

DRAFT



Worldwide Best Practices in Partnerships between HPC Centers and Industrial Users

Preliminary Findings

HPC User Forum - April 18, 2017

Irene Qualters, NSF

Bill Kramer, NCSA

Steve Conway, Hyperion Research

Agenda

INTRODUCTION

Irene Qualters

**GOALS, METHODOLOGY &
PRELIMINARY FINDINGS**

Bill Kramer, Steve Conway

NEXT STEPS

Bill Kramer

**PERSPECTIVE ON
PRELIMINARY FINDINGS**

Irene Qualters

Q&A

Introduction

- NSF Motivation for supporting the study
- Submission and decision process
- NCSA-led research team



DRAFT

NCSA/IDC Study of public- private partnership at Academic HPC centers

Irene Qualters

Director, Office of Advanced Cyberinfrastructure

April 18, 2017

HPC User Forum

Maximizing HPC Benefits for Economic Competitiveness and Scientific Discovery

NSCI Objectives

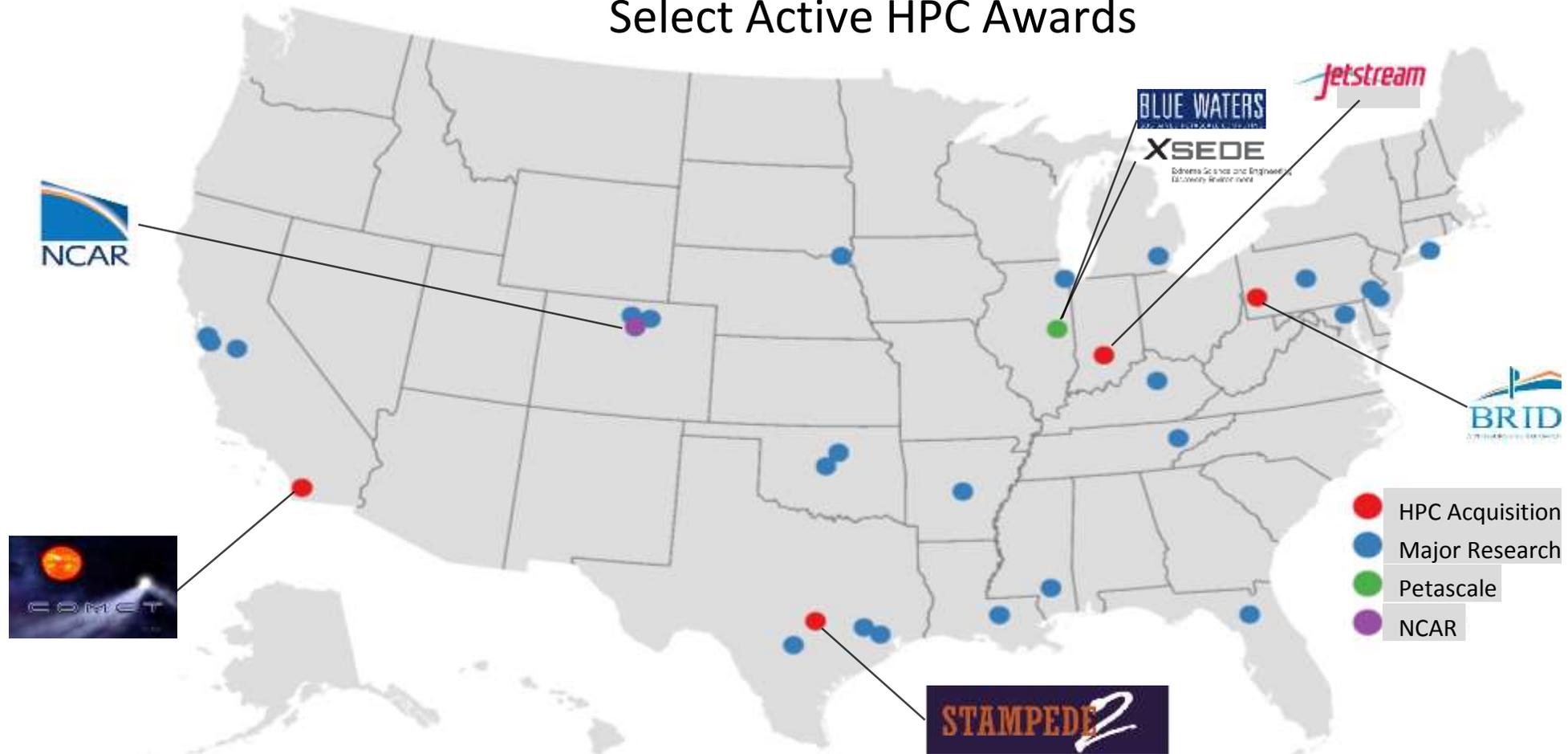
1. 100x performance increase in HPC simulations
2. Technical synergy in platform for modeling/data analytics
3. Research into new devices, architectures to scale beyond current limits
4. Increase capacity and capability of national HPC ecosystem
5. **Public/private partnerships**

NSF Mission

To promote the progress of science; *to advance the national health, prosperity, and welfare*; and to secure the national defense; and for other purposes.

