

# Research@PennState

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Industry Day 2014, April 1-2, 2014

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- Research by the numbers
- Research portfolio highlights
- IP@PSU: a fresh approach to catalyze industry partnerships

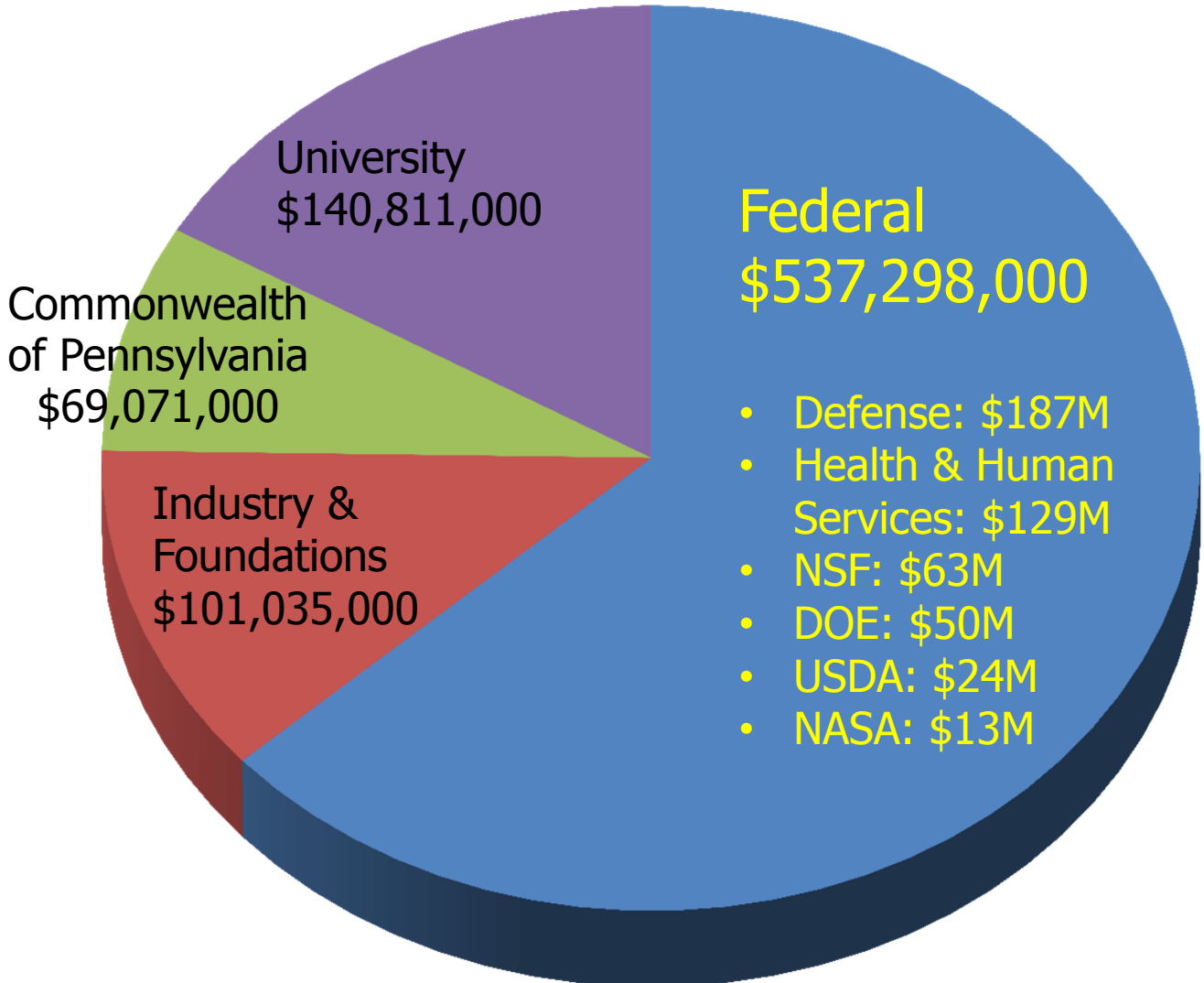
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...by the numbers

