

# 地域活性化における大学の役割

カーネギーメロン大学ロボット研究所の例

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カーネギーメロン大学

# Globalizationを求めるアメリカの大学

- 世界レベルの教育・研究を
- 世界から教授・研究者・学生を
- そして、世界に拠点(分校など)を

# カーネギーメロン大学

- ペンシルバニア州ピッツバーグ
- 1900: Andrew Carnegieによる職業学校として創立
- 1912: 4年制大学カーネギー工科大学
- 1967: Mellon科学研究所と合併してカーネギーメロン大学
- 学部: 6,000人、大学院生: 7,000人  
(Cf. 東京大学: 学部14,000、大学院生: 14,000人)

# カーネギーメロン大学のGlobalization

- 世界レベルの教育・研究を
  - Ranked 22 in Times Higher Education
    - 特に Computer Science: 1～3
    - 中でも、Robotics (1)、Human Computer Interaction (1), Artificial Intelligence (1)
- 世界から教授・研究者・学生を
  - 学部生: 21%が国際学生(114ヶ国)、米国でトップ
  - 大学院生: 40～50%? (CS/ロボット研究所での印象)
  - 教授・研究者: 30%?

# そして、世界に拠点(分校など)を



ロボット研究所でも、ロボティクス・マスターコースの一つに国際共同コースあり

# Localism ?

- 米国の大学は “伝統的に” “驚くほど” 自身が存在する地域 (町・市・州) との結びつきが強く、地域に貢献しようとする
  - Co-op Student (企業派遣学生)
  - Local Problem Solving
    - 学生実験
    - Capstone Project
  - 高校生の Early placement、Summer Intern
  - 様々な地域団体 (Science Center など) への貢献

# Localism ?

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- そして、その貢献は “学術的” レベル を越えて、地域の経済・環境活性化に直接的貢献をなし得る

# カーネギーメロン大学 ロボット研究所

- 1979年設立

設立資金(\$5M、5億円)はピッツバーグを本拠とする  
Westinghouse 社より



Raj Reddy教授  
(CMU)



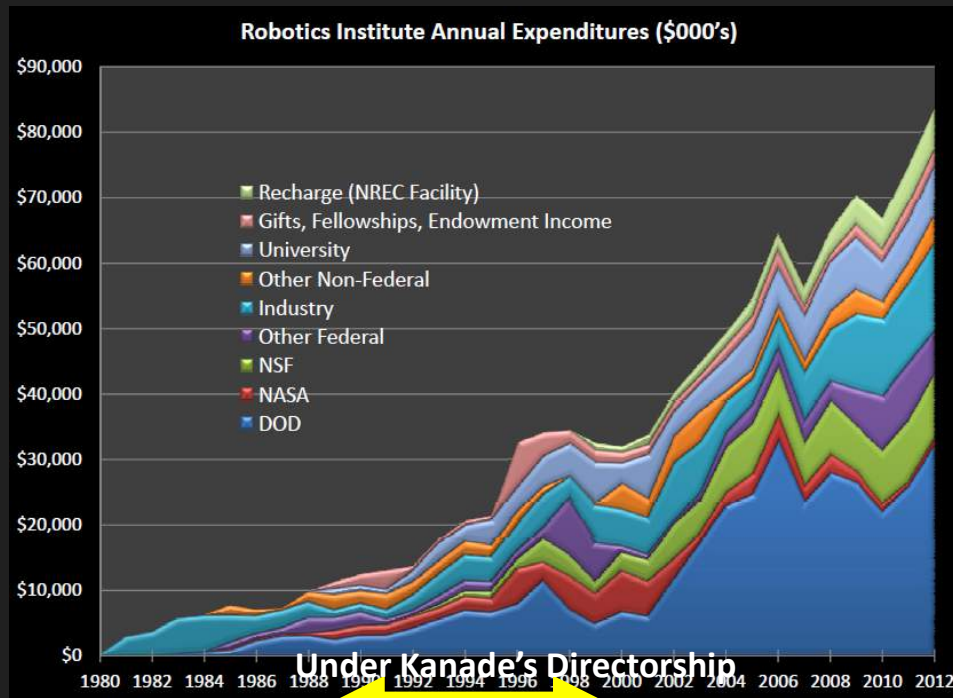
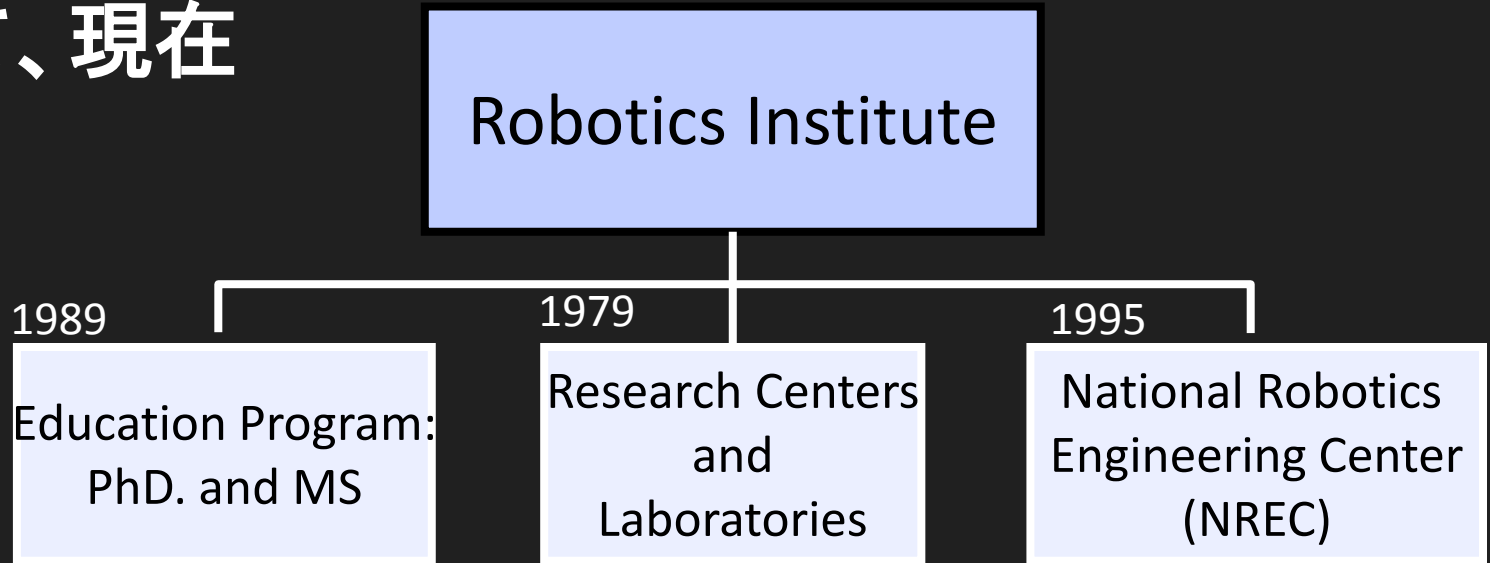
Tom Murrin、CTO  
(Westinghouse)

