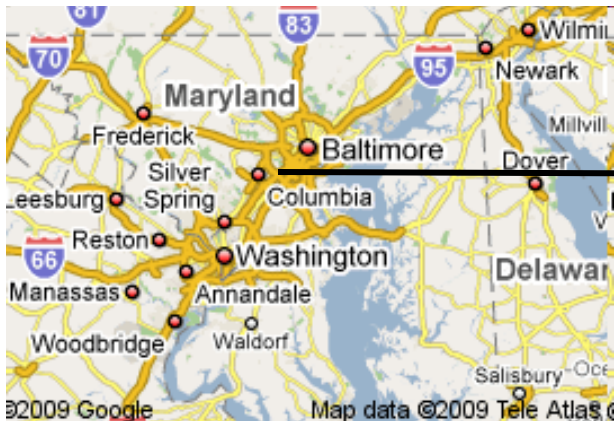


# Why Consider Universities for new Business Opportunities

**Surya Raghu**  
**Advanced Fluidics LLC &**  
**ET Cube International**

WIPO EIE Workshop  
Kuala Lumpur, Malaysia  
April 16-20, 2018



# About Me

Ph.D. Mechanical Engineering – Yale University  
Academics – State University of New York, Stony Brook  
Industrial Scientist – Automotive and Consumer Products  
>20 inventions

15 issued US and International patents

6 Products: Invention to commercialization

Entrepreneur: Started Advanced Fluidics (Small Company) in 2001

Training: ET<sup>3</sup> International (Non-Profit Organization)

# About ET<sup>3</sup> International and Advanced Fluidics

## **ET<sup>3</sup> International**

Entrepreneurship and Research Commercialization  
Training and Consulting ~ 20 countries

## **Advanced Fluidics LLC**

Research and Product Development in

1. Aerospace Sciences – Aerodynamics, combustion
2. Micro/Nanofluidics/nanotech-based biosensors
3. Medical Instrumentation
4. Technology Roadmap Development and Training

Work with many Universities...

# Motivation

Universities are a good source for front-end research capabilities, unique and expensive laboratory facilities, talented faculty and students

University researchers come up with many good ideas and inventions that may be useful for competitive position in markets.

# OUTLINE

University contributions to products

My experiences with University-Industry interactions

Conclusions

# Impact of Research beyond Academia

Impact is the effect research has beyond academia and consists of “.....benefits to one or more areas of the economy, society, culture, public policy and services, health, production, environment, international development or quality of life, whether locally, regionally, nationally or internationally”

and as “....manifested in a wide variety of ways including, but not limited to: the many types of beneficiary (individuals, organizations, communities, regions and other entities); impacts on products, processes, behaviors, policies, practices; and avoidance of harm or the waste of resources.”

*(UK 2014 Research Excellence Framework)*

# Great Contributions from Universities

**Saccharin** – Johns Hopkins 1879

**Insulin** – U. of Toronto 1922

**Plexiglass** – McGill U. 1930

**Penicillin** – Oxford U. 1939

**Computer** – U. Pennsylvania. 1946

**Polio Vaccine** – U. Pittsburgh 1955

**Pacemaker** – U. Minnesota 1958

**LCD Screen** – Kent State 1967

**Recombinant DNA** – Stanford, UCSF 1974

**Internet Search (Google)** – Stanford 1998

# Great Contributions from Universities

## 11 Important Innovations That Came From University Research



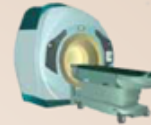
### Seat Belt

The first modern version was developed at Cornell University.



### Gatorade

Researchers at the University of Florida developed this drink for their athletes.



### CAT Scan

The CAT scan was patented by a researcher at Georgetown in the 1970s.



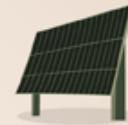
### The Internet

Numerous research innovations at universities have helped make the Internet what it is today.



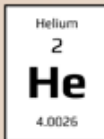
### Flu Shots

The vaccine comes from research done at the University of Rochester.



### Solar Power

Some of the earliest applications of solar power in housing were pioneered at MIT.



### Periodic Table

The first version of the periodic table was created by a professor at Saint Petersburg University.



### Chemotherapy Drugs

A number of these drugs were developed at various universities.



### Ultrasound

The pioneering work for the ultrasound was done at the University of Vienna.



### Rocket Fuel

Robert Goddard created the first liquid-fueled rocket while at Clark University.



