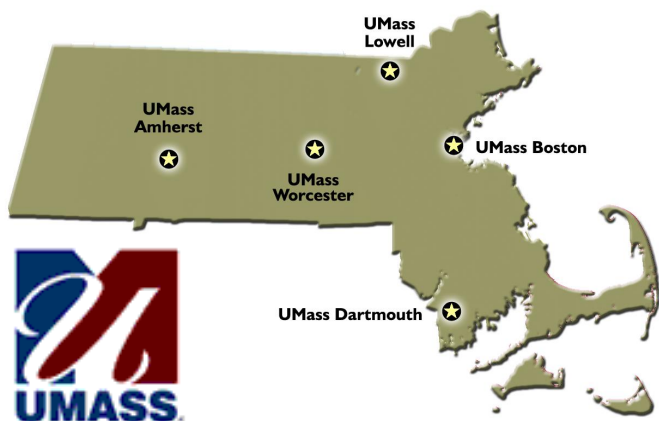


## UMass: An innovation imperative for the Commonwealth

Dr. Jack M. Wilson, President  
The University of Massachusetts

19 Nov. 2003



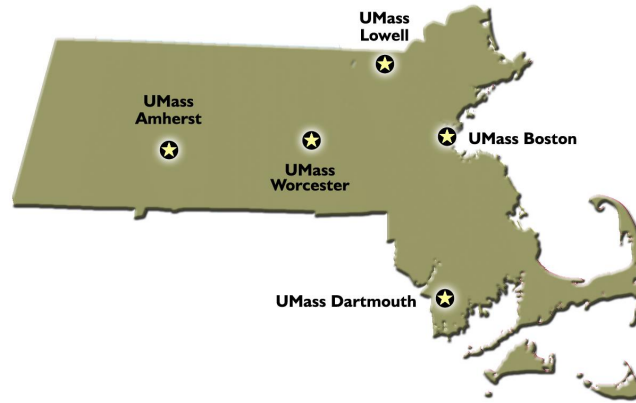
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Boston, MA 19 November 2003



## UMass: Powering innovation across Massachusetts

### A research asset for the Commonwealth



#### UMASS AMHERST

**Engineering Research Center** – Oct. 1 announced \$40 million plan to create new technology to revolutionize weather forecasting.

**Pioneer Valley Life Sciences Initiative** – \$90 million UMass/Bay State Medical bio-technology partnership under development.

**Materials Research Science and Engineering Center** – Received \$12 million NSF grant focusing on polymer-related nanotechnology. The University was one of 12 institutions chosen from a field of 100 contenders.

#### UMASS MEDICAL, WORCESTER

**Lazare Medical Research Building** – \$100 million facility opened in 2001 to advance cancer, diabetes, genetics, HIV, RNAi and other research.

**Center For Infectious Disease Vaccine Research** - \$16 million NIH grant awarded Sept. 2003 to develop vaccines and therapies for bioterror-related illnesses.

**Massachusetts Biologics Laboratory** – \$80 million facility under construction at former Boston State Hospital in Mattapan. Manufactures vaccines and recently began effort to develop SARS vaccine.

#### UMASS SYSTEM

**Office of Commercial Ventures and Intellectual Property** – Based at the UMass Office of the President, licenses UMass research to commercial firm. Earned \$20 million in licensing payments for the University last year.

#### UMASS LOWELL

**Submillimeter Wave Technology Lab** -- \$25 million Department of Defense initiative to improve radar systems.

**Commercial Venture Development Area** – A high-tech incubator that spawns companies from UMass Lowell research. Konarka Technologies, a solar technology company in based in Lowell, is among the success stories.

#### UMASS BOSTON

**Environmental Science and Technology** – Recently received \$1.5 million in federal funds to begin development of state-of-the art complex.

#### UMASS DARTMOUTH

**National Center For Botulinum Research** – Oct., 2 announced \$17 million partnership with Tufts University to fight urgent bio-terror threat.

**Marine Science and Technology Center** -- \$15 million New Bedford facility opened in 1997. Attracts nearly \$5 million in research funding and has been credited with saving the scalloping industry \$50 million.

**Advanced Technology and Manufacturing Center** – Partnership between UMass Dartmouth and MassDevelopment, this Fall River incubator economic development incubator builds high-tech businesses UMass Dartmouth research.



## The UMass Formula:

**Education + Innovation = Prosperity**

### **Education**

**UMass removes financial, geographic and temporal barriers to high quality education (58,000 students)**

### **Innovation**

**UMass ignites innovation-based economic development in every region (\$300M in research)**

**The road to regional economic development in Massachusetts must go through UMass.**

## **Massachusetts is losing its mind (share)!**

### **A challenge for the Commonwealth**

- Massachusetts' 19-24 population declined by 18% during the 90s**
- Growing evidence that those who leave are relatively highly educated.**
- Massachusetts has the largest annual net outflow of college graduates.**