“Leapfrog US manufacturing productivity”

- “*Robotics* is where **computing** meets  
the real world.” (現在のRIT, Cyber Physical System の先取り)



# そして、現在



over \$80M budget and 500 people,  
Performing research and development of  
all areas of “robotics”.  
More than 50 spin-off companies

# 代表的プロジェクト

自動運転 (since 1984)

# Navlab's



Navlab 1 (1984)



Navlab 1 - 5 lineup (1984-95)

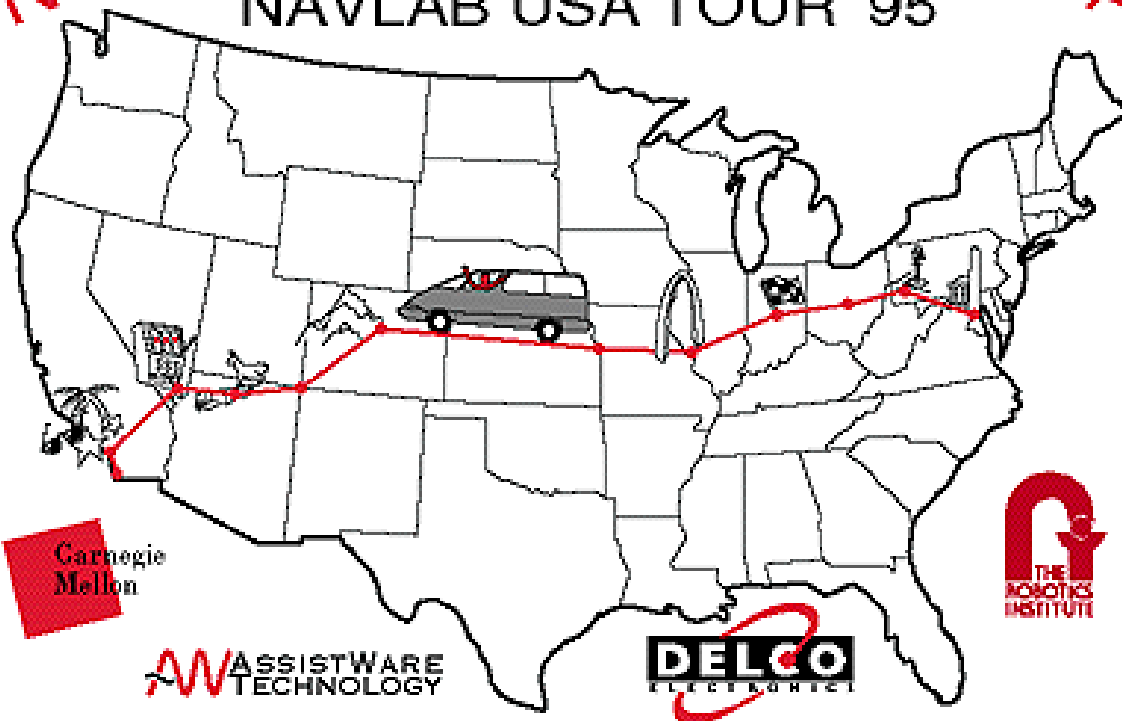
# No Hand Across America: 1995



•The **Navlab 5** steered 98.2% of the distance from Washington, D.C. to San Diego CA. (2797 miles out of 2849) by a computer-vision program.



## NO HANDS ACROSS AMERICA NAVLAB USA TOUR '95

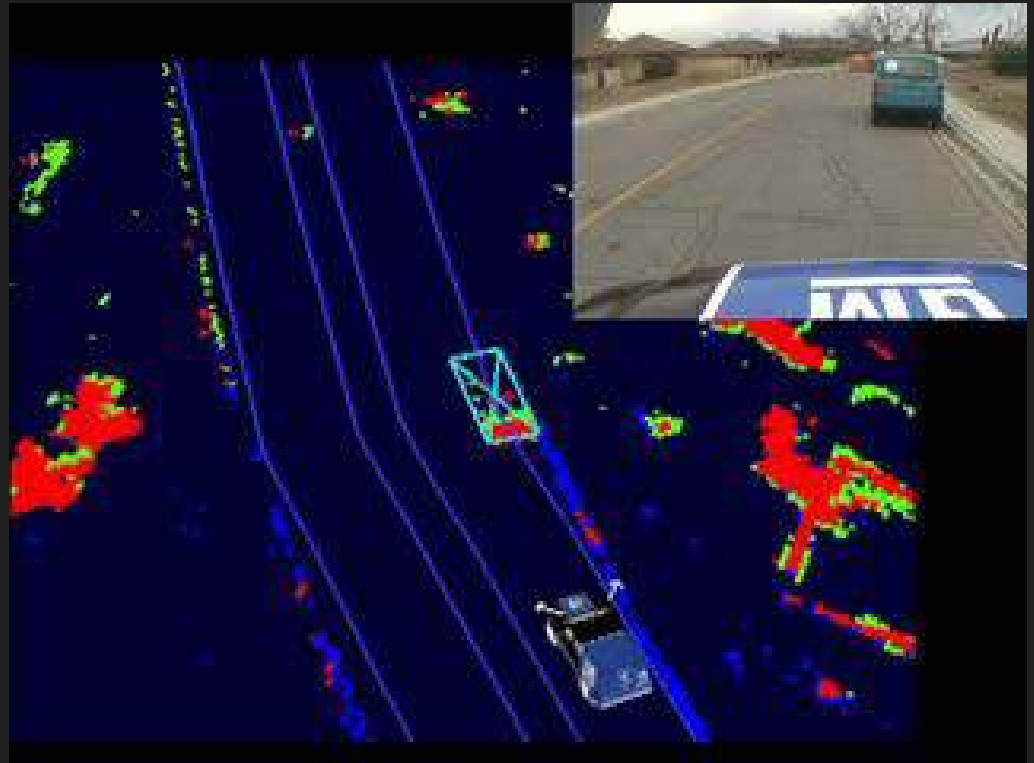


- Washington DC
- Pittsburgh PA
- Columbus OH
- Indianapolis IN
- Kokomo IN
- Saint Louis MO
- Kansas City MO
- Denver CO
- Four Corners
- Grand Canyon
- Las Vegas NV
- Los Angeles CA
- San Diego CA