NSF supports HPC in academic institutions to ensure a world-class research infrastructure.

Select Active HPC Awards



1560770 - EAGER: Supporting the NSCI Effort by Evaluating and Disseminating Effective Practices in Partnerships between HPC Centers and Industry

Summary of Goals:

- 1. Conduct in-depth surveys of a substantial number of HPC centers of various sizes in the U.S. and across the world*
 - Meaningful coverage including small, medium and large centers*
- 2. Produce a quantitative-qualitative research report that can serve as a reference guide and compendium of effective practices and lessons learned*
 - Help academic HPC centers jump-start or re-focus existing industrial programs*
- 3. Evaluate practices identified in the survey, especially to highlight those with implications that are more universal, rather than specific to the circumstances of a single HPC center*
 - Advance the state-of-the-art understanding of successful industrial programs*

Methodology

- Conduct interviews to capture the governance frameworks and partnering practices of HPC centers of various types and sizes
- Conduct additional interviews to capture the experiences of industrial partners
- Identify which practices consistently work well—along with practices to avoid
- Recommend a checklist of practices for centers to consider
- Describe what seems most relevant for NSF and U.S. academic centers

Status

- 35 centers and 31 industrial partners interviewed—enough to produce preliminary findings
- Need to interview more small/midsize academic centers
- Publication expected May-June 2017.

Key Trends

- More political leaders are seeing HPC's benefits for economic competitiveness
- More governments (non-U.S.) are pushing to develop domestic suppliers
- Science will remain primary, but more publicly funded HPC centers are expanding access for industrial users (including SMEs)
- More HPC centers are growing their industrial domain expertise
- More HPC centers are marketing to attract industrial users

Preliminary Findings

Four Main Types of Publicly Funded HPC Centers regarding Industrial Users

- Open science only, no industry participation
- Open science only, industry team members
- Open science and open industrial research
- Open science and open industrial research + proprietary research
 - Some centers permit findings to be partly open, partly proprietary

Preliminary Findings

Stated Benefits of Partnerships

■ Industry

- Increased competitiveness
- New discoveries/insights
- Faster product development

