

Government's Evolving Role in Supporting Corporate R&D: Theory and Practice in the Advanced Technology Program

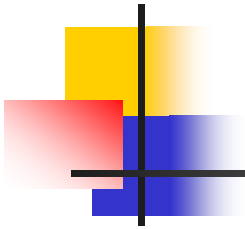


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Outline

- ATP's mission and background
- Economic rationale for ATP
- Fifteen years of Innovation
- ATP Practices
 - ATP is part of NIST
 - Project competition & selection
 - Project management
 - Project and portfolio evaluation

ATP is Praised by National Academy of Sciences

“The Committee finds that the **Advanced Technology Program** is an effective federal partnership program. The selection criteria applied by the program enable it to meet broad national needs and help ensure that the benefits of successful awards extend across firms and industries. Its cost-shared, industry-driven approach to funding promising new technological opportunities has shown considerable success in advancing technologies that can contribute to important societal goals.”

The Advanced Technology Program, Assessing Outcomes,
C.W. Wessner, editor, National Academy of Sciences, 2001, page 87.



ATP's Mission and Rationale

ATP mission

*To accelerate the development of
innovative technologies for
broad national benefit through
partnerships with the private sector.*



Key features of the ATP

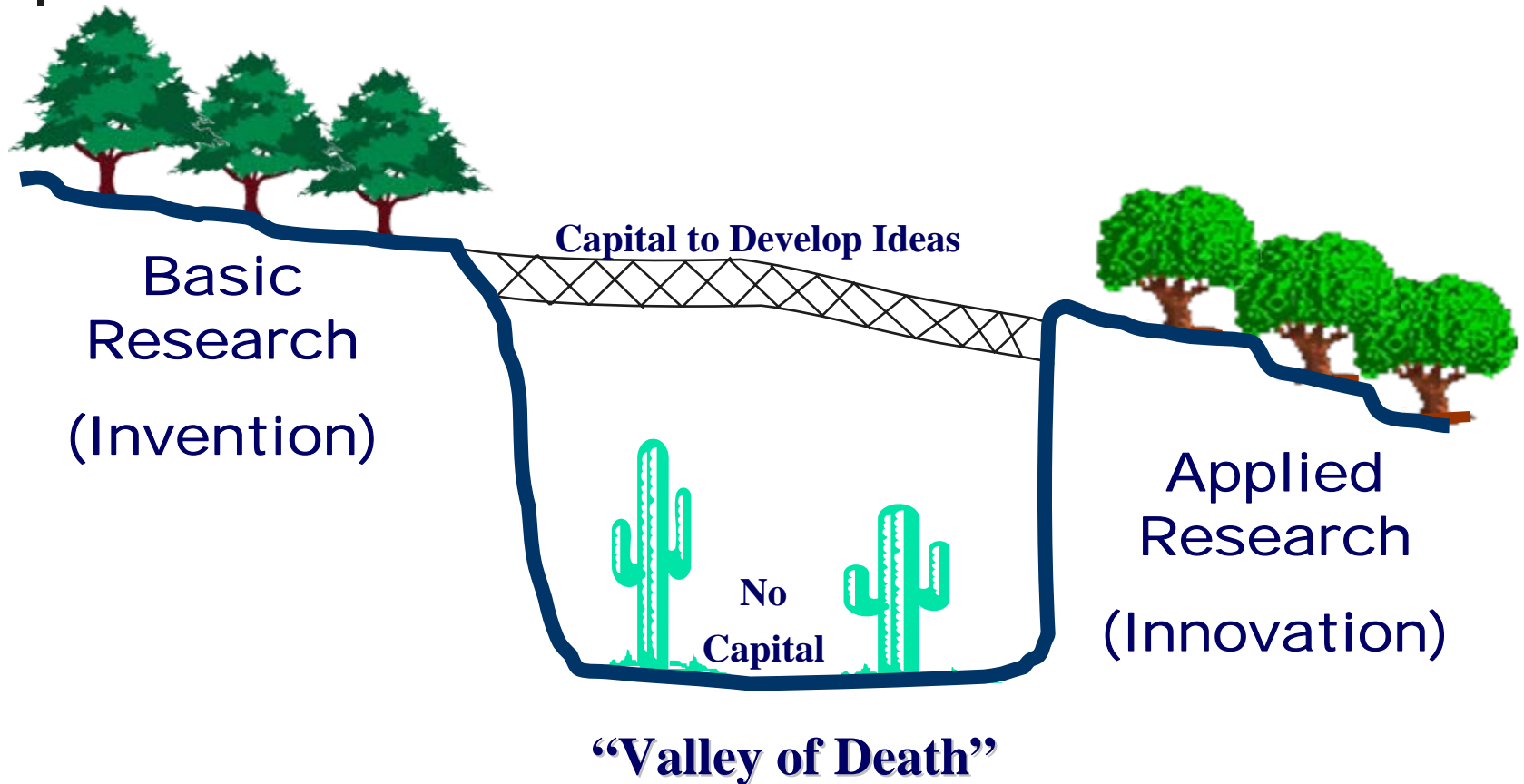
- Emphasis on innovation for broad national economic benefit
- Industry leadership in planning, implementing, and sharing costs of projects
- Project selection based on technical and economic merit
- Demonstrated need for ATP funding
- Requirement that projects have well-defined goals/sunset provisions
- Project selection rigorously competitive, based on peer review
- Program evaluation from the outset

