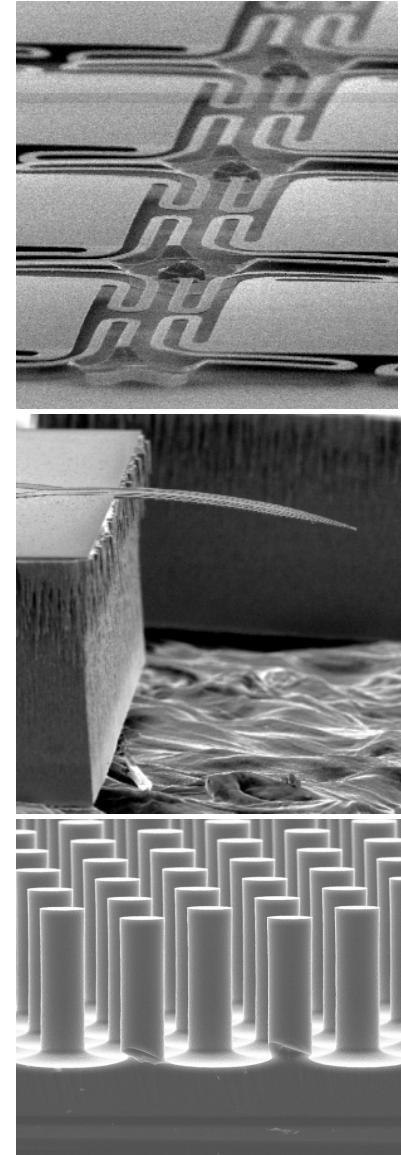
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- **Founded 2003 by Alissa M. Fitzgerald, self-funded**
- **Burlingame, CA: near SFO and Silicon Valley**
- **Consistent growth, over 100 clients served to date**
- **Active member of the MEMS Industry Group**

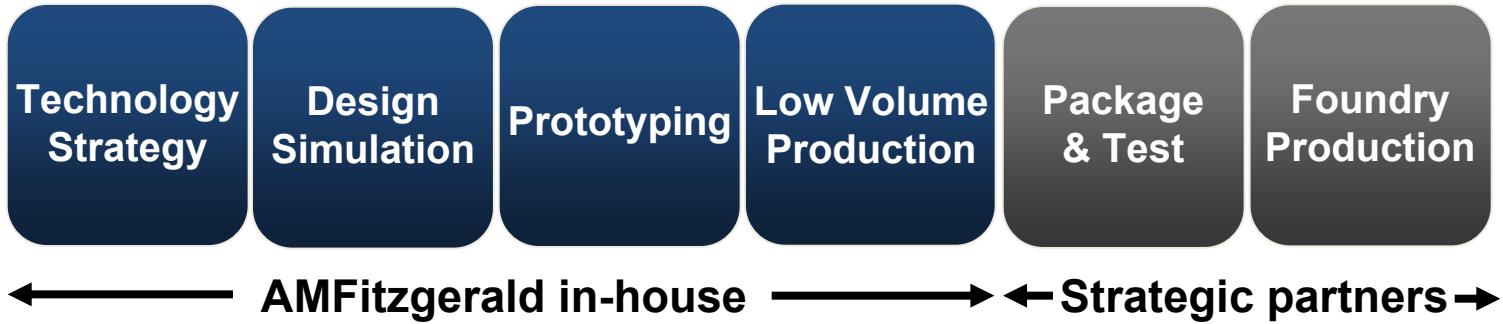


# Our value

- **First time developing MEMS?**
  - We can provide the complete solution
- **Improving your MEMS product?**
  - Let us optimize your design
- **Investing in MEMS?**
  - Valuable insight from expert practitioners
- **Our competitive advantage**
  - A complete MEMS solution
  - Expert design and process engineers



# A complete solution from concept to production



- **Project management**
- **Multi-disciplinary engineering team**
- **In-house prototype fabrication (150 mm wafers) by our engineers, not operators**
- **Smooth transition to production partners**
- **Leverage our supplier ecosystem**

# Are you ready to go to foundry?

- Yes, if you have:
  - Stable process flow and mask set
  - Budget (> \$250K/yr.)
  - Order schedule for next 1-2 years (i.e. customers)
  - Cost targets



ACME MEMS Order Schedule

Production	Number of Wafers	Target \$/Wafer
Year 1	500	\$1500
Year 2	1000	\$900
Year 3	1500	\$700