# DARPA Urban Grand Challenge 2007



CMU Vehicle – Boss  
(Red Whittaker and  
team)



このプロジェクトスタッフの主だったメンバー達が  
Googleへ行き、Google Carの開発に従事

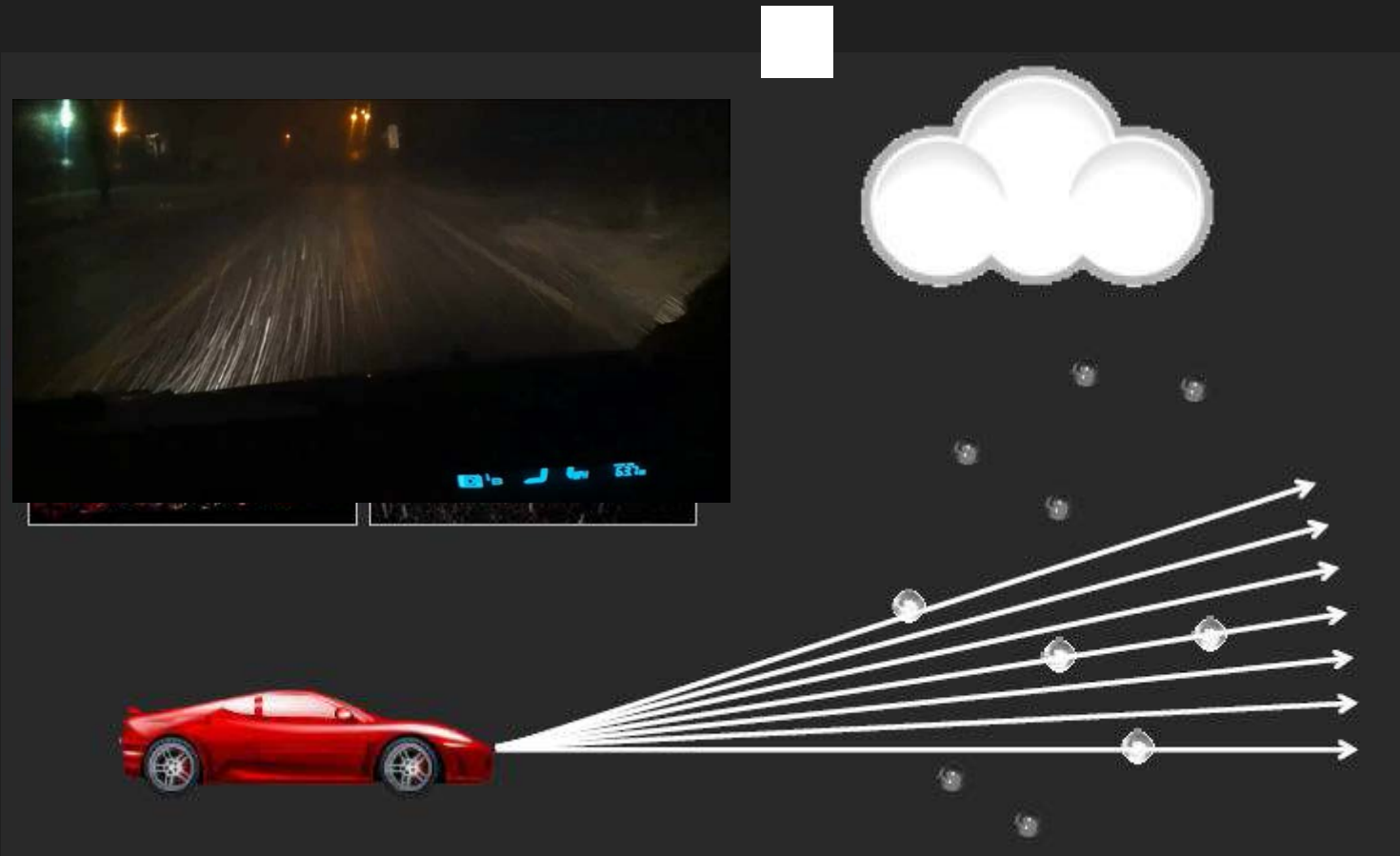
# Uber's "Raid" on CMU Robotics in 2015

- ~40 people (教官、スタッフ) left NREC for Uber Advanced Research in Pittsburgh in 2015
- Uber \$5.5M Gift to CMU Robotics to "rebuild")
- Uberの自動運転プロジェクト (2016)