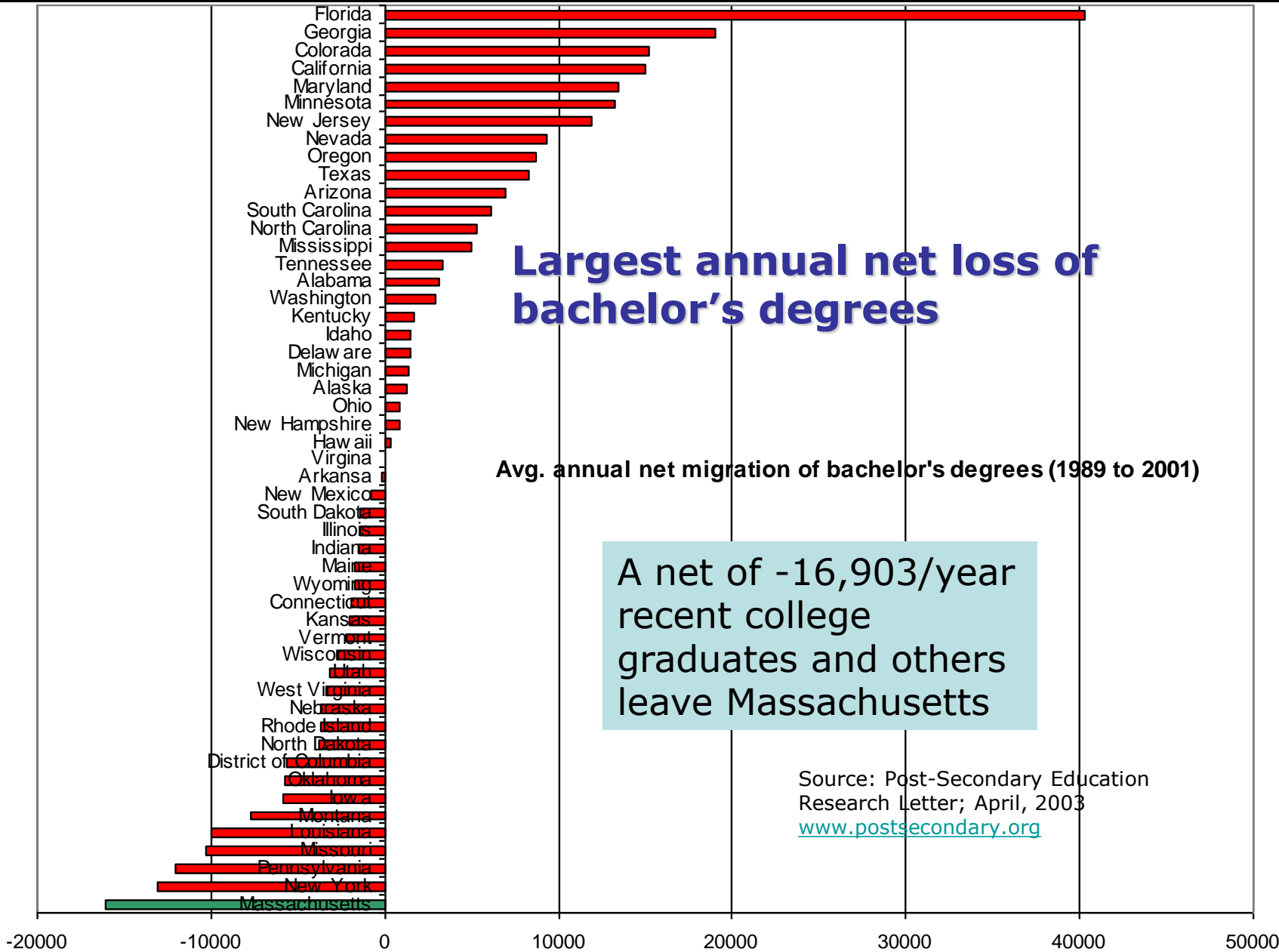


## Largest annual net loss of bachelor's degrees

Avg. annual net migration of bachelor's degrees (1989 to 2001)

A net of -16,903/year recent college graduates and others leave Massachusetts

Source: Post-Secondary Education Research Letter; April, 2003  
[www.postsecondary.org](http://www.postsecondary.org)



## The UMass Response

- Grow our own
  - 85% of our graduates who come from MA stay in MA
- Develop the Innovation Economies of the Regions
  - Many regions are more affordable than greater Boston
  - Many Leave MA due to the high cost of living