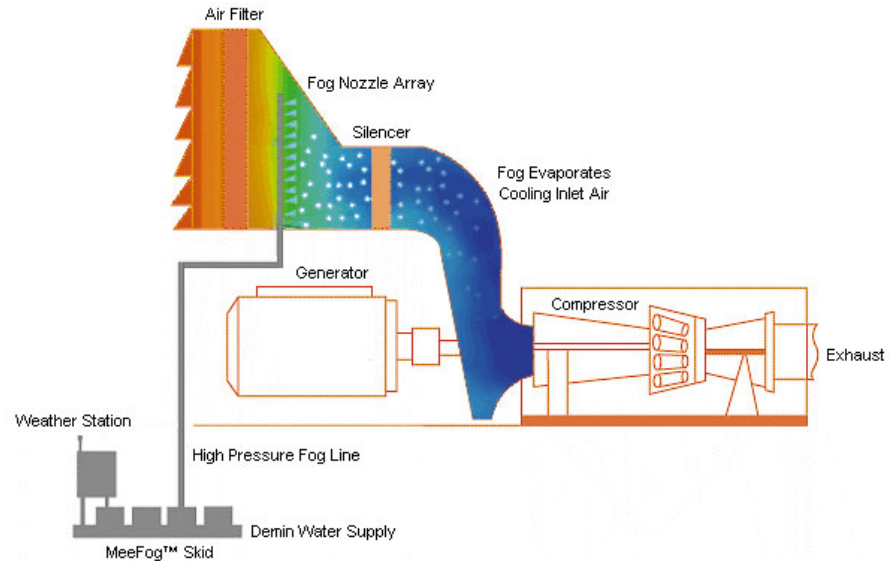
Sources: en.wikipedia.org | wou.edu | history.com | boston.com | genesis-ultrasound.com | nytimes.com | gatorade.com | inventors.about.com



# My Personal Experience in University-Industry Work

1. SUNY-Stony Brook – LILCO  
(Power generation and  
distribution company in Long  
Island, NY) – Giannotti Associate  
(Engineering Consulting  
Company)

Course – project work –  
industrial visits – co-op student –  
small grant – larger grant +  
student support – full-scale spray  
system for the power plant

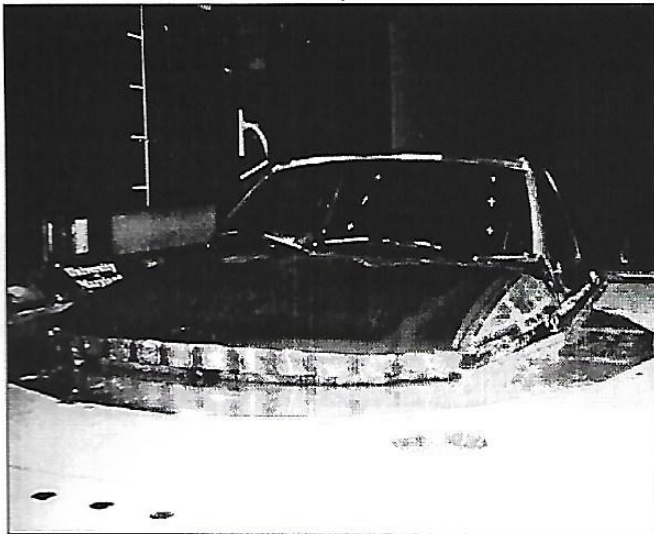


(<https://www.power-technology.com/wp-content/uploads/sites/7/2017/09/3-overview-300x191.jpg>)

# Industry-University Interaction (being on the other side now)

1. University of Maryland – Maryland Industrial Partnership (MIPS) Program – Automotive aerodynamics

Company funded University for a research project of interest to automotive industry.



**Fig. 1. Test Buck in Wind Tunnel**



**Fig. 3. Oil Flow Pattern**

(Raghu et al, SAE Paper)

# Industry-University Interaction

**University of Maryland –  
Droplet impact studies on  
hard and soft targets -  
Faculty research funding  
from company for basic  
research to address a  
consumer product  
application**



<https://www.newscientist.com/article/2108483-softening-surfaces-stops-liquids-from-splashing-when-they-hit/>

# Industry-University Interaction

Advanced Fluidics + University of Arizona + NASA

Idea: 2006:

Started working in 2008 (Invention)

Provisional Patent application – July 2009

Full US Patent Application in July 2010

Patents Issued February 2013 – Owned by Surya Raghu

2 more patents are assigned to Boeing in a separate program

# Airplanes

Green Aviation

April 22, 2015

## NASA Tail Technology Could Someday Reduce Airplane Fuel Use





## NEWS

News, features & press releases

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Current, future, past missions & launch dates

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#### News Topics

Nov. 14, 2013

#### News Releases

## RELEASE 13-340

### NASA, Boeing Finish Tests of 757 Vertical Tail With Advanced Technology

“The flow control on the 757 vertical tail model comes from **sweeping jet actuators**, which are devices that essentially blow air in a sweeping motion along the span of the tail”

“NASA’s goal for the AFC project is to increase sideforce 20% on demand, and shrink the vertical tail by 17% to reduce aircraft fuel burn by 1-2%.”