# Read the MIG Foundry Engagement Guide

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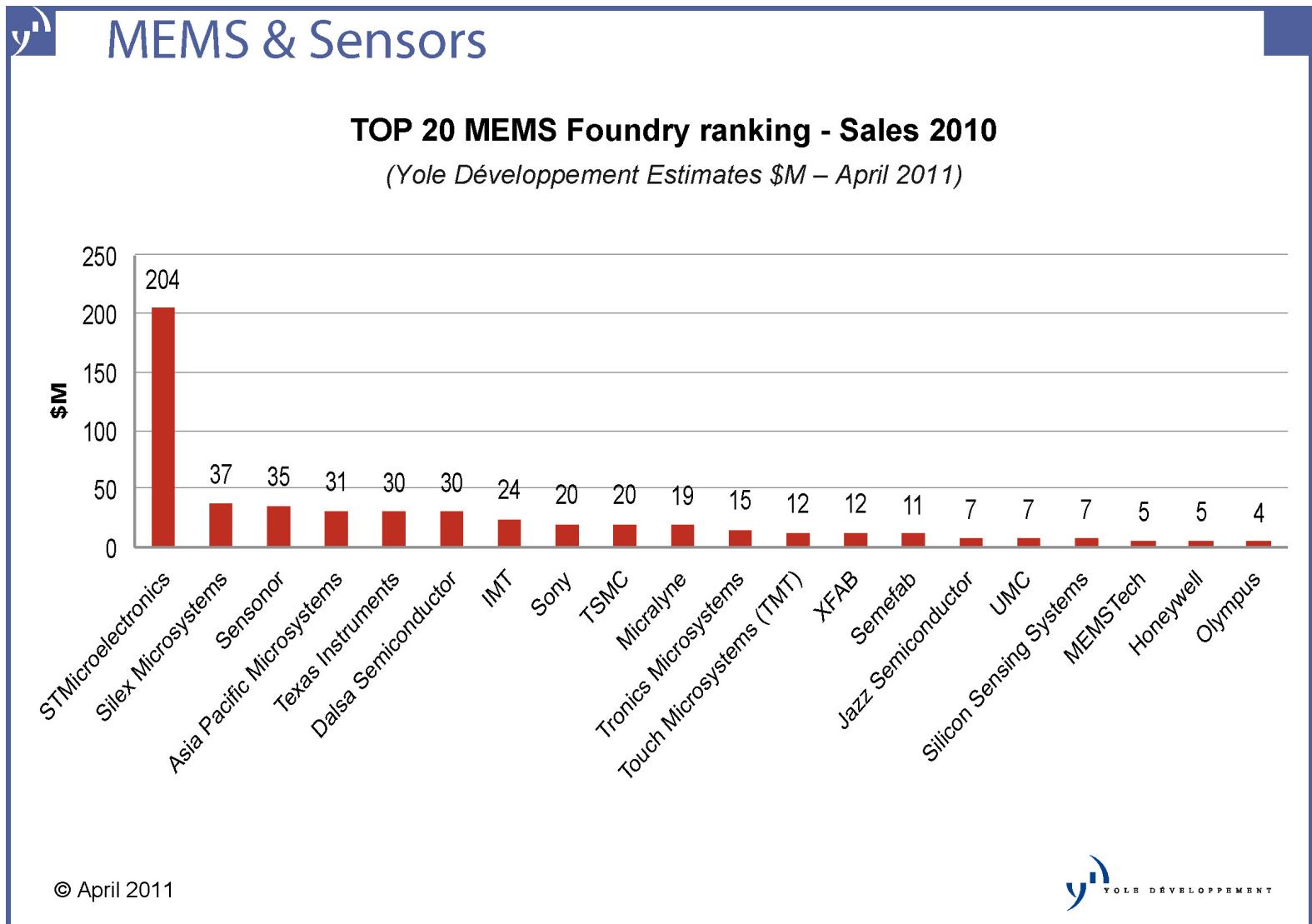
- Written by a group of foundries and MIG members

[http://memsfoundry.wikia.com/wiki/MEMS\\_Foundry\\_Engagement\\_Guide\\_Wiki#Background\\_Information](http://memsfoundry.wikia.com/wiki/MEMS_Foundry_Engagement_Guide_Wiki#Background_Information)