Economic rationale for ATP

Systematic Under-Investment in R&D, due to:

- High technological risk
- Long time horizons
- Knowledge and market spillovers (appropriability)
- Coordination failures
- Information asymmetries

ATP provides a bridge from invention to innovation



Congressman Vernon J. Ehlers

Fifteen years of ATP-funded innovation

- Since 1990, almost 7,000 research proposals submitted to ATP in 44 competitions.
- 768 projects awarded to over 1,500 participants and an equal number of subcontractors.
- 218 joint ventures (28%) and 550 single company projects (72%).
- \$4.3 billion of high risk research funded, with industry contributing half the costs.
 - ATP\$ to joint ventures (56%); to single co projects (44%);
 - average ATP\$ to joint ventures is \$5.9M; to single companies is \$1.8M.
- Small businesses lead 2 out of 3 projects.
- Over 165 universities and 30 national laboratories participate.



ATP Practices

ATP is part of NIST.
The NIST mission is to...

*Develop and promote
measurement,
standards, and
technology to enhance
productivity, facilitate
trade, and improve the
quality of life.*



Gaithersburg, MD



Boulder, CO



Companies Apply for ATP Funding...

As a single applicant company

- For-profit company
- 3-year time limit
- \$2M award cap
- Company pays indirect costs
- Large companies cost share at least 60% of total project cost

As a joint venture

- At least 2 for-profit companies
- 5-year time limit
- No limit on award amount (other than availability of funds)
- Industry share >50% total cost

Project competition and selection: Technical and economic criteria

Scientific and Technological Merit (*50%*)

- Technical innovation
- High technical risk with evidence of feasibility
- Detailed technical plan

Potential for Broad-Based Economic Benefits (*50%*)

- National economic benefits
- Need for ATP funding
- Pathway to economic benefits

Project Selection Process

PROPOSALS



SCREENING



CLASSIFICATION



Gate 1: FULL TECHNICAL PLAN + PRELIMINARY ECON/BUS PLAN

<p>SCIENTIFIC & TECHNOLOGICAL MERIT</p> <ul style="list-style-type: none"> ▪ Technical Innovation ▪ High Technical Risk with Evidence of Feasibility ▪ Detailed R&D Plan 	<p>ECONOMIC/BUSINESS MERIT</p> <ul style="list-style-type: none"> ▪ National Economic Benefits ▪ Need for ATP Funding ▪ Pathway to Economic Benefits
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**Gate 2:
FULL ECONOMIC/BUSINESS
PROPOSAL + BUDGET NARRATIVE**



Gate 3: SEMIFINALISTS IDENTIFIED

- *Oral review*



Gate 4: AWARD



**Cooperative
Agreement**



DEBRIEFING

Project management

Projects evaluated regularly

- Continuation/termination.
- Annual visits (or more often for larger projects).