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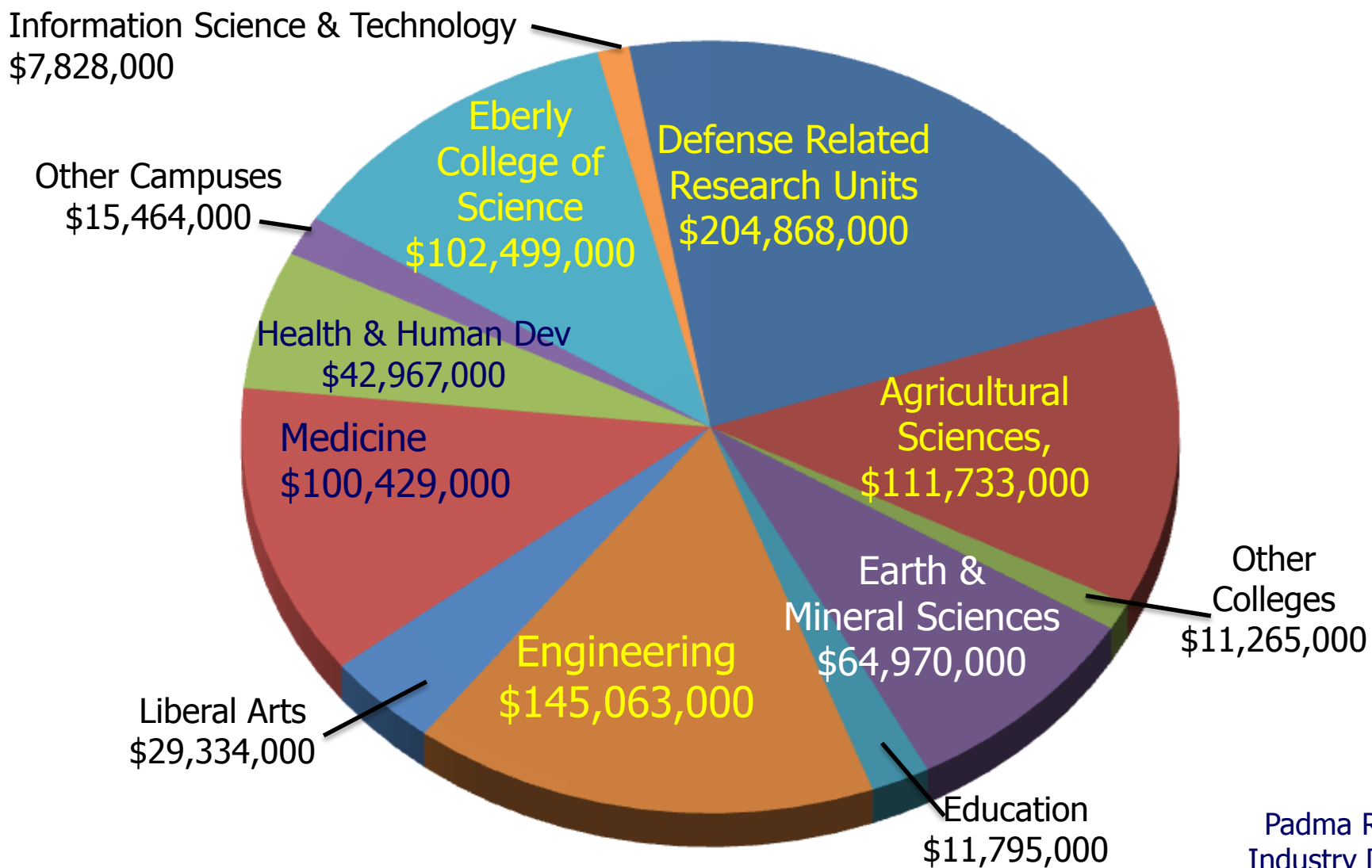
# Research Expenditures & Source of Funds