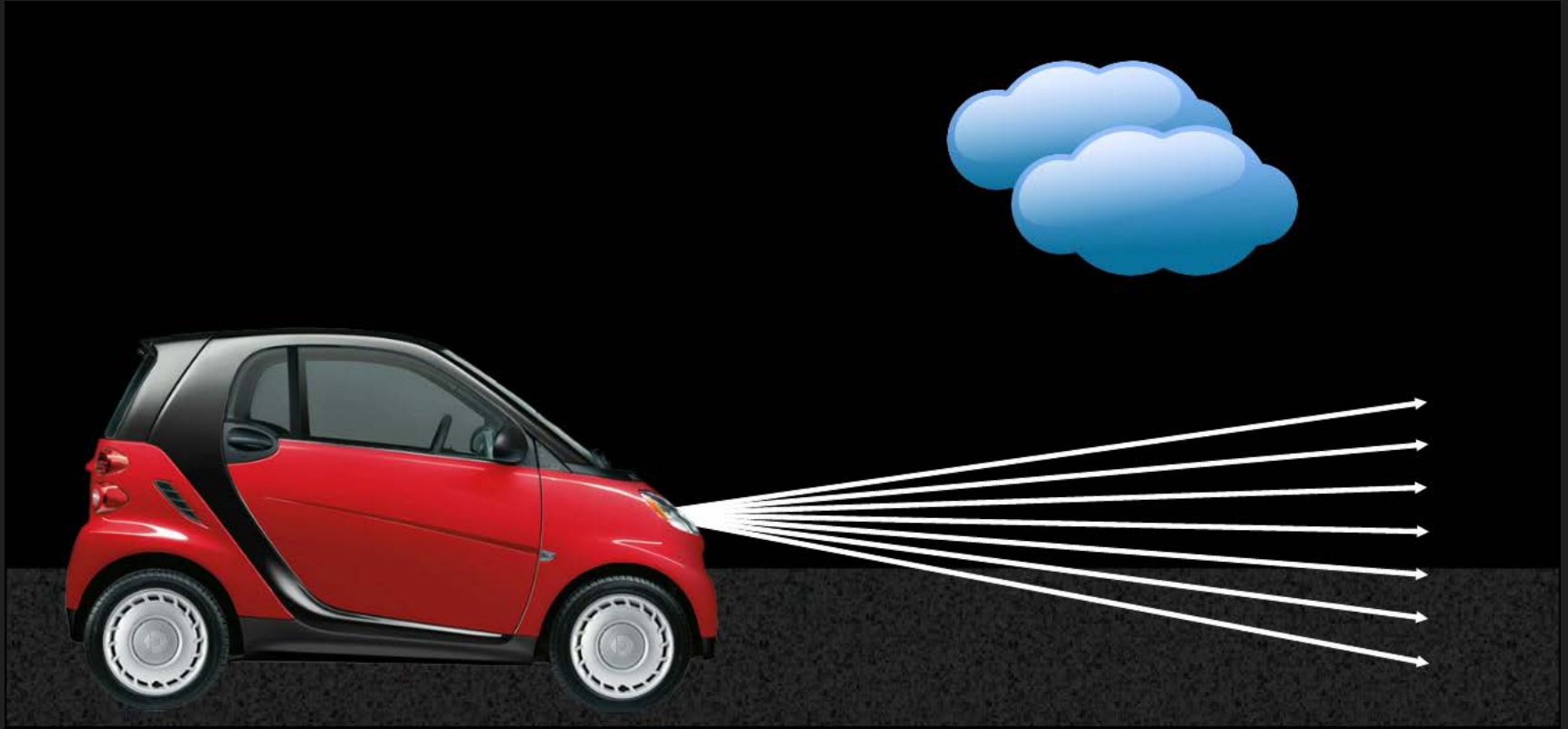


# Driving in Rain and Snow at Night

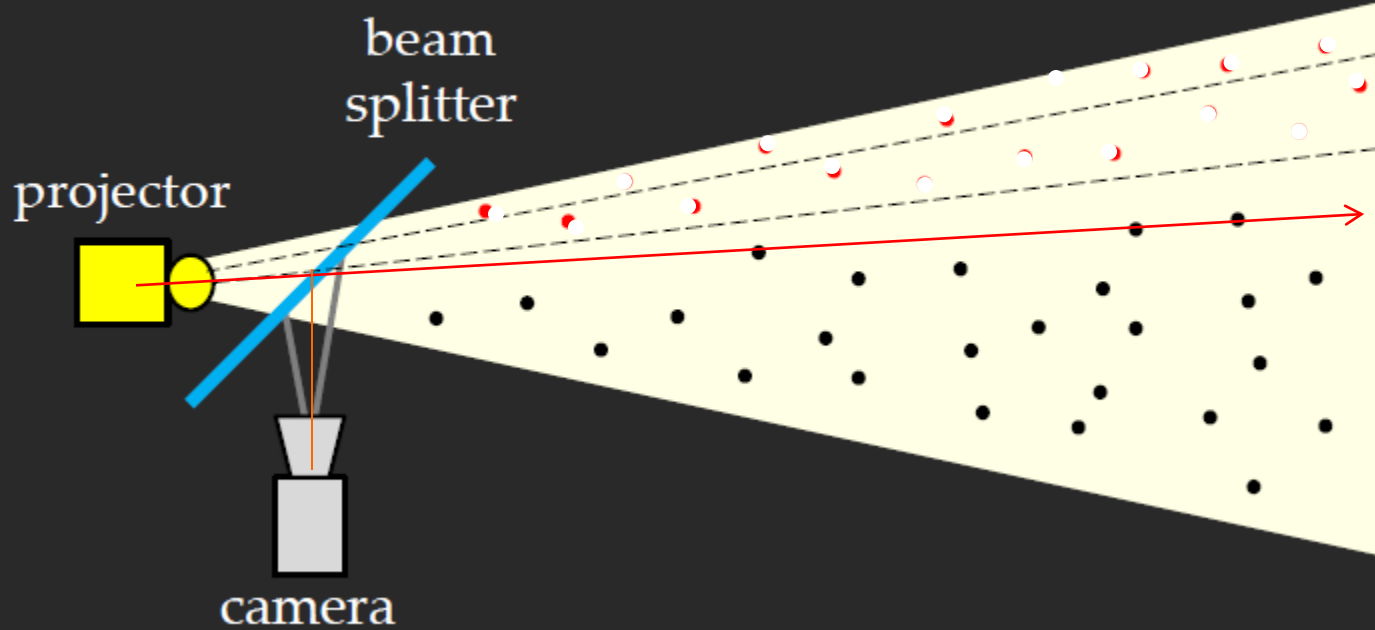
Rain drops and snow flakes are highly reflective