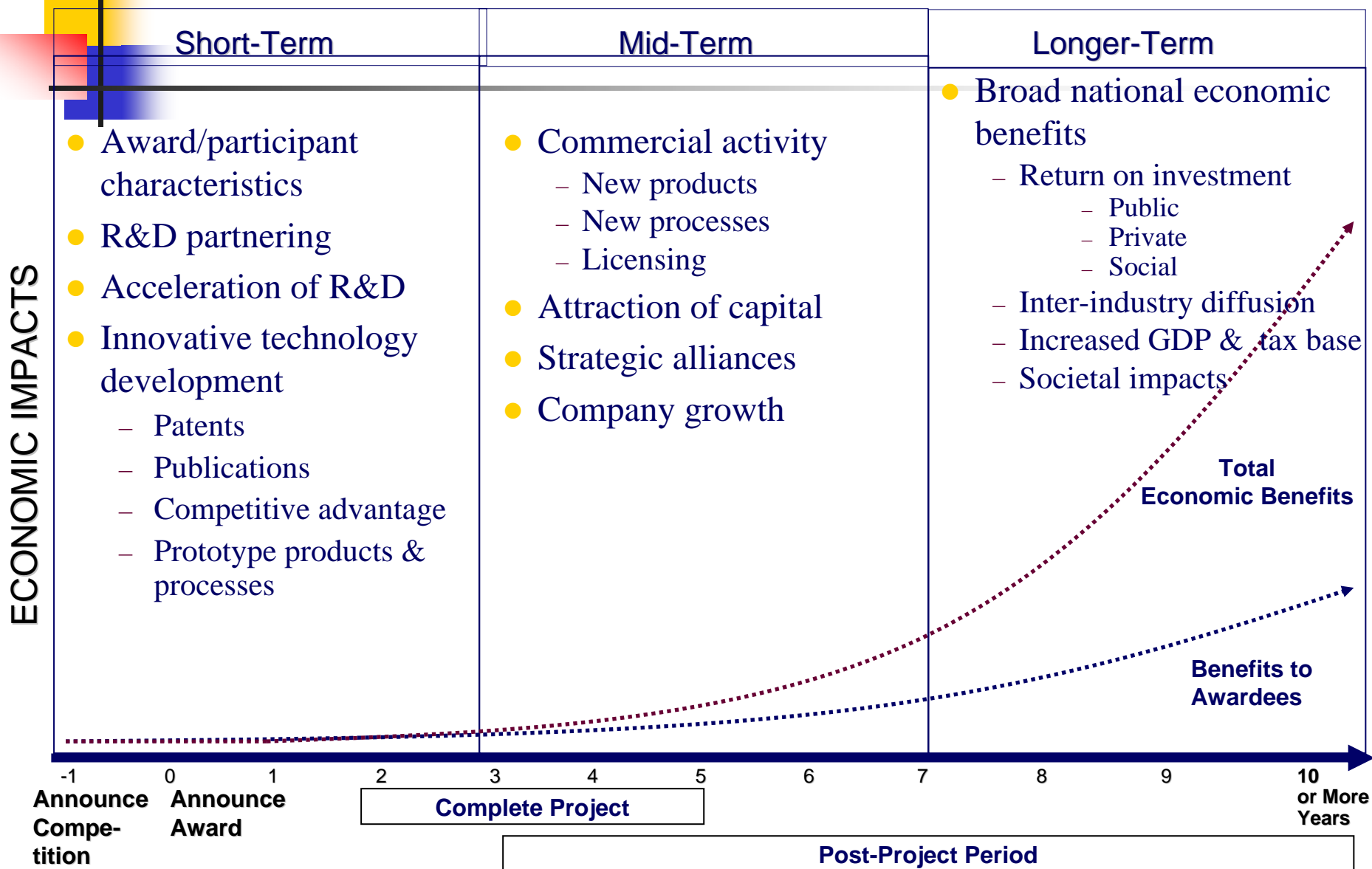
Data

- Quarterly and annual technical reports.
- Annual reporting through Business Reporting System (baseline, anniversary, closeout, and post-project).
- Annual performance plans and reports.

Project management: ATP Business Reporting System

- Business plans:
 - Identification of applications.
 - Strategies for commercialization, protection of IP, and dissemination of nonproprietary information.
 - Significant business developments.
 - Update of business plans and progress on products, processes and licensing activity.
- Collaboration experiences.
- Attraction of new funding.
- New patents.
- Technology diffusion.
- Company financial data.
- Next 5 years-technical and business goals.
- Effects outside of organization.

Project Evaluation Timeline: What We Measure When



Project evaluation activities tied to timing of expected results

Short and Mid-Term

- Ex ante peer review for project selection
- Survey tools to monitor project progress
- Performance measures
- Expert reviews
- Portfolio-wide analysis

Longer Term

- Post-project surveys and data analyses
- In-depth and cluster case studies—return on investment
- Econometric analysis
- Macroeconomic analysis

ATP's Evaluation Program: "An exceptional assessment effort."

"The ATP assessment program has produced one of the most rigorous and intensive efforts of any U.S. technology program...the quality, quantity, and analytical range of [their] studies are impressive."