**FY2013 Total: \$848,215,000**



# Research Expenditures by College

**FY2013 Total: \$848,215,000**



# NSF Science & Engineering Research Expenditures

## Rankings for FY 2012

(released Nov 2013)

|                        | Total Engineering | Aero/Astro-Engineering | Bio-Engineering | Chemical Engineering | Civil Engineering | Eng - Electrical | Eng - Materials | Eng - Mechanical | Total Physical Sciences | Chemistry | Physics   | Astronomy | Total Environmental Sci | Atmospheric | Earth Sciences | Oceanographic | Mathematical | Computer Science | Total Life Sciences | Agricultural | Biological | Medical   | Psychology | Total Social Sciences | Economics | Political Science | Sociology | Number In Top Ten Fields/Subfields |
|------------------------|-------------------|------------------------|-----------------|----------------------|-------------------|------------------|-----------------|------------------|-------------------------|-----------|-----------|-----------|-------------------------|-------------|----------------|---------------|--------------|------------------|---------------------|--------------|------------|-----------|------------|-----------------------|-----------|-------------------|-----------|------------------------------------|
| Johns Hopkins          | 1                 | 1                      | 3               | 7                    | 25                | 1                | 73              | 1                | 3                       | 24        | 1         | 6         | 19                      | 22          | 91             | 21            | 1            | 3                | 2                   | -            | 8          | 5         | 68         | 71                    | 87        | 191               | 21        | 14                                 |
| U. Michigan            | 7                 | 15                     | 24              | 17                   | 24                | 7                | 15              | 8                | 22                      | 11        | 22        | 22        | 48                      | -           | 13             | -             | 8            | 77               | 4                   | 51           | 14         | 8         | 5          | 1                     | 1         | 1                 | 2         | 11                                 |
| U. Wisconsin           | 18                | -                      | 41              | 18                   | 20                | 49               | 37              | 40               | 12                      | 27        | 10        | 21        | 16                      | 5           | 39             | 46            | 27           | 15               | 7                   | 27           | 10         | 9         | 66         | 4                     | 5         | 34                | 7         | 8                                  |
| U. Washington          | 19                | 27                     | 4               | 35                   | 21                | 17               | 42              | 37               | 23                      | 10        | 25        | 18        | 1                       | 7           | 44             | 4             | 2            | 44               | 8                   | 54           | 21         | 10        | 50         | 75                    | -         | 53                | 27        | 7                                  |
| UC San Diego           | 15                | -                      | 5               | -                    | -                 | 5                | -               | 19               | 16                      | 8         | 11        | -         | 3                       | 9           | 5              | 2             | 42           | 8                | 12                  | 210          | 86         | 4         | 4          | 38                    | 52        | 13                | 42        | 10                                 |
| UC San Francisco       | -                 | -                      | -               | -                    | -                 | -                | -               | -                | 85                      | 39        | -         | -         | -                       | -           | -              | -             | -            | -                | 1                   | -            | 100        | 1         | -          | -                     | -         | -                 | -         | 2                                  |
| Duke                   | 47                | -                      | 11              | -                    | 82                | 23               | 59              | 65               | 61                      | 70        | 44        | -         | 42                      | -           | 88             | 36            | 13           | 80               | 3                   | -            | 5          | 3         | 13         | 22                    | 29        | 8                 | 20        | 4                                  |
| UC Los Angeles         | 34                | -                      | 58              | 47                   | 75                | 25               | 29              | 20               | 13                      | 25        | 5         | -         | 41                      | 24          | 28             | -             | 22           | 25               | 6                   | -            | 109        | 2         | 20         | 10                    | 117       | 76                | 22        | 4                                  |
| Stanford               | 14                | 17                     | 12              | 13                   | 27                | 14               | 48              | 13               | 10                      | 16        | 71        | -         | 29                      | -           | 25             | 43            | 18           | 19               | 17                  | -            | 20         | 19        | 29         | 27                    | 27        | 18                | 37        | 1                                  |