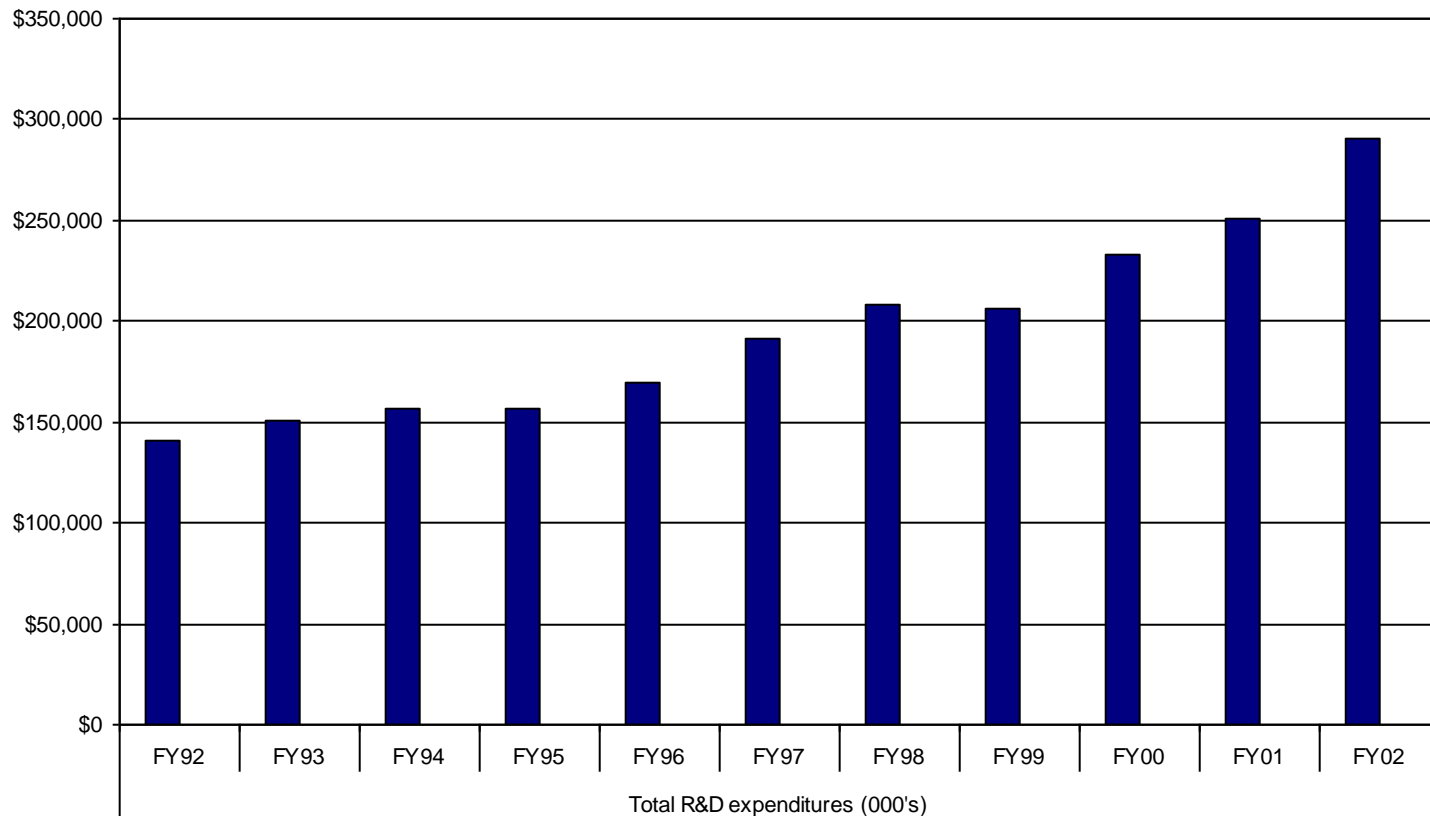
## UMass innovation performance

- 58,000 students
- \$300M in research
- \$20M in research licensing revenue
  - 17th in the US (\$13 M in Q1 )
- Anchor – Worcester Research Park (2,000 jobs)
- Two incubators developed (Fall River, Lowell)
- ED alliances (SE Mass. Partnership, WMass. Regional Tech. Alliance)
- UMassOnline: 13,000 students in workplace