**MEMS INDUSTRY GROUP™**

# Big foundries (order > 100 wafers/year or > \$250K/year)

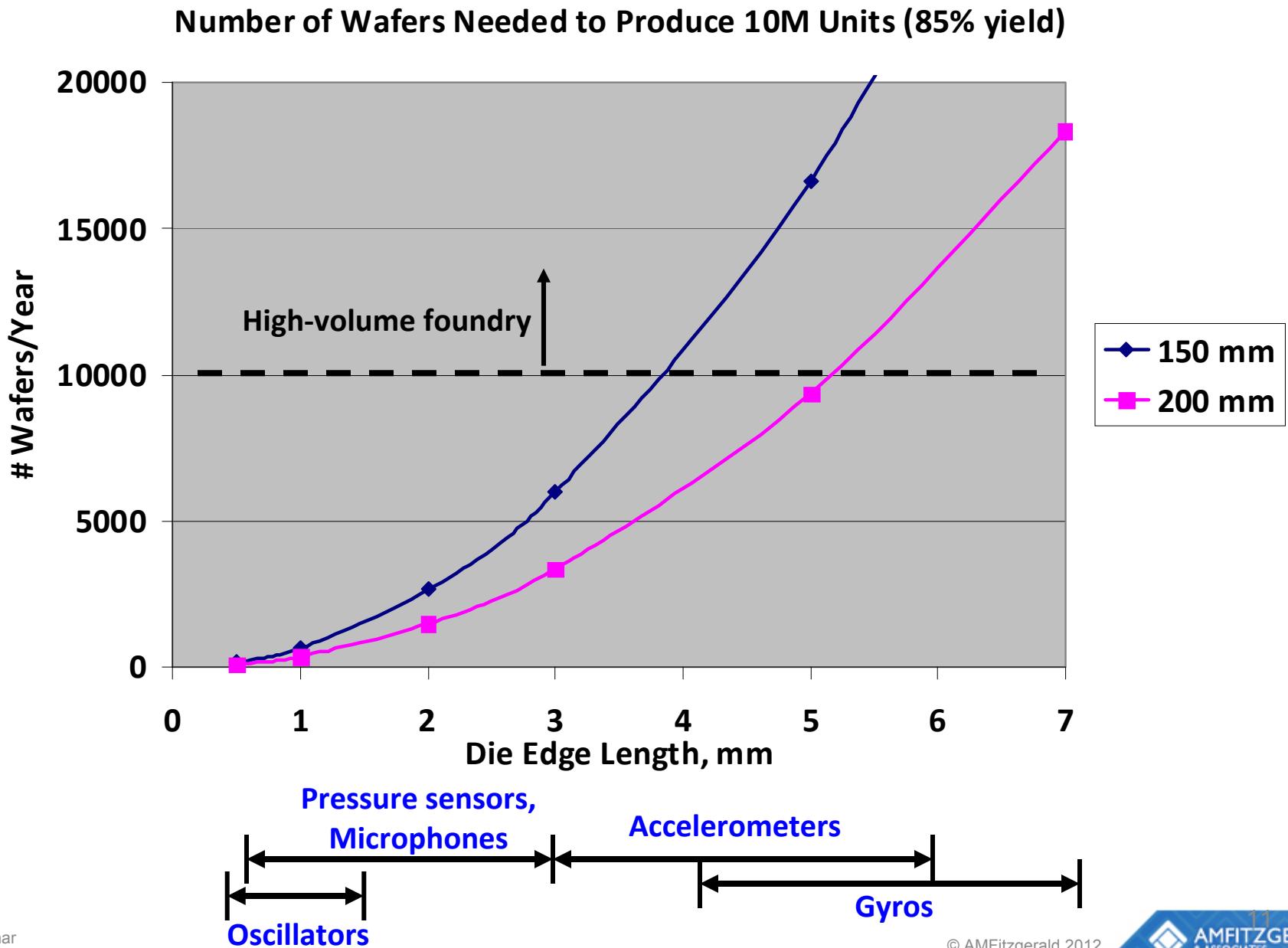


# Small foundries

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- Will consider small orders (< 100 wafers/year)
  - Micrel
  - Nanostructures
  - Advanced MicroSensors
  - MEMSCAP
  - MidWest MicroDevices
  - LioniX
  - Micronit (microfluidics)
  - MFI (MEMS Foundry Itzehoe)
  - MEMS Core