| Columbia               | 45                | 40                     | 17              | 66                   | 66                | 28               | 119             | 67               | 25                      | 51        | 15        | 17        | 7                       | 10          | 2              | -             | 34           | 18               | 14                  | 82           | 13         | 12        | 59         | 23                    | 80        | 17                | 15        | 3                                  |
| UNC Chapel Hill        | 205               | -                      | 65              | -                    | -                 | -                | -               | -                | 43                      | 18        | 57        | -         | 27                      | -           | 11             | 29            | 36           | 29               | 10                  | -            | 11         | 18        | 1          | 3                     | 186       | 38                | 1         | 4                                  |
| U. Pittsburgh          | 94                | -                      | 31              | 45                   | 114               | 117              | 125             | 69               | 51                      | 35        | 83        | 37        | 75                      | -           | 111            | -             | 45           | 62               | 5                   | -            | 15         | 6         | 39         | 109                   | 123       | 101               | 143       | 6                                  |
| U. Penn                | 61                | -                      | 30              | 69                   | -                 | 37               | 30              | 53               | 44                      | 43        | 32        | -         | 170                     | -           | 112            | -             | 53           | 24               | 9                   | 68           | 6          | 7         | 39         | 25                    | 85        | 46                | 17        | 3                                  |
| U. Minnesota           | 23                | 28                     | 13              | 15                   | 16                | 43               | -               | 18               | 32                      | 44        | 20        | 38        | 55                      | -           | 21             | -             | 14           | 28               | 15                  | 12           | 31         | 15        | 8          | 14                    | 11        | 14                | 6         | 2                                  |
| MIT                    | 3                 | 7                      | 1               | 2                    | 15                | 6                | 3               | 6                | 4                       | 9         | 4         | 9         | 18                      | 14          | 18             | 32            | 20           | 7                | 94                  | -            | 47         | 115       | 120        | 36                    | 10        | 20                | 295       | 12                                 |
| Cornell                | 27                | -                      | 48              | 46                   | 61                | 41               | 22              | 35               | 6                       | 20        | 9         | 7         | 44                      | -           | 37             | 91            | 47           | 21               | 18                  | 23           | 26         | 17        | 52         | 16                    | 4         | 163               | 11        | 4                                  |
| Harvard                | 58                | -                      | 63              | 65                   | 93                | 76               | 25              | 82               | 14                      | 5         | 17        | 14        | 34                      | 67          | 47             | -             | 17           | 161              | 21                  | 193          | 2          | 47        | 78         | 5                     | 40        | 3                 | 52        | 4                                  |
| <b>Penn State 2012</b> | <b>4</b>          | <b>8</b>               | <b>76</b>       | <b>16</b>            | <b>11</b>         | <b>4</b>         | <b>1</b>        | <b>4</b>         | <b>18</b>               | <b>17</b> | <b>13</b> | <b>15</b> | <b>13</b>               | <b>8</b>    | <b>8</b>       | <b>34</b>     | <b>10</b>    | <b>10</b>        | <b>48</b>           | <b>10</b>    | <b>65</b>  | <b>60</b> | <b>3</b>   | <b>17</b>             | <b>32</b> | <b>33</b>         | <b>3</b>  | <b>12</b>                          |
| Ohio State             | 12                | 63                     | 98              | 26                   | 23                | 18               | 7               | 5                | 35                      | 42        | 29        | 32        | 67                      | -           | 31             | -             | 21           | 11               | 24                  | 18           | 45         | 26        | 26         | 26                    | 24        | 21                | 31        | 2                                  |
| UC Berkeley            | 11                | -                      | 114             | 39                   | 6                 | 3                | 123             | 192              | 9                       | 13        | 24        | 3         | 63                      | 110         | 23             | -             | 30           | -                | 62                  | 22           | 50         | 73        | 49         | 6                     | 2         | 22                | 24        | 6                                  |