## Innovation Performance

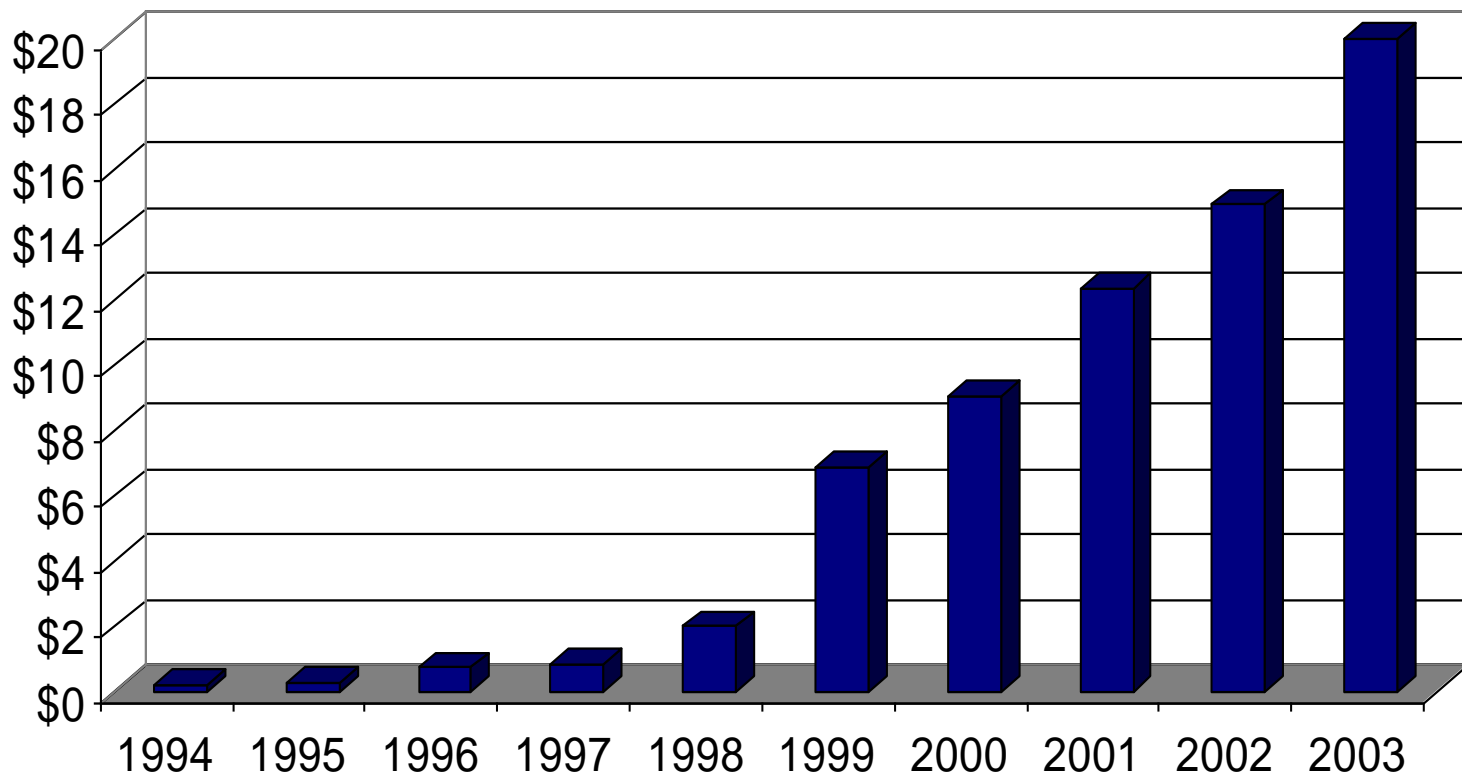
UMass R&D Trends, FY92 - FY02





## Innovation Performance

### Licensing revenue, FY94 – FY03



## Recent Successes

- \$40 M UMA ERC in Atmospheric Sensing
- \$17 Million Tufts UMD Botulinum Center
- \$16 M UMW Immunology Grant
- \$10 M + Licensing of RNAi
- \$20 M CVIP last year and \$13 M in Q1 of this year!
- \$25.9 M contracts funded
- \$10 M Supplemental
- \$2.7 M Star Store
- \$3.0 M Blais Chair to Craig Mello
- \$11 M and 13,000 student in UMassOnline
- Emerging Technology Bills

## Emerging Technology Bill

- \$20 million for matching funds
- \$15 million for John Adams Funds (regional)
- \$2.5 million for Sci-Tech Pipeline (CITI, EiMC)
- \$ 6 million for WTF funds
- R&D Tax Credit
- ITC made permanent
- \$2.5 million for Tech Transfer Center at UMass
- Life Sci pilot on Tax rebate for manufacturing

## Opportunity for UMass

- Increasing Recognition in Corporate Massachusetts of UMass Role in S&T
- Recognition on Beacon Hill of UMass Capacities and Contributions in S&T
- Stepped-up Competition from other States Recognized on Beacon Hill and in Business Community
- First ever competing proposals for new S&T initiatives in MA
- Major new federal initiatives in homeland security and nanotechnology

## Benefits to UMass

- Prestige
- Appreciation for UMass excellence and economic impact
- Targeted State S&T resources for UMass
- Stronger position in federal competitions
- More attractive partner to industry
- Stronger Philanthropy magnet

## Executive Briefing for UMass Board of Trustees

### Technology Road Map and Strategic Alliances Study for Massachusetts

November 4, 2003



CONFIDENTIAL

# A Word on Battelle and Mass Insight

## Mass Insight

- Unique nonpartisan, public policy organization serving Massachusetts since 1989
- Helping to raise the issues on MA continued leadership in science and technology
- Recent report -- ***Economy At Risk*** – shows that MA is being challenged by other states
- Now leading ***Technology Roadmap & Strategic Alliances Study***

## Battelle

- One of world's largest non-profit R&D organizations (\$1,049 million in revenues)
- Contract research with nearly 1,400 firms annually
- Manager of federal labs (Brookhaven, Pacific Northwest, Oak Ridge)
- **Technology Partnership Practice** – highly regarded national consulting group working extensively with universities, business organizations and state & local governments



## Focus of Technology Roadmap Project

- **Addressing the capability of Massachusetts to prevail in an international competition for research, innovation and talent.**
- **Industry concerns that Massachusetts is not keeping up with efforts found in other states.**
- **How to position UMass as a research powerhouse to rival Penn State or UCal campuses**



## Key Project Activities

- Inventory core R&D competencies across industry and universities and assess Massachusetts opportunities
- Address the policies and mechanisms needed for an effective MA science & technology strategy that is industry and performance driven
- Identify selective emerging technologies and conceptualize alliances and consortiums around them

## Key Lessons from Across the Nation

- **The right state investments in science and technology pay off**
- **Public universities are critical for advancing state efforts**
  - **Essential complement for a strong private university sector**
- **Strategic alliances between universities and industry are at the center of state competition**
- **Ultimately, it is a competition for talent**

## Massachusetts: Myths That Might Hold Us Back

- **Myth #1 We're smart, so don't need to compete for research money**
- **Myth #2: We have Harvard and MIT. We don't need U Mass to be a research driver**
- **Myth #3: Life sciences are the only key for our future**
- **Myth #4: We're an R&D state. We can't compete for manufacturing.**
- **Myth #5: State science & technology strategies means "picking winners and losers"**