# Not all MEMS will need 200mm wafers



# Choosing your foundry

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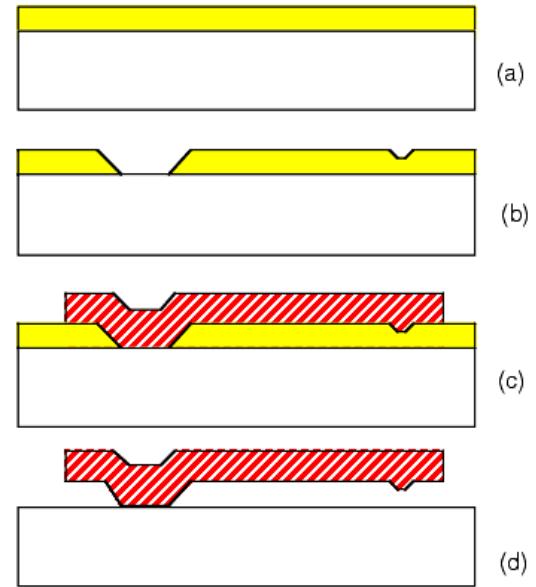
- The foundry is your partner in a long-term relationship
- Switching foundries = starting over (\$\$\$ and time)
- Take time and care to make a good decision!



*“I think this is the beginning of a beautiful friendship.”*

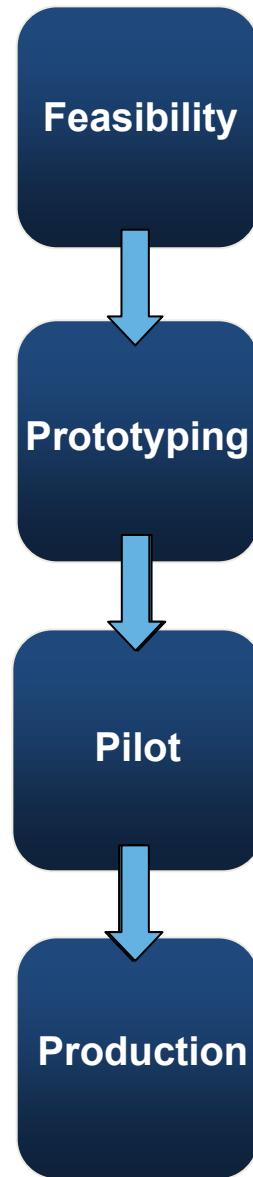
# First steps

- **Sign Non-Disclosure Agreement**
- **Write RFQ “Request for Quote” document**
  - Device drawings
  - Process flow
  - Test requirements
  - Order quantities, cost targets
  - Business case
- **Send RFQ to multiple foundries**
- **Discuss details with foundry sales teams**