# Smart Headlight that sees through Rain and Snow







# Programmable and Reactive Headlight Design

Spatial light modulator

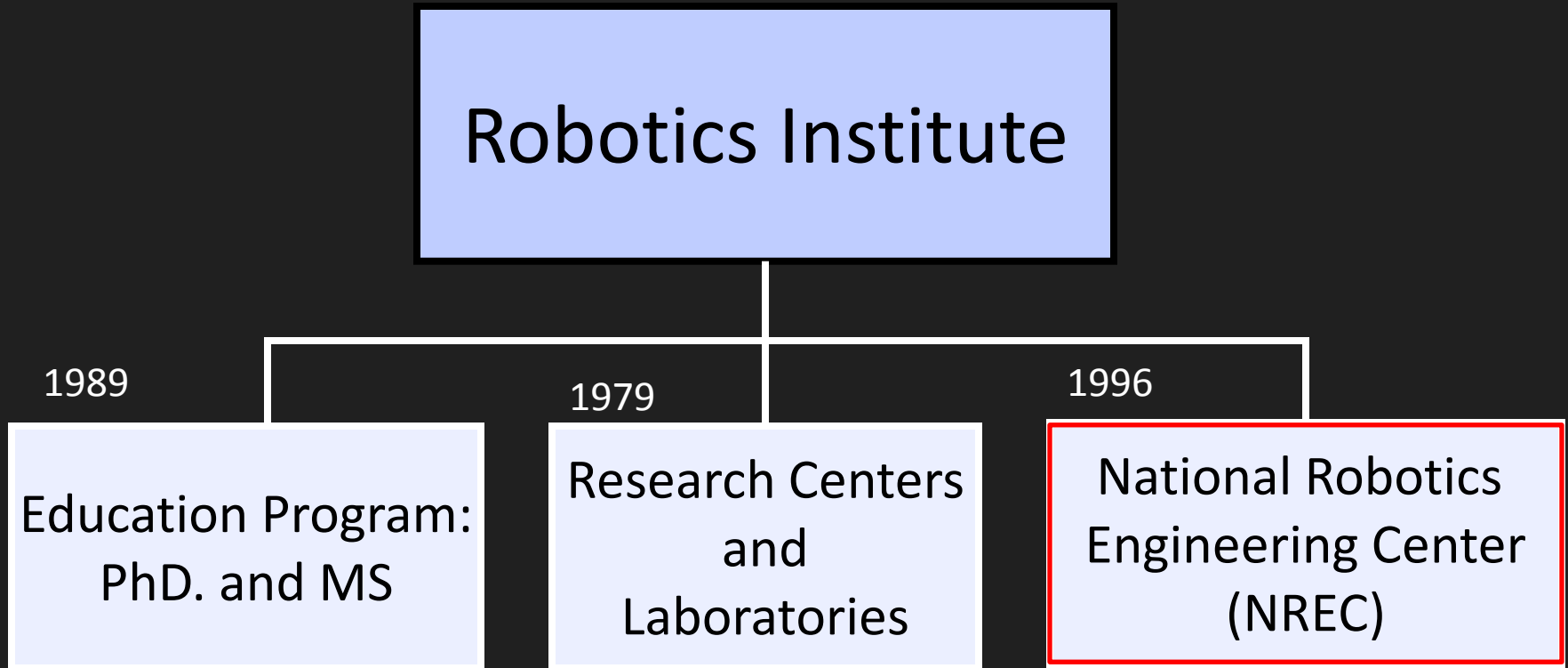


Processing



APR VIRGINIA 2013  
WSS-7424

# Our impact is more



National Robotics Engineering Center (NREC)  
Made Impact on Economic Revitalization at its  
Lawrenceville Neighborhood in Pittsburgh

# National Robotics Engineering Center (NREC) Impact on Economic Revitalization at the Lawrenceville Neighborhood in Pittsburgh



# ピッツバーグ

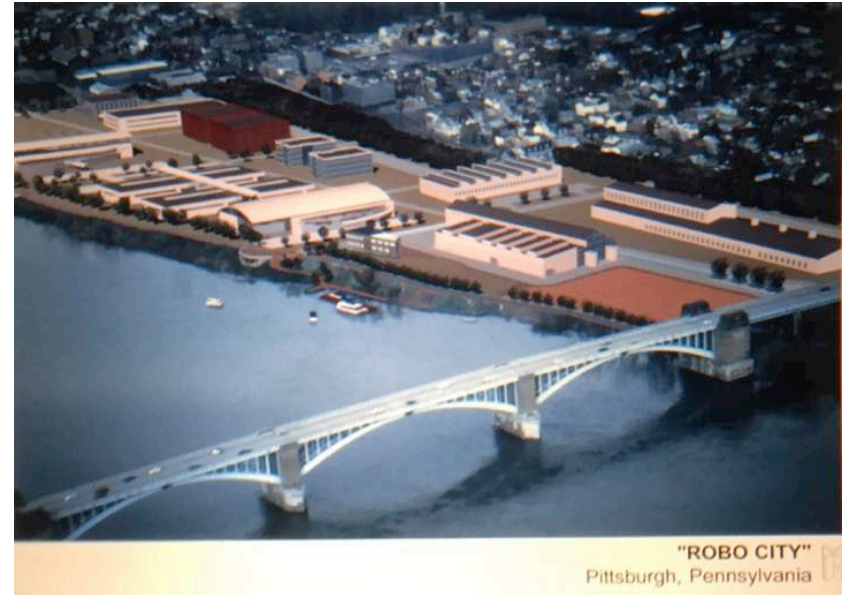
- 1950: US Steel の町として、人口68万人  
全米12位の市
- 以来、製造業、鉄鋼業の衰退
- 1980: 人口は37%減の42万人
- 1983: Pittsburgh Technology Council を結成、  
High Quality Job の産業育成を目指す
- 元工業地帯の廃墟（Brownfield）のHigh Tech Site  
への再生を目指す
- 大学は人材と技術の“吸引力”

# 20 Years Ago



Pittsburgh Lawrenceville, “most typical” brownfield

# Starting with a Dream...



*Convert the Lawrenceville Riverfront brownfield site into state of the art Robotics R&D facility and further cement Pittsburgh reputation as "Robo City" (Wall Street Journal named Pittsburgh "Roboburgh")*



# Building Process



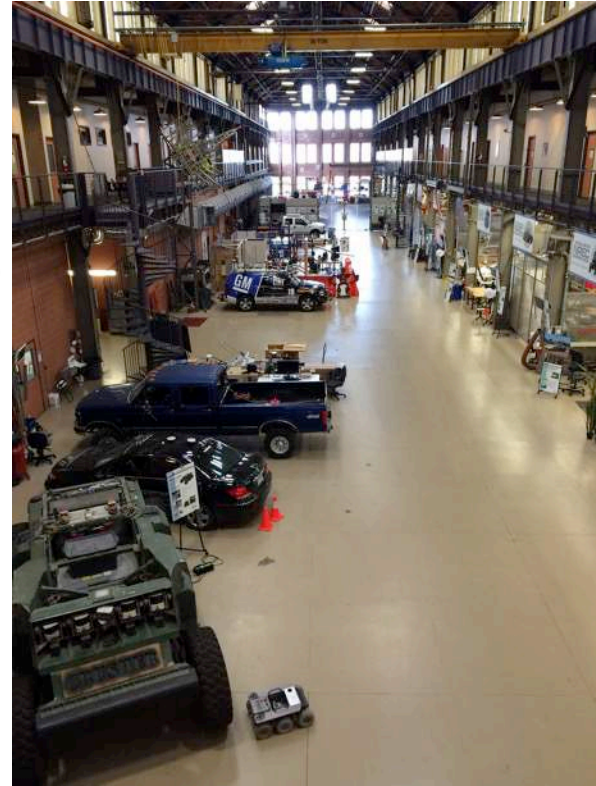
# Many Stakeholders

- Carnegie Mellon Robotics Institute
- NASA \$3M の seed funding
- Urban Redevelopment Authority and City of Pittsburgh
- ペンシルバニア州
- ピッツバーグのいろいろな財団
  - R.K. Mellon Foundation
  - MaCune Foundation

