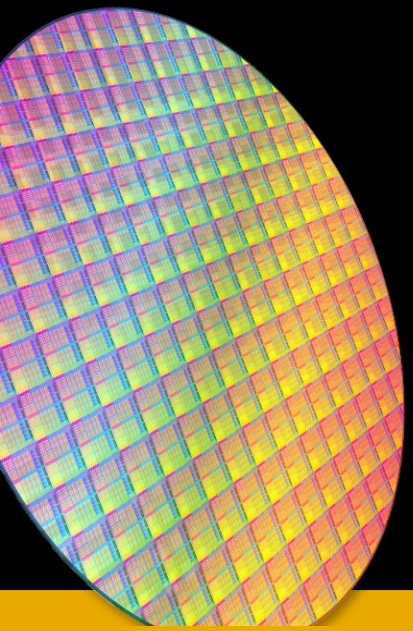
The Continued Importance of Manufacturing Institutes to US Competitiveness and National Security



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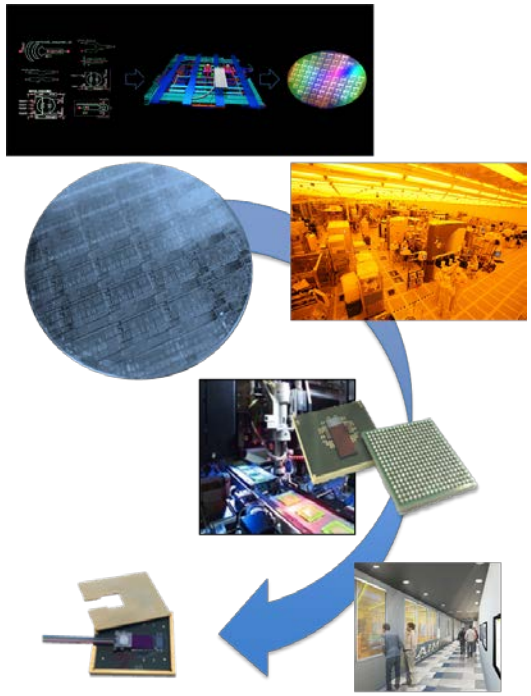
AIM Photonics Ensures that the USA Works at the Speed of Light + Proliferates the Technology Through Workforce Education

AIM Photonics makes the use of photons at an integrated chip level reality through:

- Electronic and photonic co-design
- Silicon or InP Photonic Integrated Circuits (PICs) using foundries
- Packaging and test using wafer and die infrastructure
- Low cost optical connector attach



<u>Knowledge transfer/sharing</u> - Enabled experienced industrial professionals to move from private to public

<u>Technology proliferation and sharing</u> - to a membership of >100 and ranging from a UCB spin-off to Boeing

<u>Sustained technology proliferation</u> – teaching engineers and scientists how to design, build and manufacture "light" devices through the AIM Academy (workforce education)

The manufacturing institutes all support similar initiatives in their respective technology areas & ensure that market failures are addressed