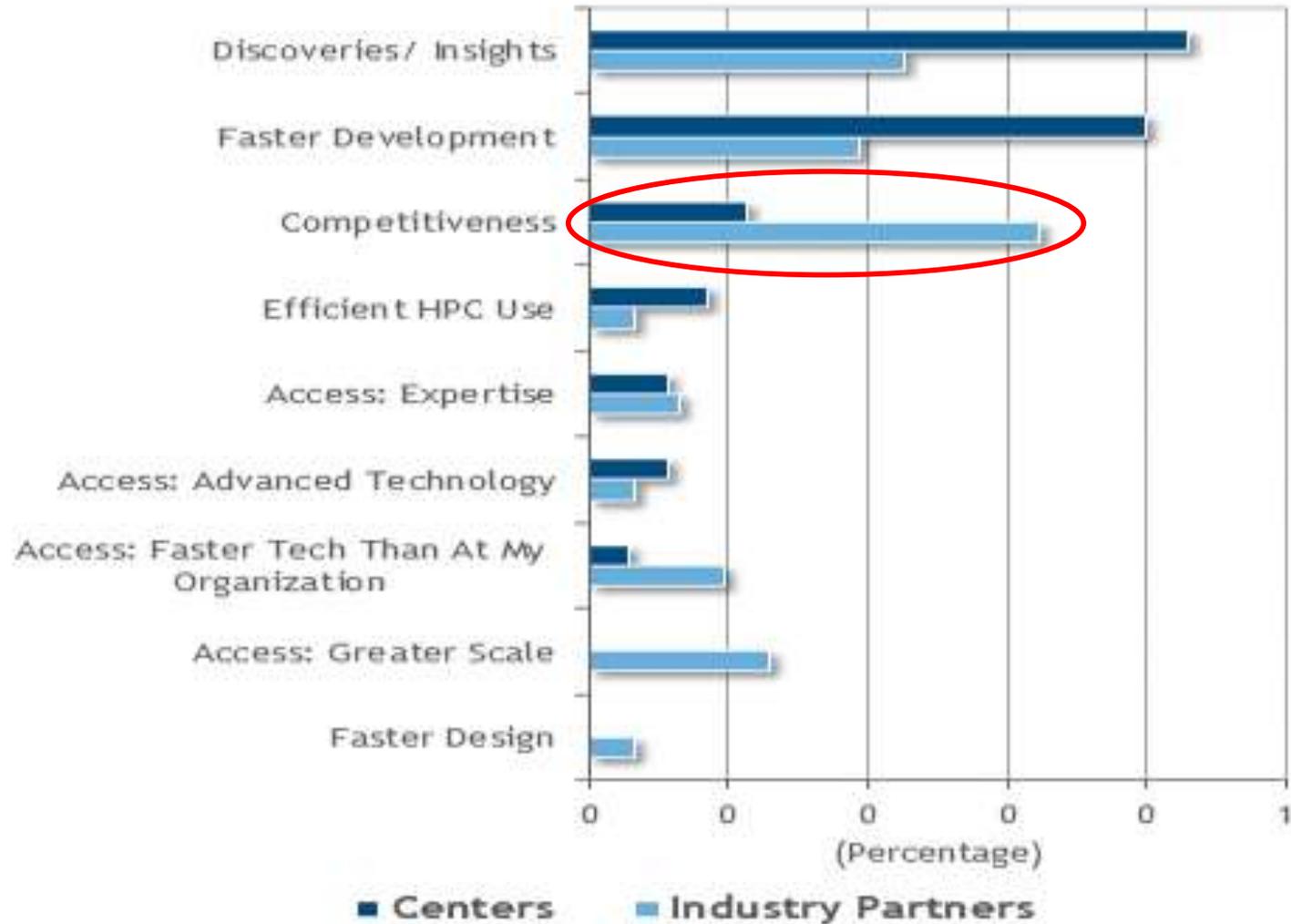
■ HPC centers

- Unexpected new pathways for science
- Increased motivation/retention of scientific and computational staff
- Revenue for reinvestment in the center (paid access)

Preliminary Findings

Most Important Benefit

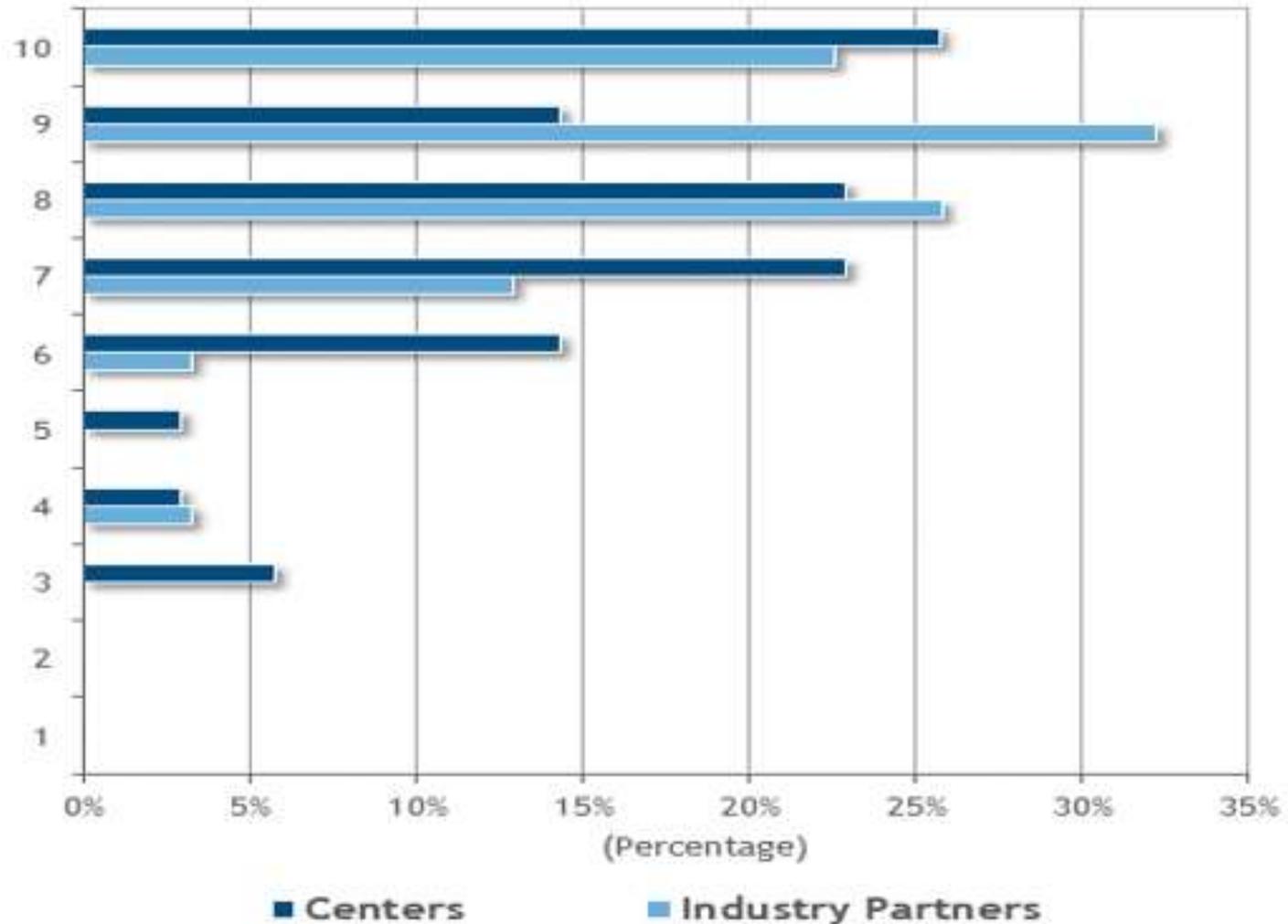
The MOST Important Benefit of the Program/Partnership