The Advanced Technology Program, Assessing Outcomes,
C.W. Wessner, editor, National Academy of Sciences, 2001,
page 91

ATP's evaluation best practices [1]

- Management and institutional commitment to performance evaluation.
- Integration of evaluation into program management while preserving independence.
 - design, implementation, assessment, learning, and feedback from performance metrics (and results).
- Dedicated and appropriate mix of expert staff.
- Coordination with technical office staff.
- Involvement of outside experts.

ATP's evaluation best practices [2]

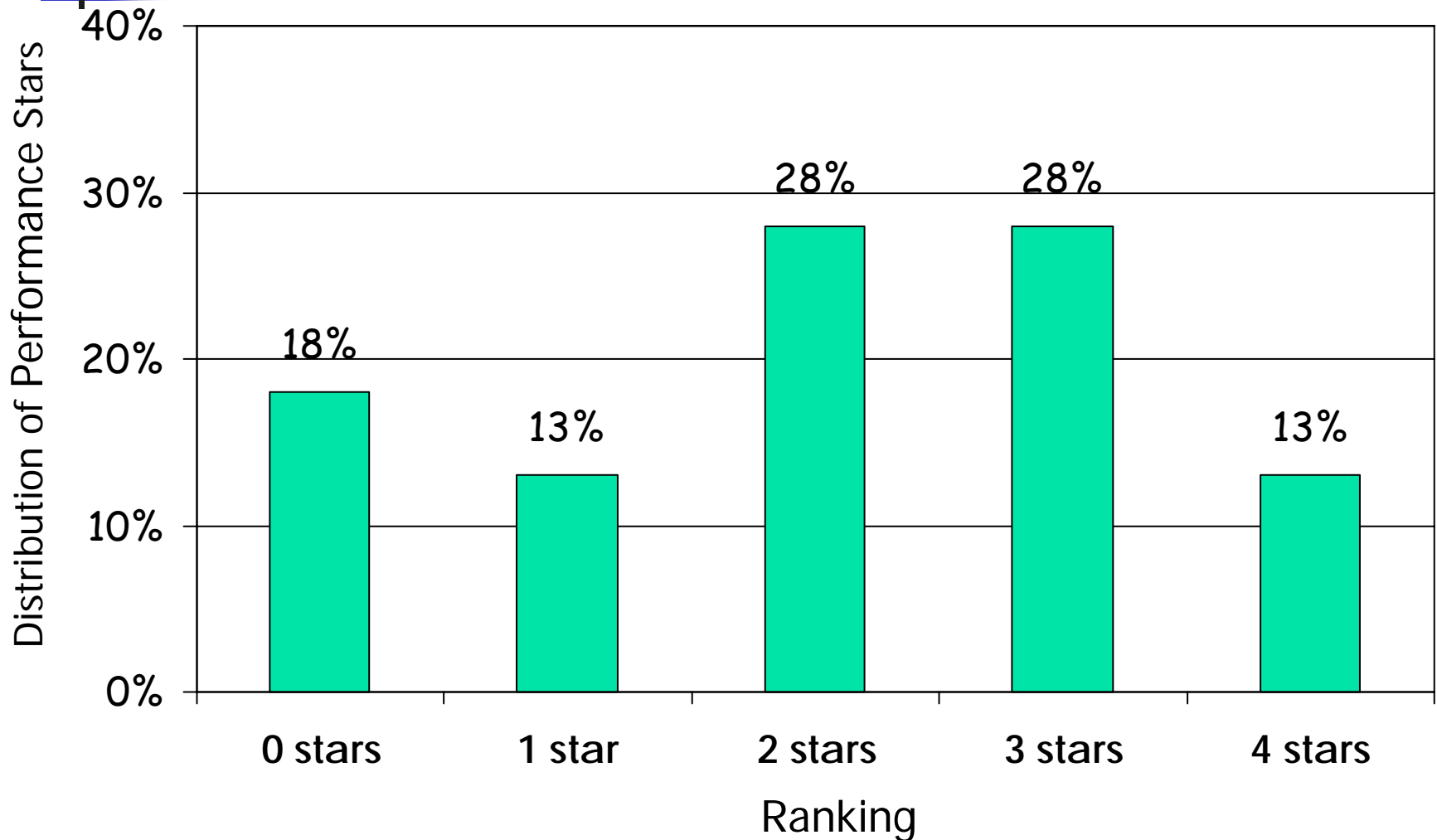
- Matching assessment methods to questions posed.
- Systematic data collection and regular reporting systems.
- Gradual evolution toward more rigorous tests of causal relationships.
- Pursuit of development and testing of new tools.
- Examination of successful and unsuccessful projects.
- Strategic communication of results.