<http://aviationweek.com/awin-featured-story/boeing-nasa-test-active-flow-control-tail>

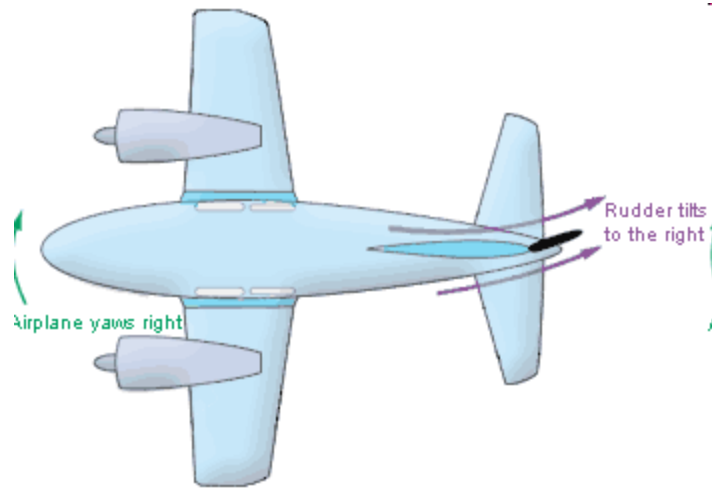
EIT Workshop  
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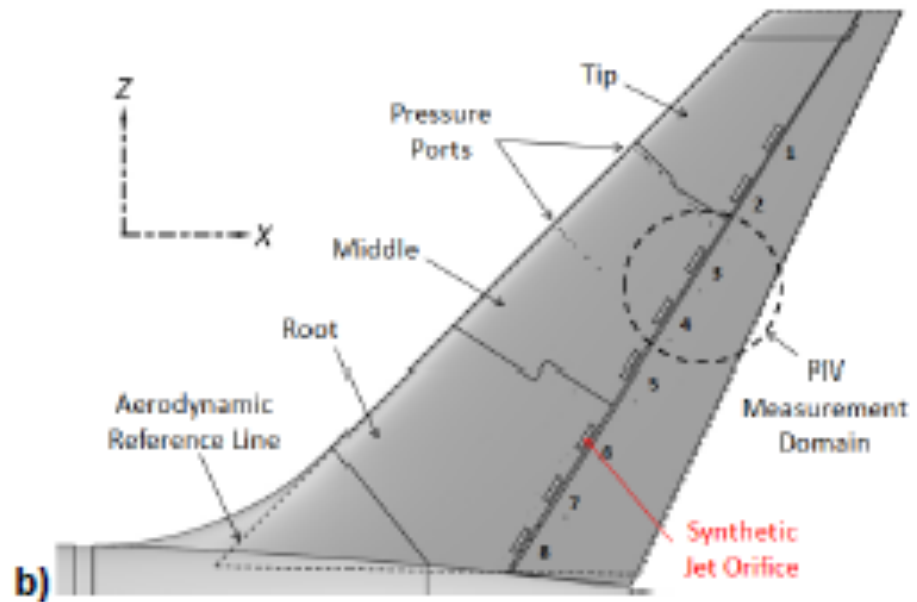
© S. Raghu



# Aerodynamic Flow Control Devices for Future Airplanes



<http://wingsovermars.arc.nasa.gov/surfaces.html>



Rathay et al, AIAA 2012-0071

# Industry-University Interaction

## Other Projects

1. JHU/AF – micropumps for fuel cells
2. Illinois Institute of Technology/Boeing/AF
3. MIT/JHU/AF – Haptic actuators
4. Georgia Tech/Air Force/AF – Helicopter Aerodynamics
5. University of Iowa, RPI, Northrop Grumman/AF
6. UMBC/AF – Biosensor; UMMC/AF – Biosensor