# **Moving Massachusetts Forward: The UMass Imperative**

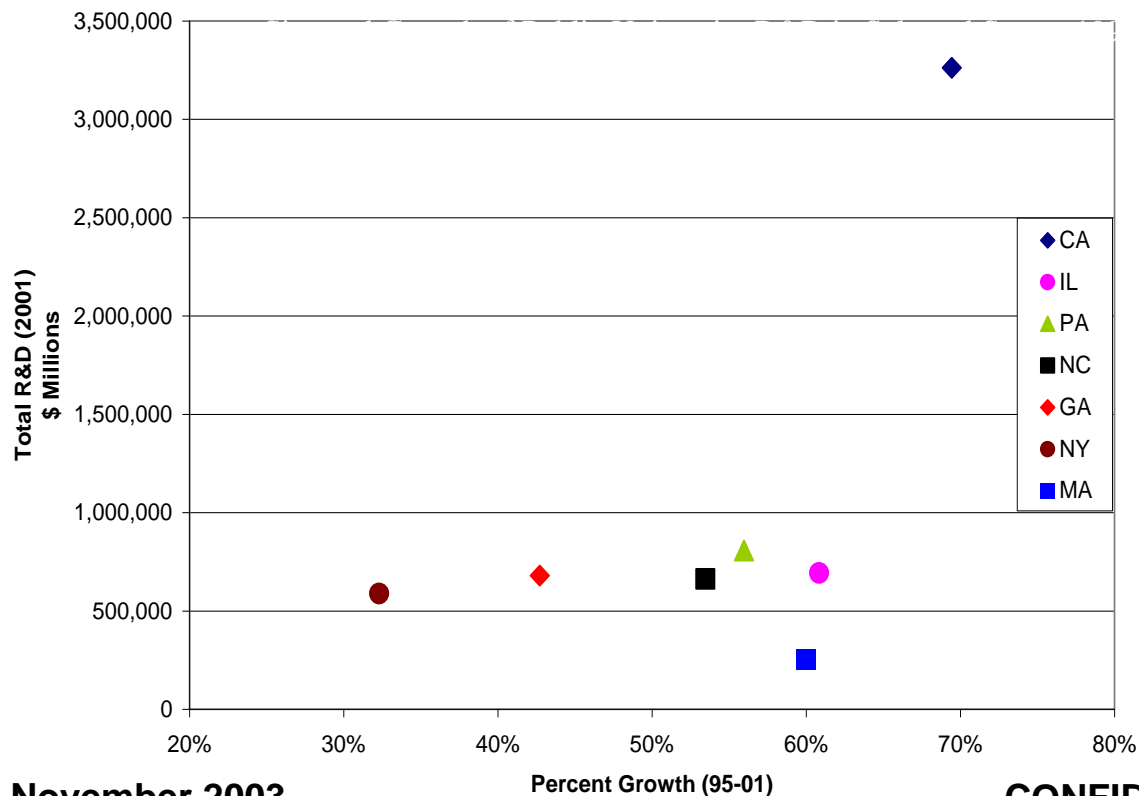
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## UMass needs to be a big part of equation for moving Massachusetts forward

- Successful states have learned that without building capacity, difficult to effectively pursue collaborations and strategic alliances
- **Pennsylvania**
  - Ben Franklin Partnership Program – 20 year track record of success – generated 35,579 job-years in assisting 1850 companies from 1989 to 2001
  - Continued advancement of public universities
  - University of Pittsburgh: grew in research by 87.1%, while Penn State continued to keep pace with national university R&D growth
- **California**
  - Key initiatives: Cal Institutes – at least 4 at \$100 million each in one-time funding for new buildings; UC Discovery Grants – \$50-250k/yr now in 7 fields, total of \$20m annually – matched at least 2:1 by partners
  - At same time, research at the UC campuses grew by 70.7% from 1995 to 2001 – strongest growth in the nation
- **Georgia Research Alliance**
  - \$300 million to attract top research talent over ten year period – largely to public universities as well as Emory -- generated \$900 in leveraged federal research dollars
  - 75 start-up firms associated with eminent scholars recruited, attracted \$500 million in private investments and employ 2,000

## UMass Growing Strongly, But Not in the Top Tier of Public Universities

- UMass R&D grew by 60% from 1995 to 2001, well outpacing the national growth rate of 47.6%
- But at \$251 million in 2001, still well off level of leading universities.
  - Overall system would rank 42nd as a university



## Insights into UMass Amherst

- R&D Ranking: 106
- R&D Growth: 48.3%
- Key Fields (publications analysis)
  - IT & Communications (15<sup>th</sup> in total citations, 1997-2001)
  - Polymers (4<sup>th</sup> in total citations)
  - Cell & Development Biology (20<sup>th</sup> in total citations)
  - Chemical Engineering (16<sup>th</sup> in total citations)
  - AI, Robotics & Auto Control (23<sup>rd</sup> in total citations)
- Observations:
  - Highly productive given a modest level of support and quality of facilities
  - Risk of hollowing out without future investment
  - Research strengths speak to needs of state, but not well connected with MA business base
  - Key developments with new ERC in remote atmospheric sensing, awards in nanotechnology, environmental genomics and alliance with Baystate Health System point to healthy mix of activities

## Insights into UMass Worcester

- R&D Ranking: 40<sup>th</sup> in NIH funding for medical schools, FY 2002
- R&D Growth: 114% in NIH funding from FY 1006 to 2002 compared to 94% nationally
- Strong in several fields based on having over 100 publications and 25% higher citation rate from 1997 to 2001
  - Molecular biology & genetics (133 pubs, 134% higher citation rate)
  - Neurosciences (188 pubs, 111% higher citation rate)
  - Biochemistry (284 pubs, 90% higher citation rate)
  - Immunology (190 pubs, 86% higher citation rate)
  - Microbiology (129 pubs, 60% higher citation rate)
  - Cell & Developmental biology (286 pubs, 54% higher citation rate)
  - Cancer Research (114 pubs, 32% higher citation rate)
- Observations:
  - Major up & coming biomedical institution – following proven path of others before it from UC San Francisco, University of Pittsburgh, UAB
  - RNA interference (gene silencing) is a significant technology platform
  - Key role in biodefense with microbiology & immunology strengths – unique facility/expertise with Mass Biologic Labs
  - Success is found in differences from other UMass campuses – able to build new facilities and develop endowed chairs
  - Key driver in technology transfer for UMass system – very entrepreneurial