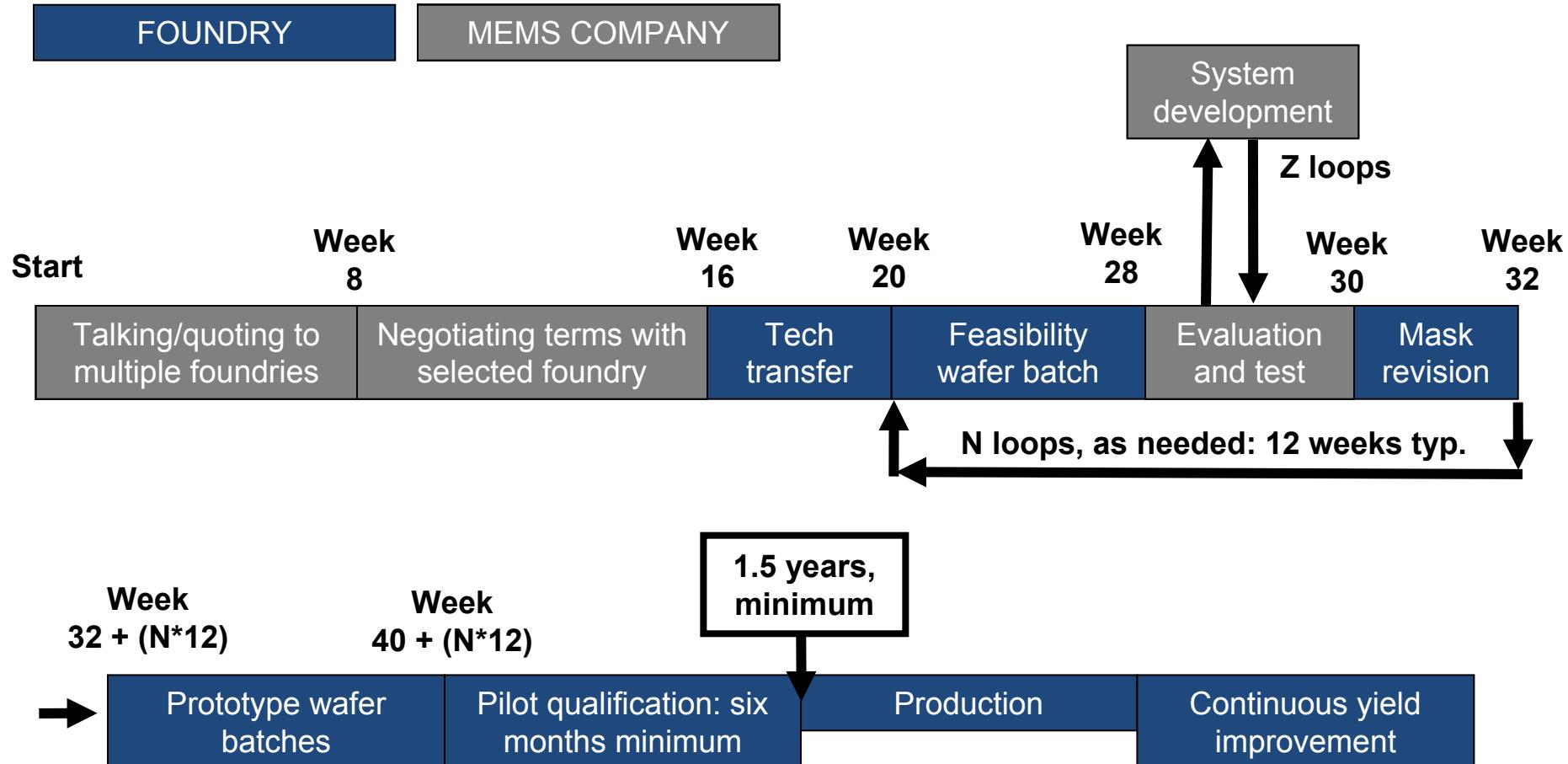


# The foundry quote

- **Quote will be for Feasibility phase only, with rough estimates for Prototype, Pilot**
  - NRE: masks, setup, shortloops
  - Wafers
  - Batch size minimum 10 wafers started
  - Priced per wafer or batch
  - No yield guarantees (“best efforts”)
- **Typically – multiple Feasibility batches required before moving to Prototyping phase**



# Ramp to production timeline (with an existing prototype)



# How to get the best prices

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- **Low technical risk keeps NRE low:**
  - Frozen design/process
  - Repeatable process
- **Confirmed order quantities keep wafer prices low:**
  - The more you order, the cheaper it gets
- **Show a path to volume**
  - Foundries want to crank out wafers, not do engineering projects



# Making a decision

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- Evaluate foundry's process capability and experience with your type of product
- Make sure you have compatible:
  - Business models
  - Timelines
  - Expectations
  - Quality standards
  - Product volumes – ideally, don't want to be smallest or largest customer
- Go for best fit, not lowest price

# The foundry will be evaluating you, too!

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- Are you a stable company?
- Are you well-funded?
- Do you have established customers?
- Do you know what you are doing?
- Present your business well, don't make them dig for information



# Closing the deal

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- Price
- Contract terms
- Purchase order
- Downpayment



# **Successful technology transfer and ramp up**

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- **Provide to foundry:**
  - Die layout in .GDS
  - Runsheet, process data
- **Dedicate an engineer to be foundry liaison**
  - Transfer tech info to foundry
  - Monitor wafers in progress
  - Troubleshooting
  - Visit foundry
- **Timeline and budget management**
- **To get the best results, be a teammate to your foundry**

# Rookie mistakes

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- Only quoting one foundry
- Expecting to go to production in less than a year
- Not presenting a good RFQ or business case
- Throwing design “over the fence”
- Twiddling design/process
- Being underfunded
- Lack of communication with foundry



# Summary

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- Selecting a foundry is an extremely important business AND technical decision
- Don't underestimate time and money involved
- We can help you!
  - [www.amfitzgerald.com](http://www.amfitzgerald.com)
  - (650) 347 6367 x101
  - info@amfitzgerald.com



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