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... some highlights

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## Transforming Networking & Security

- 2009: "Ultimately we will be able control the behavior of communication networks in a way that allows people to exchange the most important information." Tom L Porta (PI)



- 2013: "We're going to develop a new science of understanding how to make security-relevant decisions in cyberspace." Patrick McDaniel (PI)

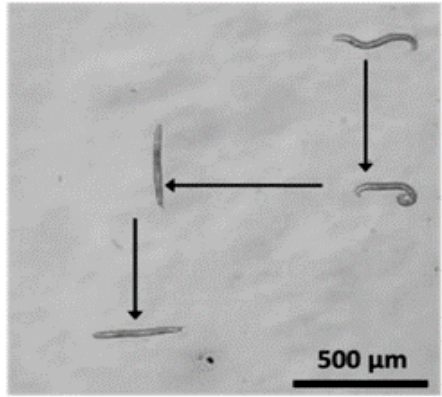
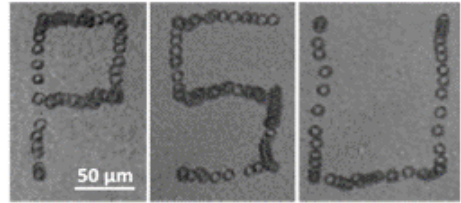
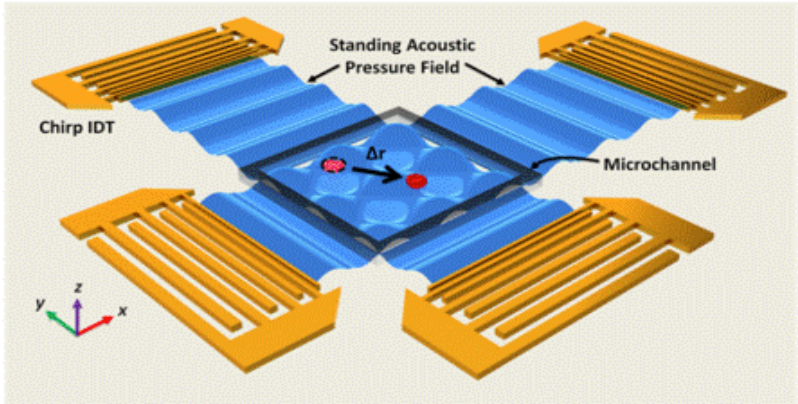


# Center for Nanoscale Science NSF MRSEC 2000-Renewal 2014 Vin Crespi (PI)

## Manipulating Single Cells & Organisms with Acoustic Tweezers



Penn State MRSEC DMR-0820404: X. Ding, S.-C. S. Lin, B. Kiraly, H. Yue, S. Li, J. Shi, S. J. Benkovic, and T. J. Huang



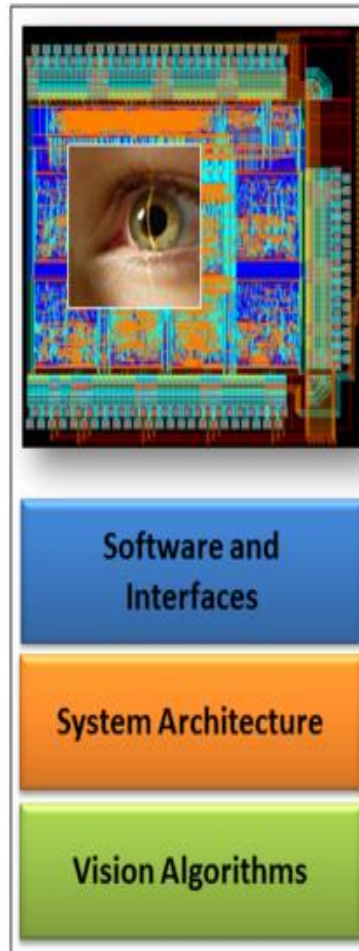
MRSEC researchers have developed a novel acoustic manipulation platform – acoustic tweezers – which can trap and manipulate single microparticles, cells and entire organisms along programmed routes in two dimensions within a microfluidic chip. “PSU” is spelled by moving a bovine red blood cell. The organism *C. elegans* can be manipulated and immobilized. With its non-invasiveness, miniaturization and versatility, these acoustic tweezers will become a powerful tool for many disciplines of science and engineering.

# Visual Cortex on Silicon NSF Expeditions 2013

Vijay Narayanan (PI)

Towards a machine vision system that will approach the cognitive abilities of the human cortex.