# Early Usage



Trailer in the Highbay for Temporary Working Space During Construction



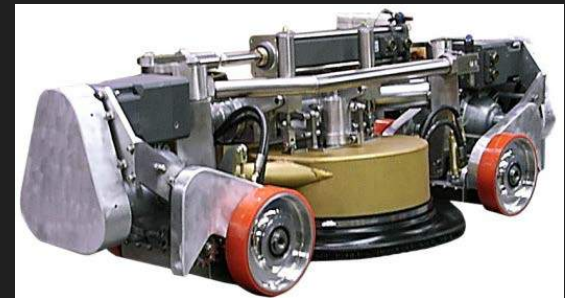
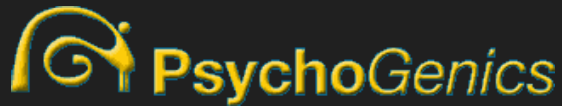
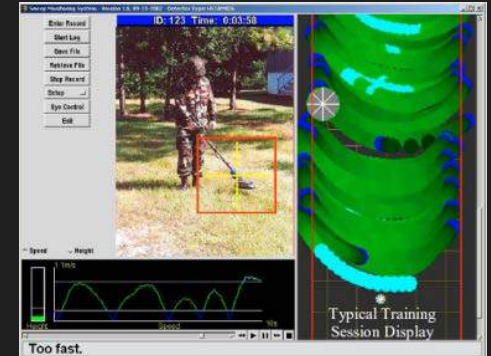
Current Picture of the Highbay

CMU used the facility while it was under construction, and in the process immediately poured money into the local economy

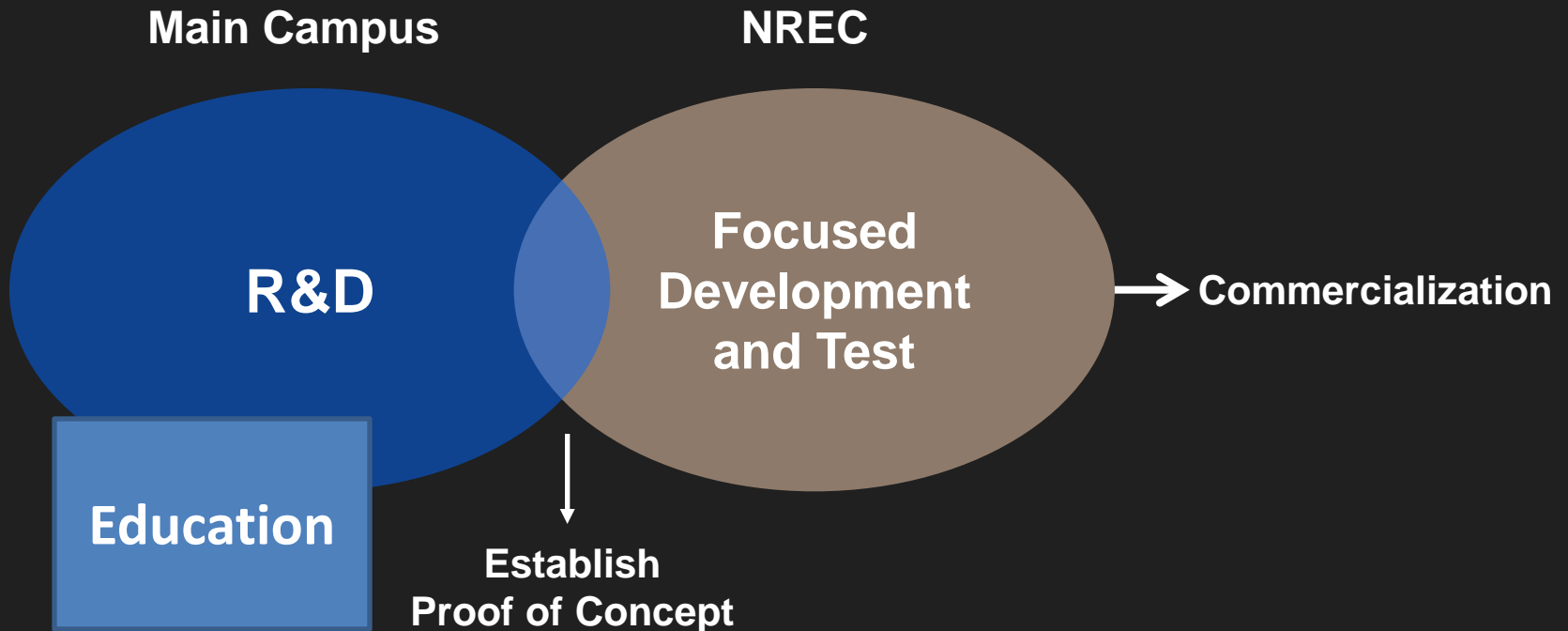
# Official Opening Day: July 1996



# Tech Transfer: New Products



# Cover the whole spectrum of Robotics E, R, D, and C



# Moving Forward 20 Years

Thousands of new housing units around NREC



NREC provides good jobs directly and through CMU spin-off companies

# Increasing Real Estate Value

Looking for a Change?  
Change from your utility for Fixed Rates & avoid supply rate spikes  
Find Your Plan

Lawrenceville Pittsburgh Real Estate 91 homes for sale. 6 unmapped.