Preliminary Findings

Satisfaction with The Partnerships

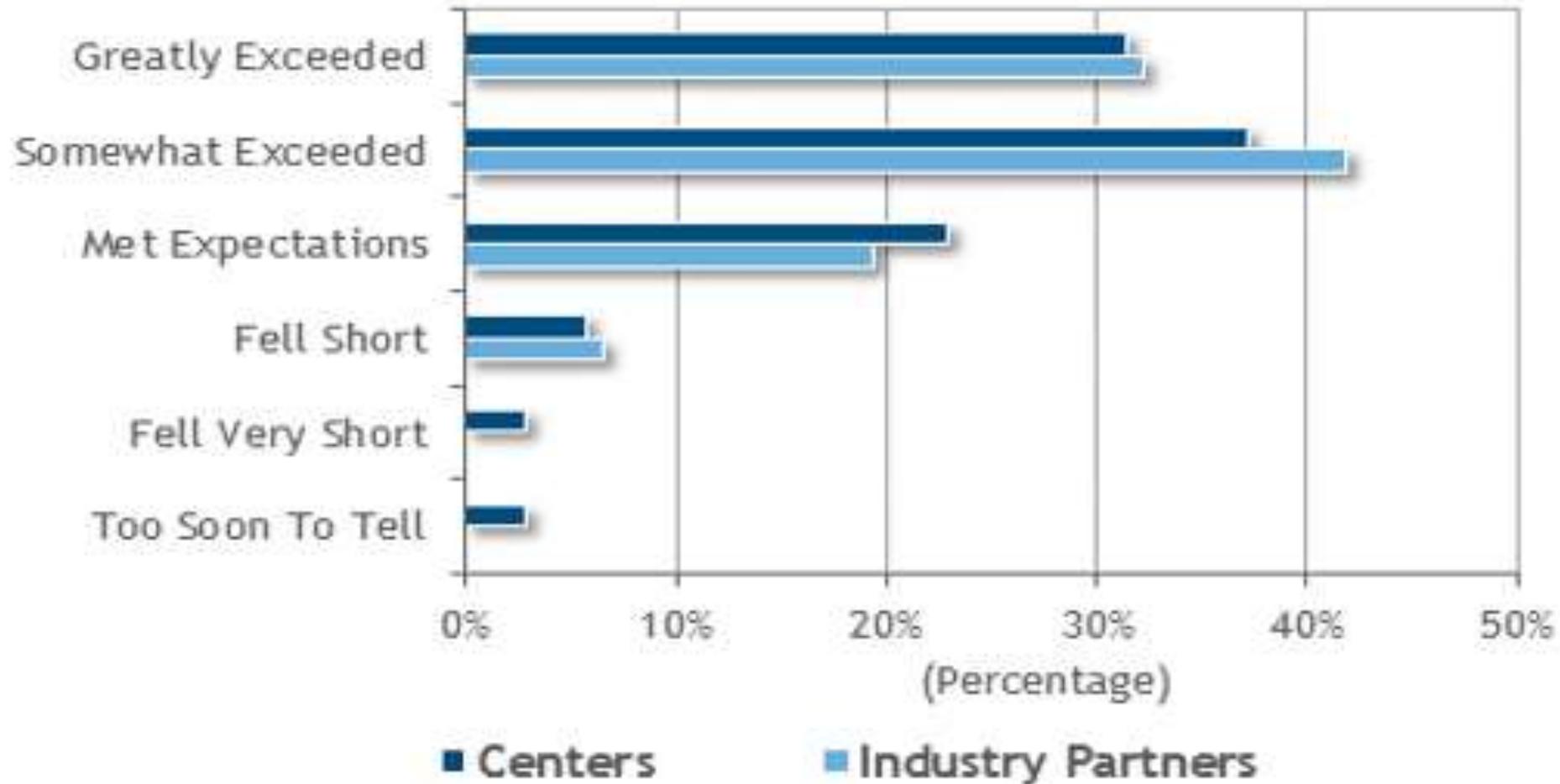
Satisfaction with the Partnership



Preliminary Findings

Results Compared with Expectations

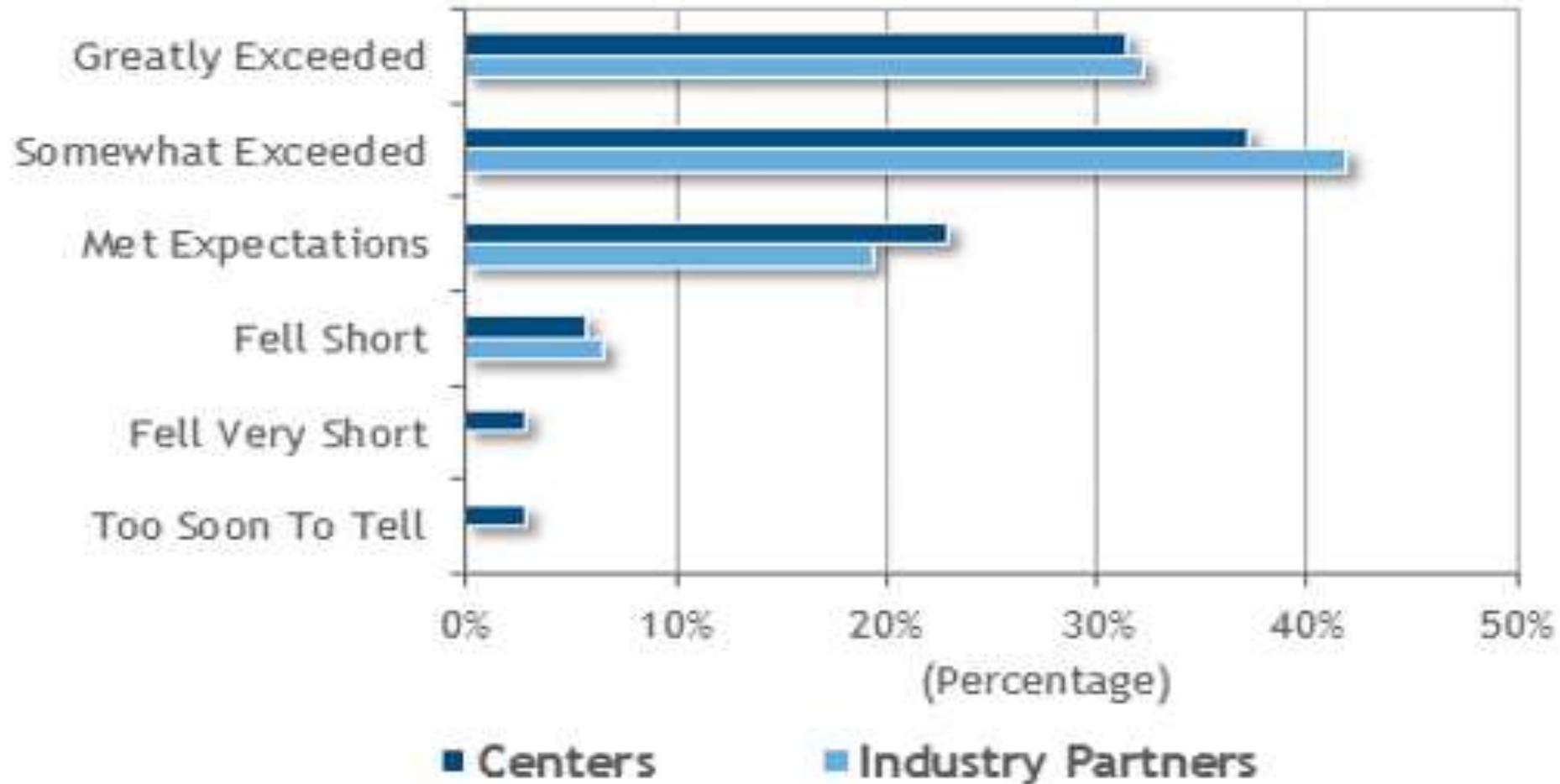
Results Compared to Expectations



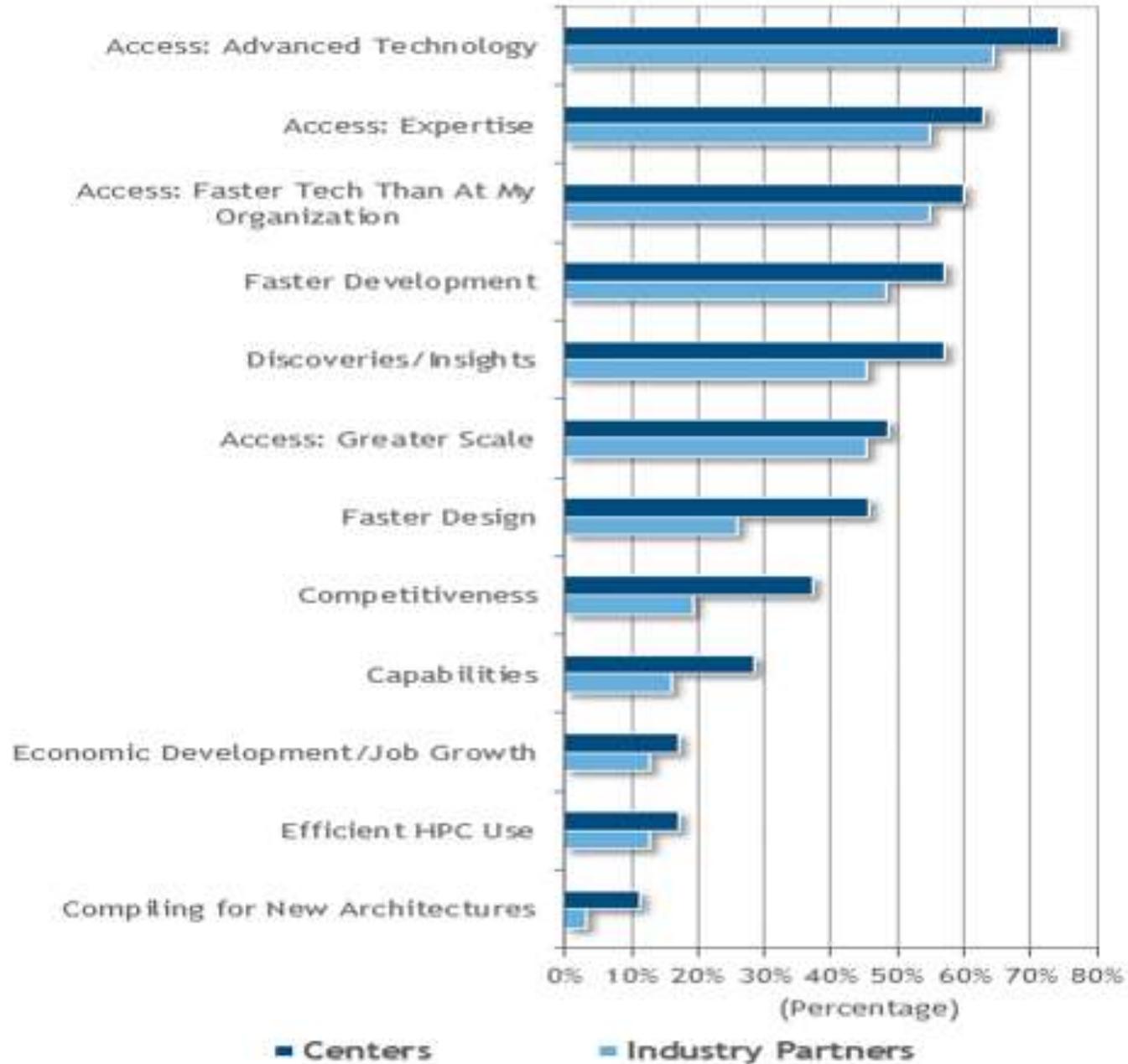
Preliminary Findings

Results Compared with Expectations

Results Compared to Expectations



Benefits: HPC-Industry Partnerships

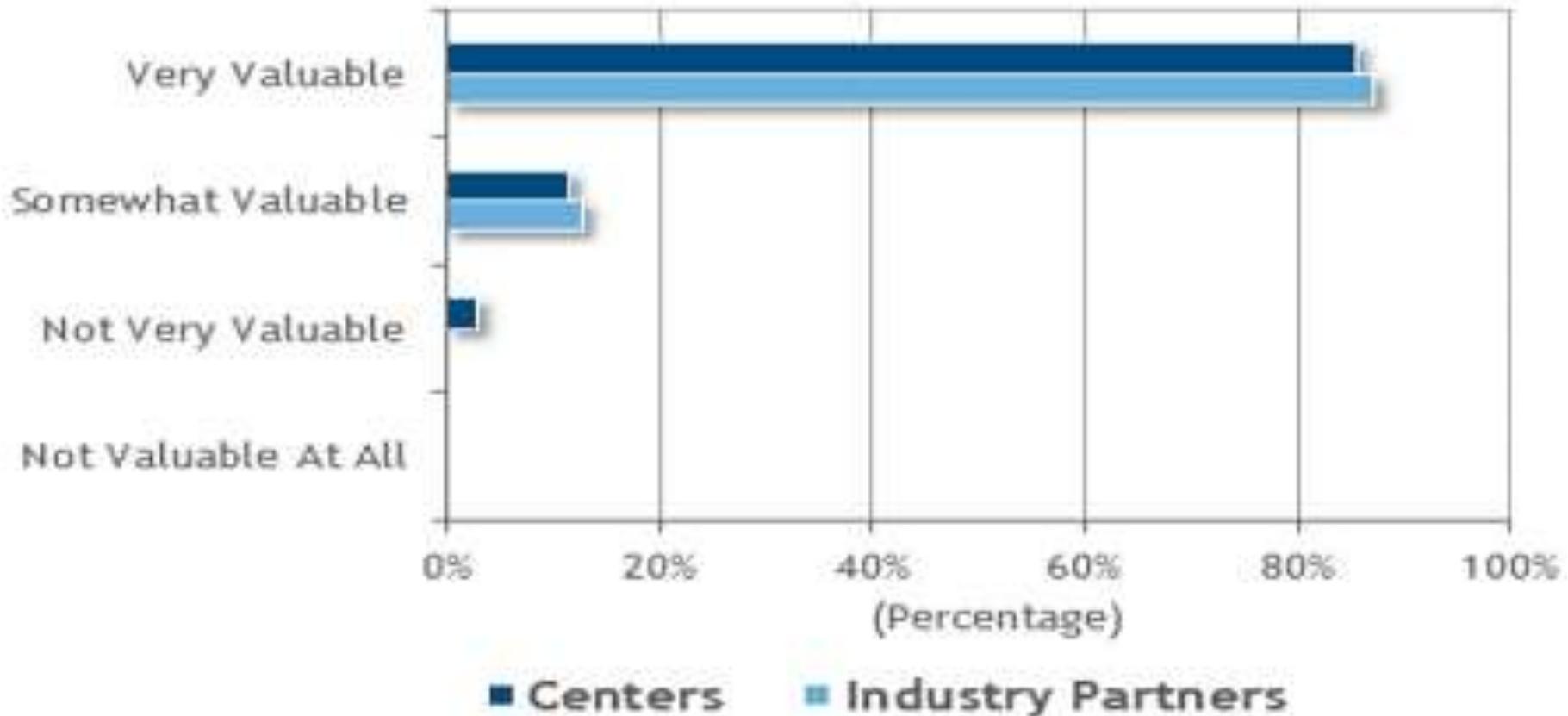


Preliminary Findings
Results Compared with
Expectations

Preliminary Findings

Value of the Partnerships

Value of the Partnerships



Preliminary Findings

Most Important Best Practice: Take Industry Seriously

- Ensure support for industrial users should be an explicit part of the Center mission
- If industry is to use the HPC system, consider industry requirements for systems and services