“With this expedition, we are aiming to leapfrog the intelligence of these vision systems to approach human cognitive capabilities, while being extremely energy efficient and user friendly.”  
Vijay Narayanan (PI)



# Sustainable Climate Risk Management

NSF Research Network 2012

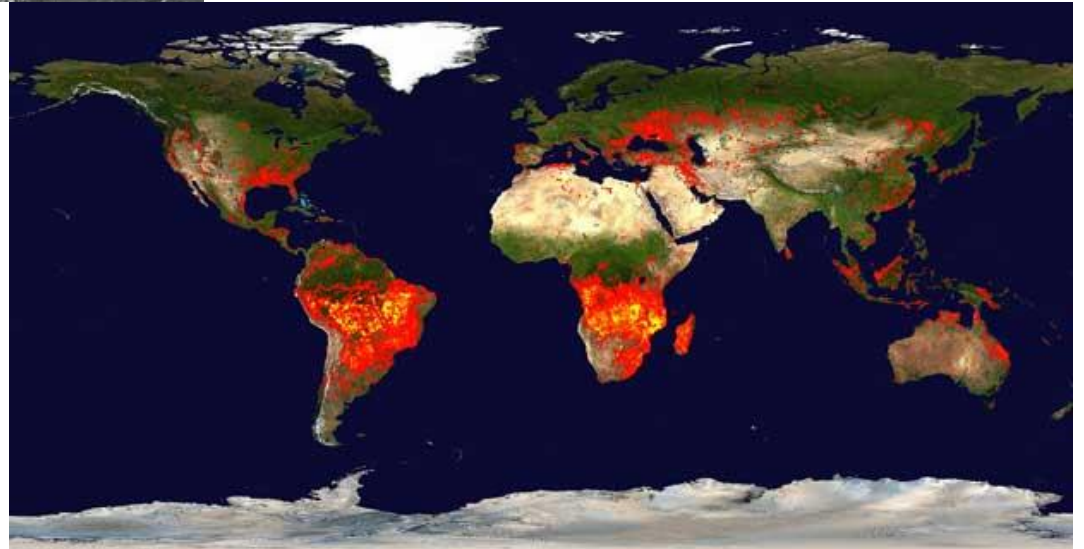
Klaus Keller(PI)



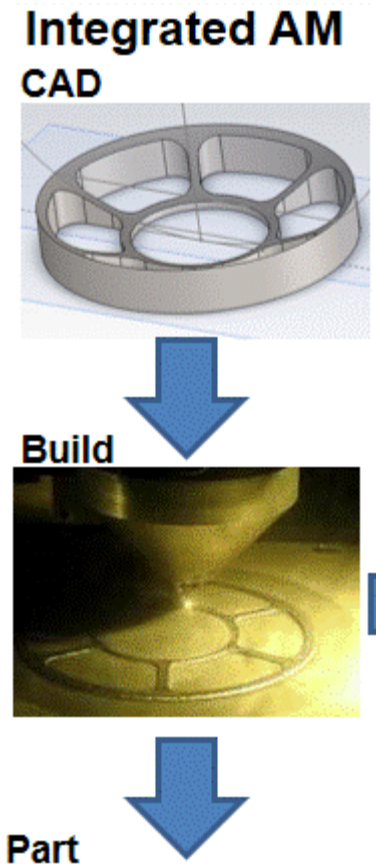
What are sustainable, scientifically sound, technologically feasible, economically efficient, and ethically defensible climate risk management strategies?"

"Our goal is to advance the foundations of sustainability research through an integrated and quantitative approach that links the social, economic and environmental components of climate risk management."

Klaus Keller (PI)