Homes for You Newest Cheapest More

1 photo  
**HOUSE FOR SALE**  
**\$275,000** 3 bds • 2 ba • 1,140 sqft  
3 days on Zillow • 337 42nd St, Pittsburgh, PA  
Howard Hanna - Shadyside

22 photos  
**CONDO FOR SALE**  
**\$279,000** 2 bds • 2 ba • 1,360 sqft  
3 days on Zillow • 265 Main St # 1, Pittsburgh, PA  
Coldwell Banker Real Estate Services - Shadyside

8 photos  
**FOR SALE BY OWNER**  
**\$310,000** 3 bds • 1 ba • 1,643 sqft  
1 day on Zillow • 137 Home St, Pittsburgh, PA

24 photos  
**HOUSE FOR SALE**  
**\$449,900** 4 bds • 3 ba • 2,034 sqft  
1 day on Zillow • 216 Main St, Pittsburgh, PA  
Howard Hanna - South Hills

1 photo  
**HOUSE FOR SALE**  
**\$123,456** 2 bds • 1 ba • -- sqft  
1 day on Zillow • 3949 Howley, Lawrenceville, PA  
Coldwell Banker Real Estate Services - Shadyside

25 photos  
**HOUSE FOR SALE**  
**\$300,000** 3 bds • 1.5 ba • -- sqft  
2 days on Zillow • 5114 1/2 Butler St, Pittsburgh, PA

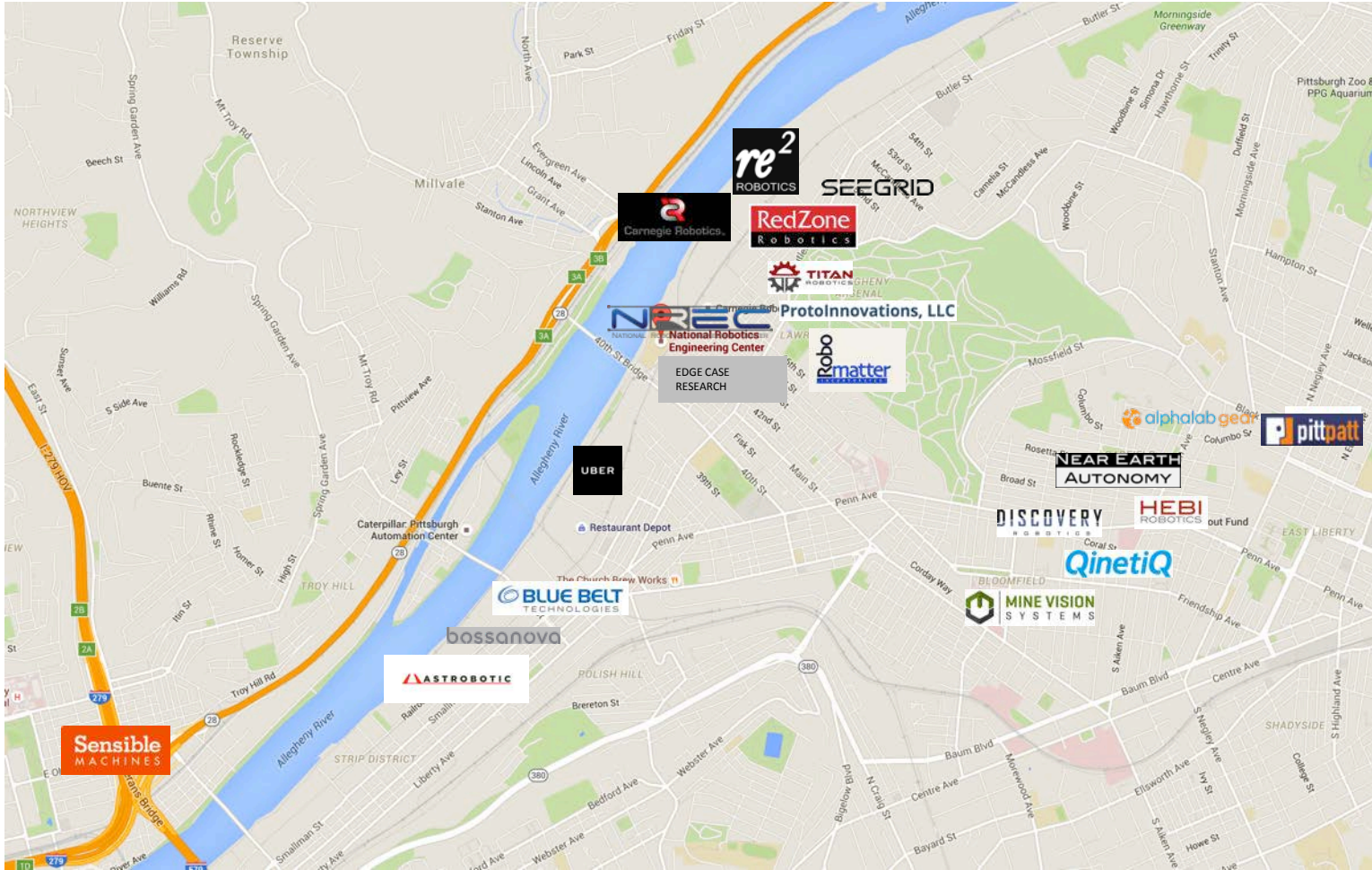
1 photo  
**LOT/LAND FOR SALE**  
**\$550,000** 3.00 ac lot  
3 days on Zillow • 336 Linoleum Way, Pittsburgh, PA  
Coldwell Banker Real Estate Services - Shadyside

16 photos  
**HOUSE FOR SALE**  
**\$140,000** 2 bds • 1 ba • 1,047 sqft  
3 days on Zillow • 125 Banner Way, Pittsburgh, PA