- Focus on supporting industrial domains the HPC center has expertise and experience to provide excellent services
- Hire experienced business personnel to lead the center's partnership program
- Assign some high level expertise from the center's staff to work with industry

Centers serious about supporting industrial partnerships should

- Sends a strong signal to the center's staff and to industrial users that industry partnerships are important activities.
- Public funders agencies should actively encourage this expanded articulation of the centers' missions.
- Take Industrial users requirements into account when selecting or bidding systems.
- Focus on domains the HPC center knows well.
 - It may be tempting, especially at the start of an industry partnership program, to welcome industrial partners from all domains in order to show progress
 - odds for success greatly increase when a center limits its partnership program to domains in which the center has strong existing competence.
- Hire some people with business experience to lead the partnership program.
- Assign experienced people to work with industrial users are staffed with some of the companies' best people.
- Keep the same center staff assigned to the industrial project from start to finish, rather than replacing them in the middle of projects.

Provide Opportunities for Both Open and Proprietary Research

- In most areas of the world, the governance frameworks under which academic and other HPC centers operate are inhibit public funding from being used to allow companies to gain a competitive advantage in the market place.
 - Rules against enabling unfair competition can be especially intricate in the European Union, where the trading interests of 28 large and smaller member states must be protected. As a result, most industrial projects carried out at publically-supported HPC centers around the world are restricted to open, pre-competitive, peer-reviewed research whose results must be published in some form (at least in large part).
- Some of the largest HPC centers offer a third category for collaboration, where contracts specify that some results of a project may be kept proprietary while others must be published.
- Each type of industrial research—open and proprietary—can produce benefits for an HPC center.

Address Cultural Gaps in a Timely Manner

- Business projects typically operate with shorter timeframes and harder deadlines than their scientific counterparts.
- Hire people with business experience to lead the industry partnership program
- Set clear expectations at the start of the relationship and maintain frequent communication during the project.