## Insights into UMass Lowell

- R&D Ranking: 195 with a research base of over \$20 million in FY 2001
- R&D Growth: 33.2% from FY 1995 to FY 2001
- Key Fields (publications analysis)
  - Organic chemistry/polymer sciences – 47 pubs, 92% higher citation rate
  - Material sciences and engineering – 32 pubs, 56% higher citation rate
  - Environmental medicine & public health – 35 pubs, 40% higher citation rate
  - Applied physics/material sciences – 59 pubs and 21% higher citation rate
- Observations:
  - Very focused development in material sciences, plastics processing and nano mfg – just missed out of an NSF center
  - Varied activities in biomedical arena from drug delivery, bioprocessing, diagnostics and nutraceutical testing & evaluation – innovative use of polymer based nanoparticles for drug delivery, scale-up testing facility for biopharmaceuticals.
  - Submillimeter wave technology is a specific niche activity
  - Strong commitment to regional development stands out – found in focus of research, supportive activities and commercial venture center

## Insights into UMass Dartmouth

- R&D Ranking: 247 with \$9.4 million research base in FY 2001
- R&D Growth: 155.8% from FY 1995 to FY 2001
- Specific focus areas in research gaining national recognition:
  - Marine science with focus on fisheries science, coastal systems, autonomous underwater platform – key capabilities in modeling dynamics of ocean, oceanography
  - Textile science program including electrostatic textile processes, non-wovens, coated fabrics and applying nanotechnology to new fiber materials; active member of 8-university National Textile Center consortium
  - Detection tools and treatments for botulism poisoning led by Professor Bal-Ram Singh – Major new NIH center award creates ability to grow biochemistry & biotechnology efforts
- Active connections with regional development
  - Advanced Technology and Manufacturing Center
    - Active program for partnering with industry and advancing new ventures
    - Offers a platform for new technology business activity
  - School for Marine Science and Technology
    - Connection with Navy, Woods Hole, fisheries
  - Workforce development – key source of engineers for region, address talent pool for region

## Insights into UMass Boston

- R&D Ranking: 232 with \$11.7 million in research funding in FY 2001
- R&D Growth: 27.6% from FY 1995 to FY 2001
- Developing a focused, well-rounded research expertise in environmental health, science and technology linked with strong industry outreach
  - Growing green chemistry – 19 faculty members across departments involved in program area -- implications for renewable energy, water purification, advanced detection techniques;
  - Environmental biology focusing on ecosystem degradation, water quality
  - Eco-informatics involving novel distributed information systems on ecosystems involving computer visualization and unique software algorithms
- Integrated approach with active outreach to industry can position UMass Boston to be a solutions provider and draw on research strengths found across public and private universities.
- Key workforce development role in Boston
  - Recent NSF award for regional center to meet needs for IT workers



## Broader Technology Roadmap Findings

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## Core competency analysis points to need in Massachusetts for a diversified university research base

### *Non-Life Science Areas*

- **Advanced Materials**
- **Signal processing, electronics & optics**
- **Computer networking, data storage & management and vertical applications**
- Instruments, controls, sensors & mechatronics
- **Environmental sciences**

### *Life Sciences Areas*

- **Genomics & proteomics**
- Drug discovery and development
- **Immunology and infectious diseases/HIV**
- **Cancer**
- Cardiovascular diseases
- **Neurosciences**
- Clinical research & health studies

### *Cross-cutting applications*

- **Biomedical devices**
- **Renewable energy**
- **Sensors**

## Broad Alignment of UMass Research Activities with Core Focus Areas – Illustration of Linkages

- **Advanced Materials**
  - Significant strengths in advanced materials at Amherst and Lowell covering polymers, plastic processing and nano-manufacturing; Dartmouth brings specialized focus on textiles
- **Environmental**
  - Strong area of focus across many campuses, particularly Boston, Dartmouth & Amherst – opportunity for UMass to be a leader in emerging fields from environmental genomics to ecosystems to green chemistry
- **Life Sciences is a strong and fast growing area of research capabilities at UMass**
  - Key lead by Worcester, but Amherst has a “hidden” life sciences strengths and pockets of strength at Dartmouth and Lowell
  - Opportunities for bioinformatics with data mining and computational modeling expertise
- **Renewable Energy**
  - Draws on advanced materials and environmental (esp green chemistry) strengths for unique batteries, solar energy and fuel cells

## Broad Alignment of UMass Research Activities with Core Focus Areas – Illustration of Linkages

- Signal Processing & Electronic/Optic Components
  - Amherst strengths in wireless technologies, interface of software and hardware, submillimeter wave, antennas
  - Pockets of efforts at Lowell efforts in submillimeter wave, and Dartmouth involved in signal processing, use of antennas and electromagnetic modeling of cars and aircraft for wireless communications
- Computer Networking, Data Storage and Vertical Applications
  - Amherst brings a leading computer science department with strengths in computer networking, information retrieval, machine learning, computational modeling
- Medical Devices
  - Key area of opportunity; Worcester most active with sensing and imaging technologies, but opportunity to apply advanced materials and engineering strengths found at Amherst, Lowell and Dartmouth

## The “Good” News and the “Bad” News

### The Good News

- **Massachusetts is still a leader in R&D in universities, teaching hospitals and industry**
- **Not a “one-trick” pony – many areas of science and technology**
- **We have existing or emerging R&D strengths across the state**
- **R&D at UMass is growing faster than that of the US and state’s private research universities**
- **Enormous opportunities for continued leadership in R&D**