# Some challenges..

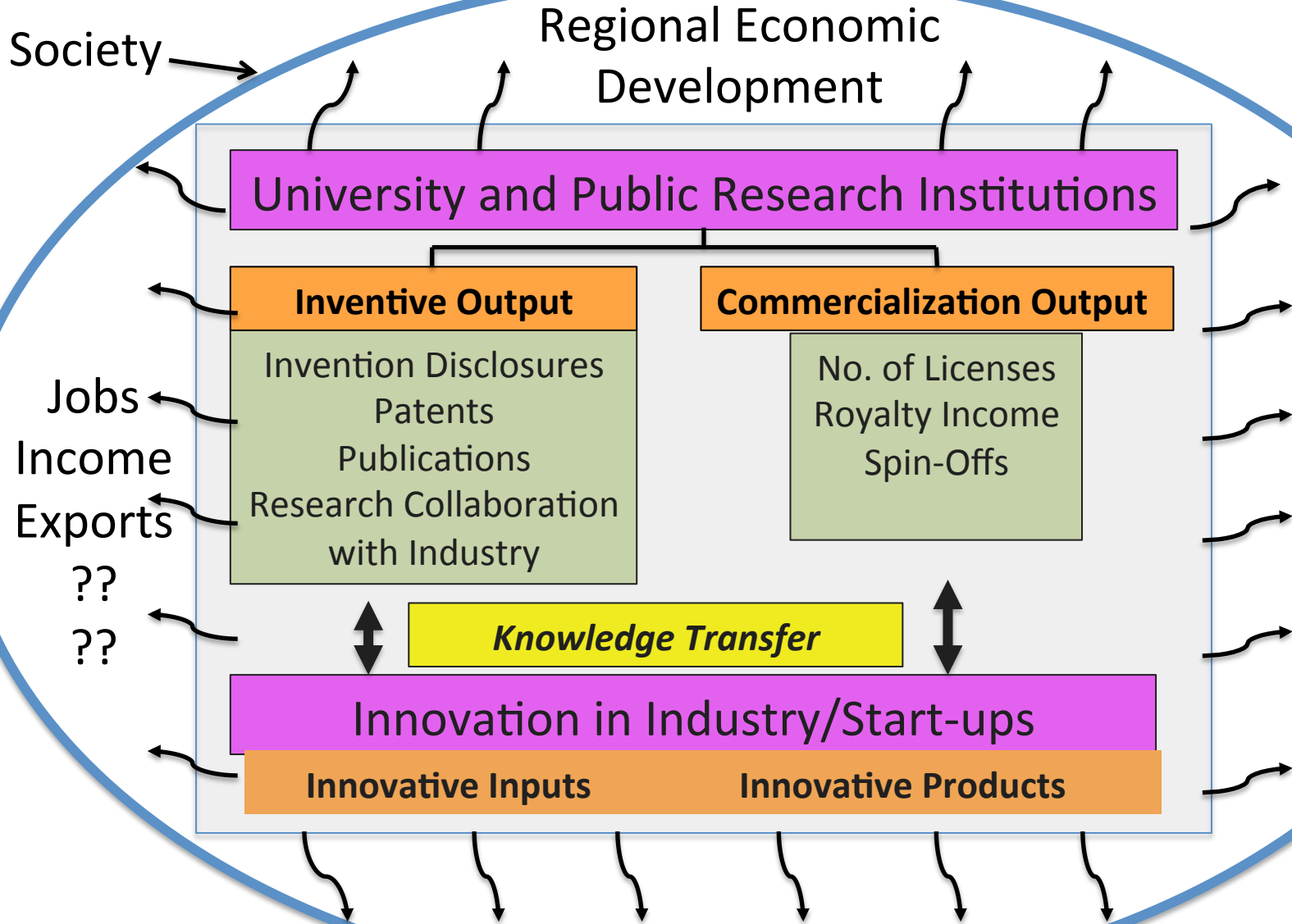
IP

Time scales

Publications and impact on IP

Authorships

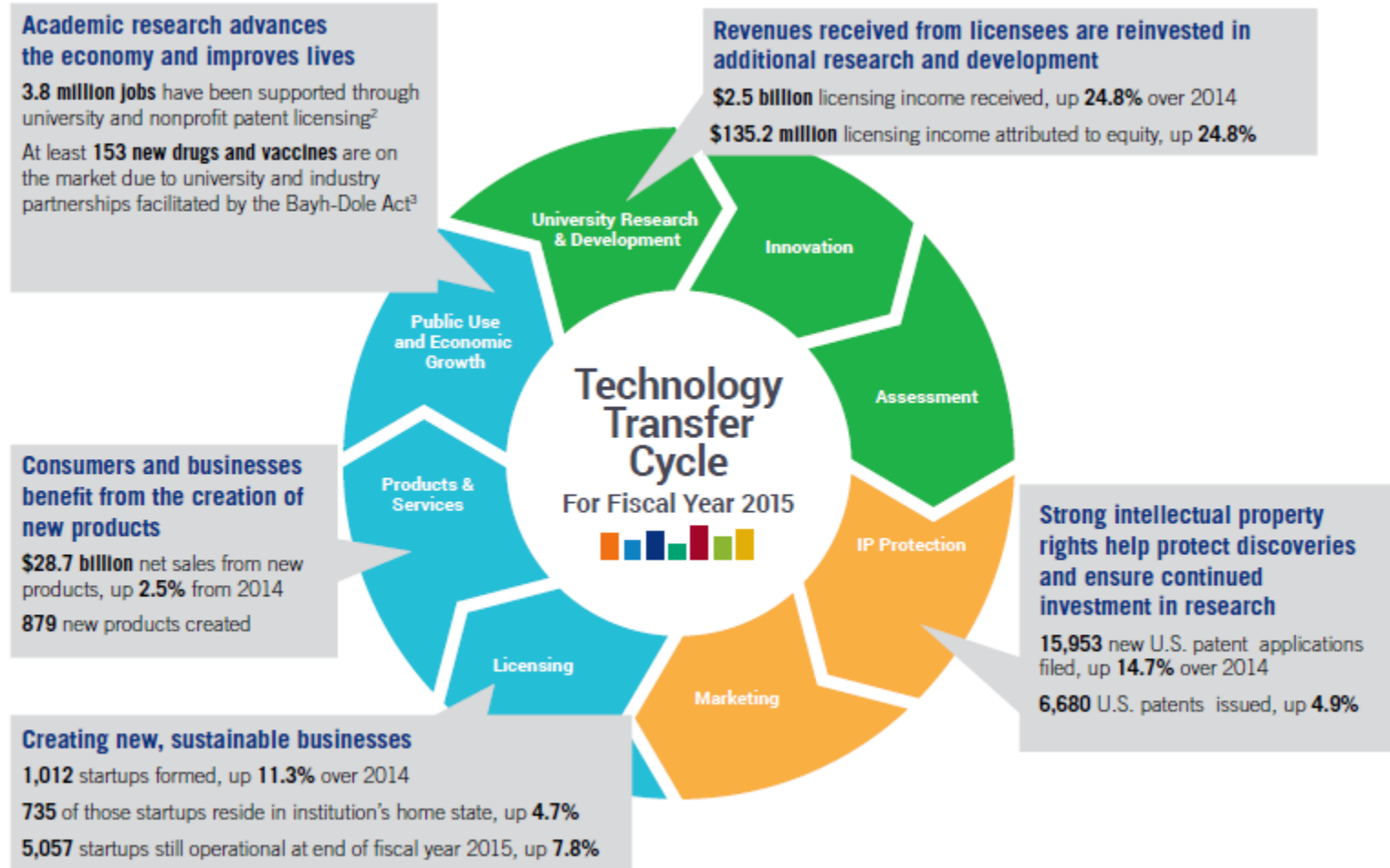
# University-Industry Interaction



# Thank You

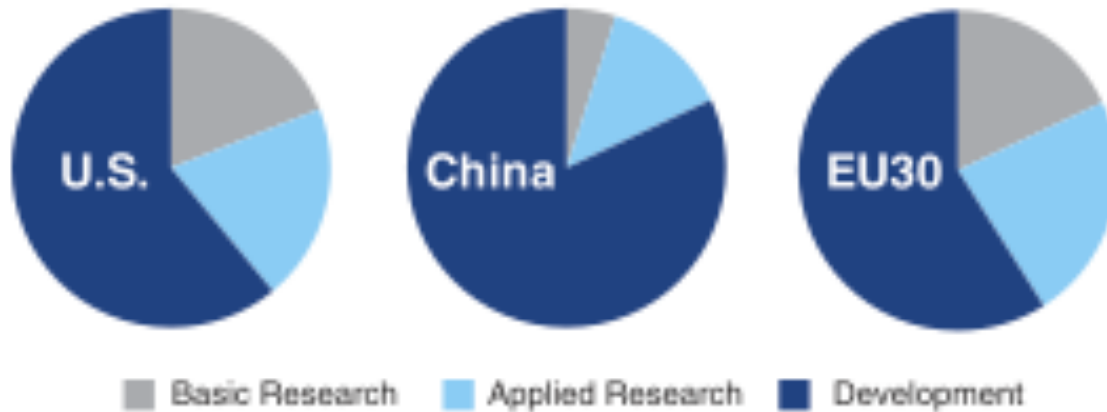
# Questions?

# National Metrics: USA



# National Research Priorities

Different Priorities Among Research Leaders



China places more emphasis on development, less on basic research

(December 2013 R&D Magazine)