Portfolio-wide analysis

- Performance measures
- Status reports of completed ATP projects
 - Descriptive mini-case studies.
- Portfolio analysis of project performance.
 - Each project receives a rating between 0 and 4 stars on how well it met ATP's mission objectives
 - overall project performance = knowledge creation and dissemination + commercialization progress and diffusion + future outlook.
 - Aggregation of stars provides portfolio of ATP success.

Portfolio Performance Results

First 150 ATP Completed Projects



Portfolio of ATP performance measures of outputs (2004)

Performance Measure	Actual FY 2004
Cumulative number of projects with new technologies under commercialization	297
Cumulative number of publications	1462
Cumulative number of patents filed	1254
Percent of projects reporting an increase in longer-term and/or higher-risk R&D	96
Percent of projects involving R&D collaboration	86
Percent of project participants reporting acceleration of R&D cycle time	88

Source: ATP Business Reporting System and status reports of completed projects.

ATP accelerates technology development

- **9 out of 10 project participants indicate that ATP funding accelerated their R&D cycle.** Of those organizations indicating they were *ahead* in the R&D cycle
 - 13% indicate they are ahead by a year
 - 53% indicate that they are ahead by one to three years
 - 7% indicate that they are more than three years ahead

Based on Business Reporting System (BRS) survey data from 673 organizations in 347 ATP projects funded from 1993-1998 – for projects with one or more years of ATP funding.

ATP accelerates Introduction of new products

- **ATP participants report that the acceleration of R&D will reduce the time it will take to bring products to market or to implement new production processes.**
 - Reduction in time-to-market by two years or more is anticipated for about 3 out of 5 planned commercial applications.

Based on Business Reporting System (BRS) survey data from 673 organizations in 347 ATP projects funded from 1993-1998 – for projects with one or more years of ATP funding.

Survey of ATP Applicants 1998, 2000, 2002

Key Findings:

- ATP awards attract additional funding (“**Halo Effect**”)
- ATP fosters new R&D directions and partnerships
- ATP fosters collaboration between companies and universities

What happened to nonfunded projects?

When ATP decides to not fund a project, what happens to these projects?

- 39% of these projects are not pursued.
- 44% are pursued on a smaller scale.
 - 4 out of 5 report that project is less than 40 percent of proposed ATP project.

Source: Survey of Applicants, 2002

Behavioral additionality: Joint venture survey-Key findings

- Governance and contractual provisions are more important than goodwill in fostering trust and increase perceived value of project
- ATP involvement is important to ensure stability and to help foster cooperation
- Joint venture size

Behavioral Additionality: 2 Years After ATP Project Ends- Did ATP Companies Continue in any R&D?

- Yes: 83% continued R&D
 - 55% due to positive ATP experience
 - 39% no ATP impact
 - 6% negative impact or DK
- NO:
 - 17% did not continue any R&D
 - Only 2 out of 78 said it was due to negative ATP experience

Source: ATP Post-Project Survey (2 years after ATP project ends)

Behavioral Additionality: 2 Years After ATP Project Ends

ATP companies continued work on ATP Technology:

- New collaborations with new partners: 27%
- Continued collaborations with ATP JV partners: 19%
- Continued collaborations with ATP subcontractors: 31%

ATP companies work on non-ATP Technology:

- Working with ATP JV partners: 46%
- Working with ATP subcontractors: 14%

Source: ATP Post-Project Survey (2 years after ATP project ends)

Hot-spot cluster analysis of high impact patents: purpose

- **Motivating Question: What is the regional impact of ATP?**
- **Hot-Spot Analysis** is a powerful tool that maps out current areas of innovative activity off the beaten path. This tool:
 - Examines clusters of patents that are highly cited by recently issued patents.
 - Identifies a subset of clusters that are developing early stage technologies most relevant to ATP.
 - Analyzes the regional, organizational, and collaborative characteristics of these clusters.