### The Bad News

- **Much of current success depends on past infrastructure investments, such as creation of UMass Medical Center**
- **Competition from other states has intensified and Massachusetts is losing market share in many fields**
- **Need for diversified R&D base is threatened by shifting focus of federal R&D**
- **Changing nature of R&D and federal opportunities calls for more “strategic alliances” and closer “university-industry linkages” than have been the norm in Massachusetts**
- **Not all regions are well positioned to capture the economic benefits from our R&D base**



## What does Massachusetts Need to be Successful?

- **Ensure capacity building, and not just matching programs**
  - **Further development of UMass is critical – addresses regional needs, broad range of core focus areas and talent pool generation**
  - **Focus on infrastructure (capital facilities) and faculty (endowed chairs)**
- **Advance multi-institutional collaboration to leverage private university involvement**
  - **Major federal research centers – signature facilities**
  - **Effective industry-university partnerships around emerging technologies.**
- **Make the connection between university research and economic development more seamless**
  - **Incubators**
  - **Incorporate prototyping/proof-of-concept programs**
  - **Pre-seed investments**
  - **Key role of matching programs**
- **Achieve State success through Regional approach**
  - **Strengthen regions by building statewide collaborations**
  - **May need specialized economic development incentives and mechanisms**

## Concluding Observations on UMass

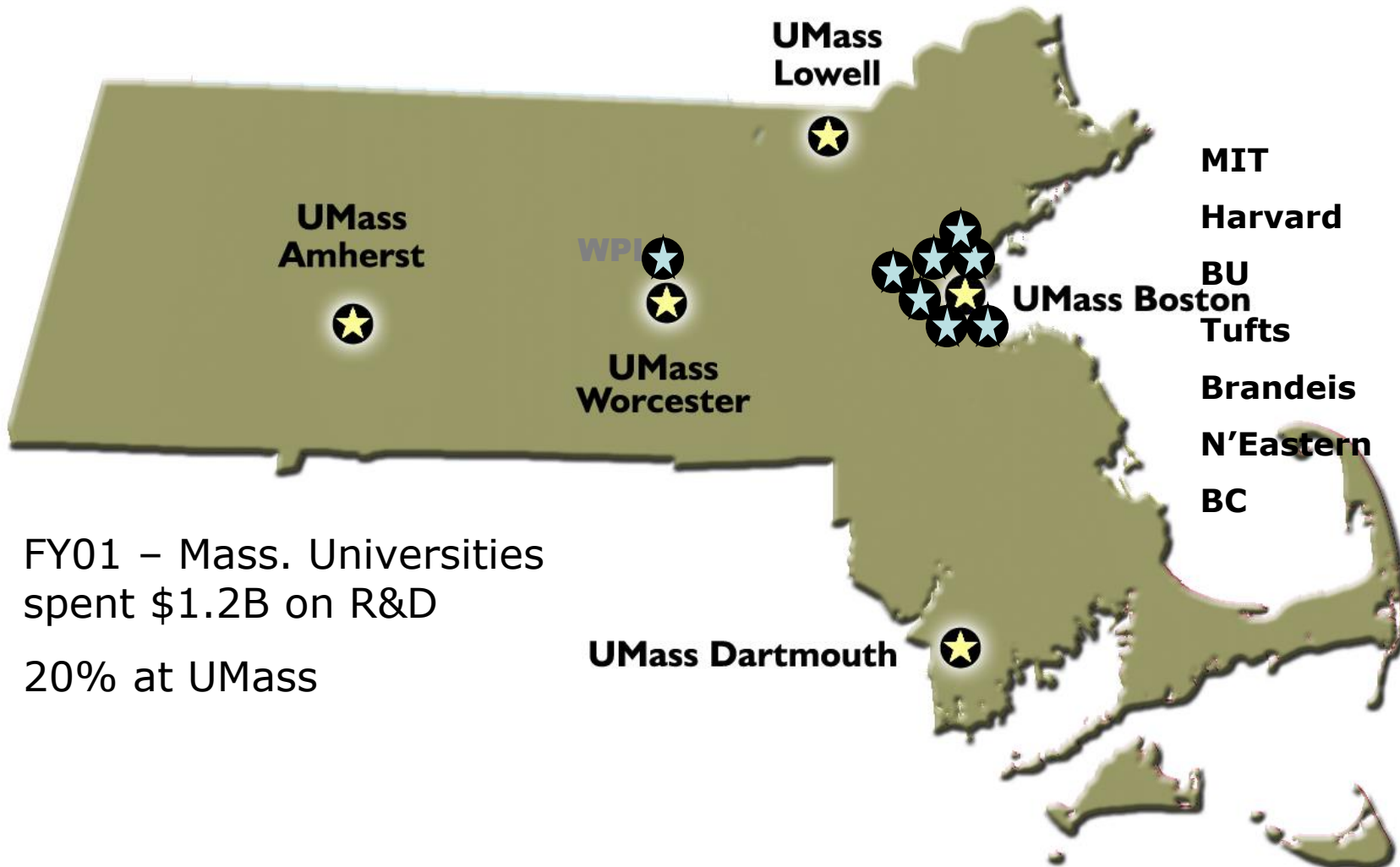
- **Vibrant system, committed leadership across the system**
- **Emerging examples of collaboration across the system (e.g. marine science, bioengineering and CITI) and with private institutions (e.g. Baystate, Tufts) can set UMass apart from traditional public universities**
- **Recent record of above-average R&D growth and notable successes (e.g., ERC, CVIP), but still a ways to go to reach key state competitors**
  - UMass still half the size of public universities in other top R&D states – North Carolina, Pennsylvania, Illinois, New York, Georgia
- **Continued development requires a sustained investment effort in capital facilities and faculty – can't live on past successes**
- **But funding is not the only issue**
  - Difficulties and delays in constructing facilities
  - Need for additional mechanisms to strengthen connections with industry and economic development
  - Potential for additional multi-campus collaboration and private linkages
  - Need to unleash the entrepreneurial drive found across the campuses
-