Leading Edge Technology Takes a Long Time to Develop + is Very Expensive

The Leading Edge CMOS Technology Menu

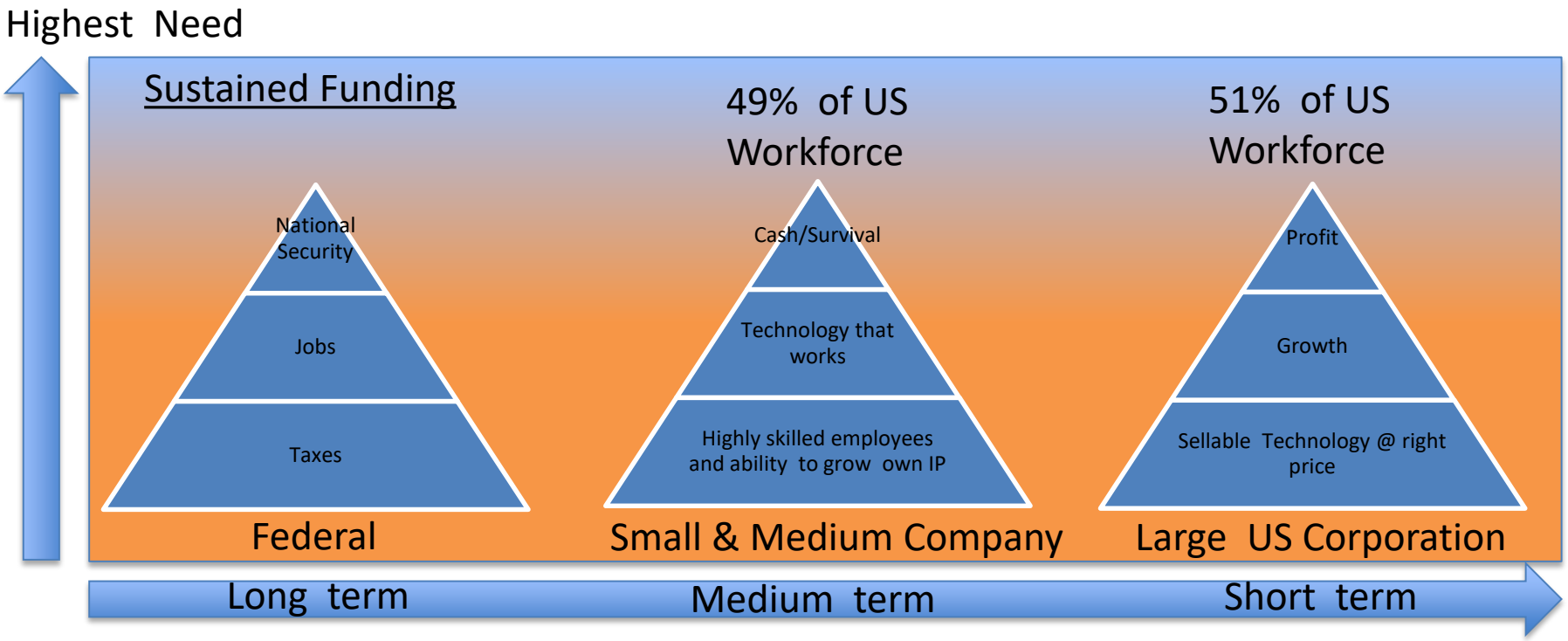
- Cost of a fab - >$15bn
- Time to build and ramp a fab - > 5 years
- Cost of Developing technology - >$1bn
- Price of one leading edge lithography tool - > $100M

- Process steps - > 1000
- Mask layers - > 60
- Time for 1 wafer to go thru Fab - ~90 days

- Typically you need 20 learning cycles ~ 5 years R&D
- New material introduction adds ~ 5 years
- Risk production adds ~ 1 year

Well funded and staffed institutes can help de-risk processes, avoid costs , shorten time to market and drive technology proliferation while maintaining National Security

Institutes Support Different Needs and Help To Minimize Market Failures



Sustained Funding ensures that **different needs/market failures** are dealt with by:

1. Developing a highly skilled workforce & building/maintaining critical infrastructure
2. Enabling rapid advancement in technology deployment
3. Facilitating cost avoidance
4. Stimulating supply chain activity and co-operation

Home truth -If you fall behind the leading edge, industry will be the first to walk!

"Case Study" – Does AIM Photonics Address Market Failures?

AIM Photonics makes available the use of a leading edge 300mm Fab, Test Assembly & Pack facility as well as the opportunity to collaborate within an active integrated photonics eco-system - $bns of hard and intellectual assets available for use at little cost

AIM Photonics has enabled the following USA customer portfolio:

1. Two major defense contractors
2. A rapidly growing medium sized optical business
3. A global datacoms corporation
4. Several round A/round B funded start-ups
5. Process transfer to large volume foundry manufacturing
6. Large number of leading edge US universities
7. Strong positive feedback at recent congressional hearing from a defense contractor

Common themes:

De-risk processes BEFORE investing

Try-out new materials and structures - customization

Will work with low volumes - customization

MPW program offers a low cost way to experiment with new technology

Work force education for sustainability/proliferation and growth

Bottom Line – the manufacturing institutes ensure that the USA remains at the leading edge by being technology focus points, addressing market failures and providing continued workforce education

Some technologies may not receive timely support without the support of manufacturing institutes……

Star Trek - 1966

USA-2018

Hand held wireless communication devices	✓	
Portable bio/atmospheric sensors	✓	
Body scanning	✓	
High speed computing	✓	
Robots	✓	✗
Artificial intelligence	✓	✗
Photon torpedoes	✓	
Warp drive	✗	
Teleporting system	✗	

Next Steps – Focus on Commercialization/Proliferation and Establish and Appropriate Level of Base Funding for Each Institute

Provide base funding for the institutes and focus on execution not sustainability

Measure and Report

- How many US high tech start-up companies have been de-risked?
- How many US engineers and scientists have been educated?
- New processes transferred to volume manufacturing?
- Proliferation of the technology – patents, workforce education, member collaboration
- # of products facilitated to commercialization
- Stimulation of academic research
- Collaboration with government agencies and defense contractors on national security critical projects

+ establish appropriate level of base funding for institutes according to product lifetime cycles, product development costs and economic growth/national security considerations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