# Center for Innovative Materials Processing(CIMP-3D) DARPA Demonstration Facility for Additive Manufacturing



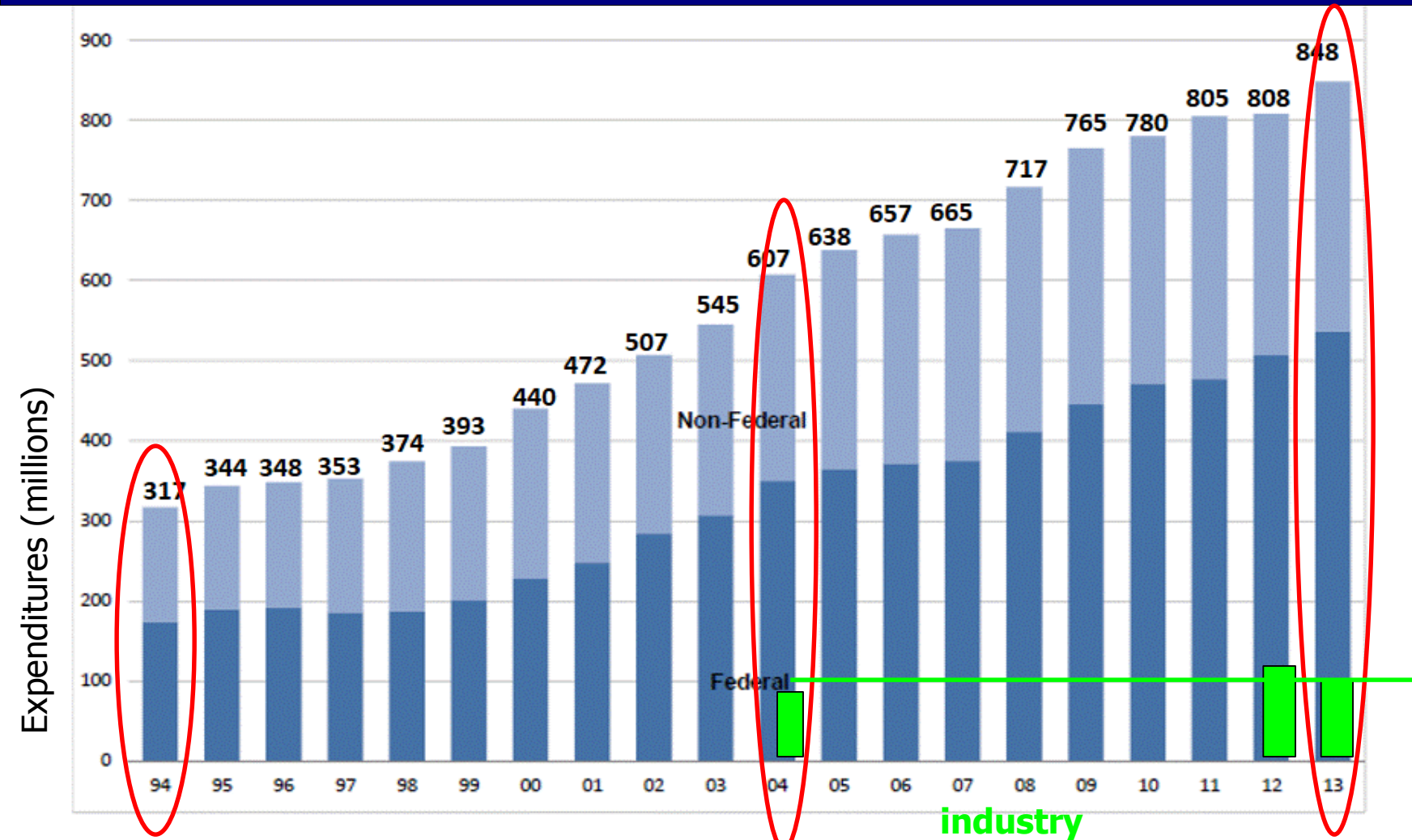
- Direct digital deposition uses complex computerized descriptions of objects to directly create objects by gradually depositing a variety of materials in specific locations.
- CIMP-3D allows industry participants to evaluate the technology.
- Industrial users will be able to develop, demonstrate, test and assess direct digital deposition quickly and inexpensively.



Sciaky Electron Beam DDM

# Research Growth

## 20 Year History



❖ A fresh approach to  
IP @PSU to catalyze  
industry partnerships

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# IP@PennState for Industry-Sponsored Research

## Effective July 1, 2012

- A company sponsoring research has the option to request ownership of Intellectual Property (IP) resulting from a sponsored project
- If all Penn State researchers involved in the project agree to release the IP, then the IP terms of the agreement will be such that any new IP generated will be the property of the sponsoring company
- A quick turnaround 5-step process for assigning ownership of the IP to a company sponsor
- Contact OSP at 814-865-1372 or [osp@psu.edu](mailto:osp@psu.edu) or OTM at 814-865-6277 or [otminfo@psu.edu](mailto:otminfo@psu.edu)
- One-page flyer on IP policy changes