## An action agenda

- **ADVOCATE FOR UMASS ROLE IN STATE S&T PROPOSALS – Ongoing dialogue with Governor, House, Senate**
- **SECURE SUPPORT OF STATE'S INDUSTRY-BASED TECHNOLOGY COUNCILS – Achieved (High Tech, Bio-Tech, Software, MassMedic, Telecom, et al)**
- **S&T ROADMAP STUDY WITH MASS INSIGHT AND BATTELLE –Underway, completion due December, 2003**
- **SPONSOR INCUBATOR CONFERENCE – Nov. 12, 2003 @ UMD (ATMC)**
- **ESTABLISH PRESIDENT'S HIGH TECH ADVISORY COUNCIL – December, 2003**
- **CREATE S&T NEW INITIATIVES FUND TO STRENGTHEN SYSTEM-WIDE COLLABORATION AND STRATEGIC ALLIANCES – Proposal being drafted for Board review**
- **CREATE CVIP DEVELOPMENT FUND TO MOVE TECHNOLOGIES CLOSER TO COMMERCIALIZATION -- Achieved**

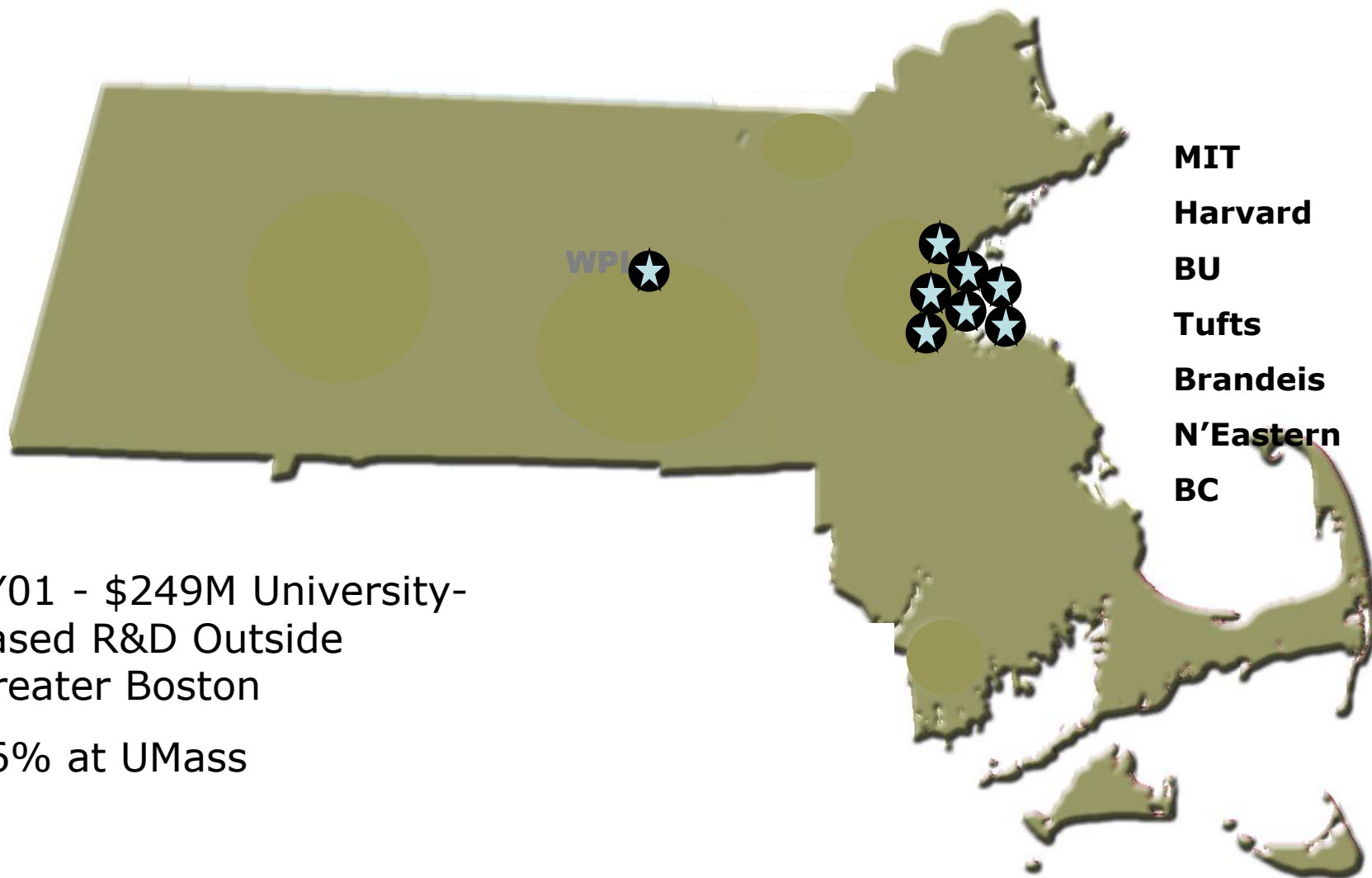


## Mass. Innovation w/UMass



FY01 – Mass. Universities  
 spent \$1.2B on R&D  
 20% at UMass

## Mass. Innovation w/out UMass



FY01 - \$249M University-based R&D Outside Greater Boston

96% at UMass



# THANK YOU!