Hot-spot cluster project: Implications and next steps

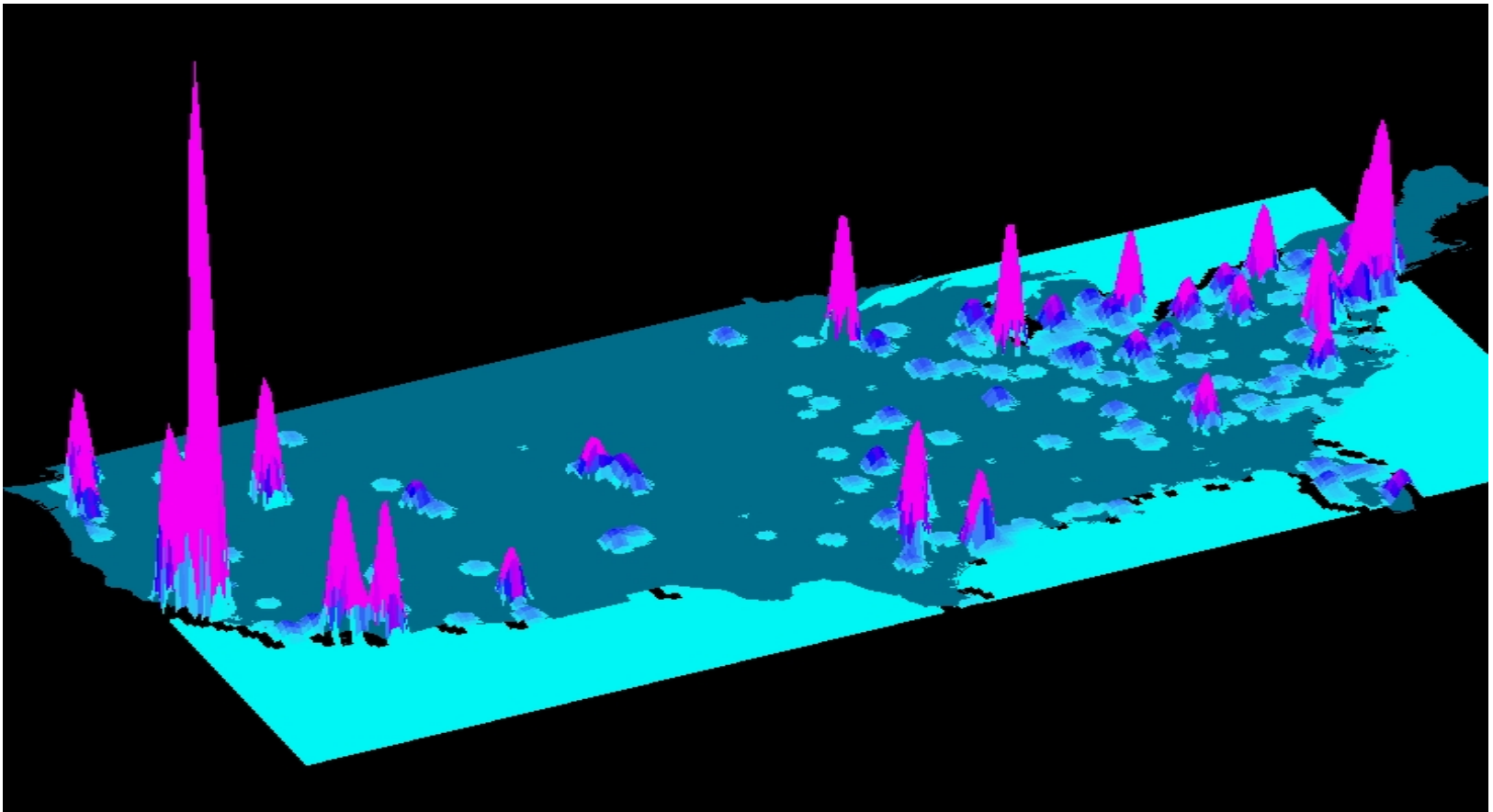
Findings:

- Association between ATP-related patents and Next Generation Clusters.
- Suggests that ATP is funding technology that is closely linked to high-impact technology.
- ATP dollars are likely to have a broad impact beyond individual award recipients.

Visualizing innovative activity

“Understanding Regional Innovative Capacity” Project

Visualization of the 2002 Hot-Spot Patents



ATP is meeting its mission

ATP Studies Provide Evidence that ATP is *Meeting Its Mission* through

- Acceleration of R&D
- Increased collaborations
- Strong small business participation
- Refinement of manufacturing processes
- Commercialization of products and processes by US companies
- Large spillovers, leading to broadly distributed economic benefits

In summary ... ATP

- ***Focuses*** on the civilian sector
- ***Funds*** enabling technologies with high spillover potential
- ***Focuses*** on overcoming difficult research challenges that cannot find private funding
- ***Encourages*** company-university-laboratory collaboration - capitalize on R&D investments
- ***Requires*** commercialization plans and implementation to ensure societal outcomes
- ***Measures*** against mission in our evaluation work