*\$30K row houses have been turned into luxury >\$300K houses*

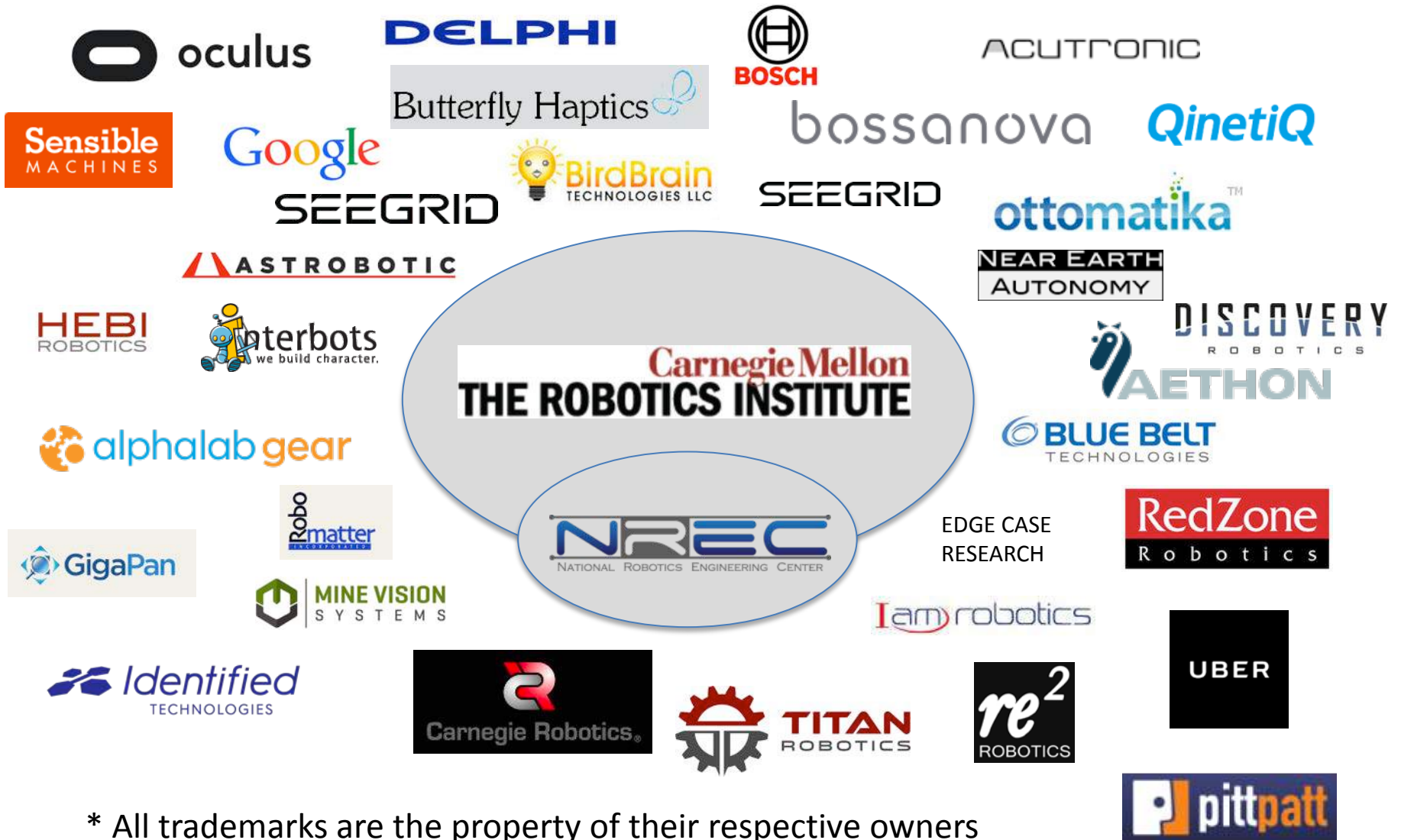


# Robotics Spin-Off Companies from NREC and Robotics Institute



Contribute to the development of thousand of high paying jobs in the region

# Pittsburgh Robotics Ecosystem

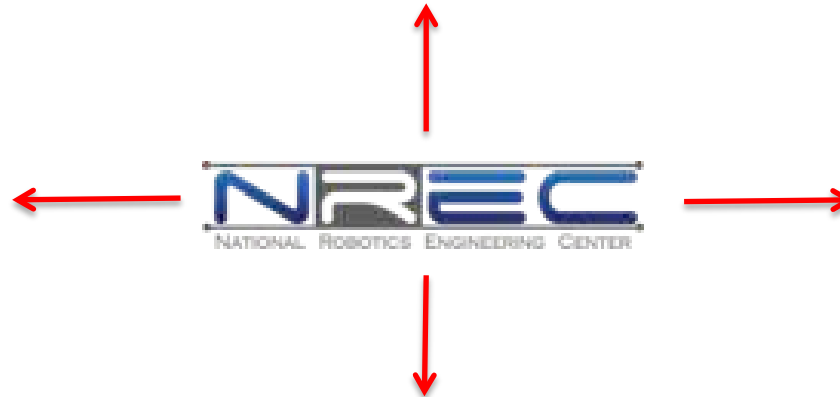


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# Multi-Faceted Impact

Skillful Workforce

Spin-off Companies



Pittsburgh Branch  
of Established  
Companies

Increasing demand for  
the local economy (new  
housing, stores,  
restaurant etc.).

From the initial \$3M seed funding, NREC has brought in  
>\$350M directly into the region

# Innovation - 新しい価値作り

- “Good science starts with a problem”. *Allen Newell, Late Carnegie Mellon Professor, Turing Award Winner, NAE/NAS Member*
- “Innovation resides at the intersection of invention and insight, leading to the creation of social and economic values. Thus. innovation starts with problems.” *Nicholas Donofrio, ex IBM VP for Innovation and Technology, Council on US Competitiveness*
- “Science of Artificial” *Herbert Simon, Late Carnegie Mellon Professor, Nobel Prize winner*
- “人が何を欲しているか“がすべての始まり  
→ 問題駆動研究 (Problem-“Driven” Research)

# シナリオのある研究

- 何が、どうして、どうなって
- どこで、どんな風に、「役に立つ」か

自由に考え、そして

- 問題を絞り、正確に実行し、
- 本当に動くものを作り上げる

それができる人を集め、実行を通じて学生を  
育てる

# システムを作って見せる面白さを教える

- “役に立つ”技術志向
- システムとして“実際に働く”ことを示したい
- Funding Agencyもそれを要求することが多い — DARPAは勿論、NSFやNIHも
- 超一流の研究者が企業に移ることもおおい
  - Microsoft、最近ではGoogle
  - 日本のロボットベンチャー SHAFT
- **企業 Satellite Lab の存在**
  - Intel, Google, Disney, Facebook
  - Amazon, Googleの人工知能研究へのUmbrella資金

# シナリオ作りのできる ひとを育て、集める

- 教育： Content から Method へ
- 環境： Diversity（多様性）がアイデアの源泉
- 組織： Interdisciplinary、Inter-culture, Inter-X

- Warning!

Paul Graham (big VC, Y Combinator Founder), in his recent talk at CMU said, essentially “Top-rank people and tangential living environmental factors are everything”.