Engage Marketing/PR Professionals to Recruit Industrial Partners

- ,Most of the centers insisted that active marketing and public relations are needed.
 - Marketing activities can take many forms, from attending industry meetings and conferences to disseminating success stories.
- Focusing on a small number of domains
 - The choice of domains follows naturally from the areas of expertise of their staff members and their geographical locations. For example, it may be hard for a U.S. center to specialize in automotive research if the center is nowhere near Detroit.
- Set Expectations Clearly at the Start
- The desire of industrial partners for clear expectations to be set before a project begins may seem self-evident, but many of the surveyed users indicate that it does not often happen well. Either party, the center or the industrial user, might begin a project without having clearly thought about how it should be carried out and what will constitute success. At a minimum, centers and industrial partners should agree on what to expect in the following areas:
 - The time needed for the contract to be completed—including legal and IP considerations—so the project can begin;
 - The composition of the project team (from the center and the industrial partner) and how much time the members will devote to the project;
 - Methodologies to be used;
 - What the industrial partner will contribute, including payment terms, if applicable;
 - The nature and extent of the HPC resources and support the center will provide;
 - What will constitute success for both parties;
 - Project milestones and associated deadlines;
 - Any provision or option for follow-on collaboration.

Streamline the Process for IP and Contract Agreements

- Reaching agreement on IP rights can be especially difficult and time-consuming.
- In light of the survey findings, a best practice is academic and other HPC centers
- Reinforce that the center's (or agency's) mission supports both scientific and industrial research HPC access to industrial partners—along with public organizations and/or agencies supporting such initiatives—take some or all of these steps —and that these activities can be equally worthy and mutually beneficial.
- Make it clear that collaborating with industry means working with industrial partners, not just HPC technology vendors.
- Periodically review and communicate providing HPC access for industrial partners, along with the attendant rationale. Not everyone in your community may consider industrial R&D to be as worthwhile as scientific research or realize that partnerships with industrial partners can help to advance science.

Opportunities

- Best practices identified in the study can help promote the vital transfer of scientific knowledge to industry and the important transfer of industrial experience to the scientific community.
- For publically-supported HPC centers that provide access to industrial partners, the relationships have the potential to open new pathways for the centers' scientific research and further motivate scientific researchers by allowing them to work on industrial problems.
- For industrial partners that access publically-supported HPC centers, key benefits are accelerating the development of competitive products and solutions, as well as learning how to use HPC systems.
- For public funders (e.g. federal, regional, state and local government, as well as public and private non-profit institutions such as Universities), advanced computational scientific research and advanced industrial R&D in the manufacturing sector often rely on the same foundational science and methodologies (e.g., computational fluid dynamics, finite element modeling, molecular dynamics).
 - investments in advancing the theoretical or applied science can often be leveraged across computational researchers in both science and industry.
 - For government funders, providing private-sector businesses with access to HPC systems and human expertise can help to justify the substantial funding needed to purchase and operate ultrahigh-end supercomputers at publically-supported facilities.

Challenges

- Bridging the cultural gap that separates the worlds of science and industry, from missions to deadlines and attitudes.
- For centers that provide access to industrial partners, a key challenge are
 - treating industrial research problems as seriously as scientific research problems,
- For industrial partners that access publically-supported HPC centers,
 - accept the constraints under which a center may operate, such as not accommodating on-demand requests for expanded access to HPC resources, not allowing foreign students to participate in projects, and not using public monies to give any company a competitive advantage.
 - Many challenges can be addressed in the terms of contracts with HPC centers.
- For government and public funders
 - challenges may include missions and governance frameworks that limit collaborations with industrial partners, over-subscribed HPC resources and budgets that are inadequate for expanding resources to accommodate industrial users, and not fully appreciating the potential benefits of collaborating with industry.

Preliminary Findings

HPC Centers' Partnership Statistics

Profiles of the HPC Centers: Partnership Time Frames

Attribute	Years
Average Length of the Partnerships (in years)	15.0
Average Number of Participating Businesses (Over Time)	93.9
Average Number of Participating Businesses Today	24.1
Average Duration: Of a Partnership (in years)	3.4
Longest Duration: Of a Partnership (in years)	9.8
N = 35 total respondents	

Preliminary Findings

HPC Centers' Satisfaction with Their Governance Frameworks

Profiles of the HPC Centers: Governance Frameworks

	Number of Responses	Percentage of Responses
Satisfactory Governance Framework	24	68.6%
Unsatisfactory Governance Framework	11	31.4%
N = 35 total respondents		

Source: IDC 2016

- What laws, regulations, guidelines govern your partnership program?
- Where do they come from?
- How satisfactory are they? What could make them better?
- What about intellectual property rights – how is this issue treated?

Preliminary Findings

HPC Centers: Do Any Industrial Partners Pay or Reimburse the Centers?

Profiles of the HPC Centers: Do the Partners Pay?

	Number of Responses	Percentage of Responses
Partners Pay? YES	24	68.6%
Partners Pay? NO	11	31.4%
N = 35 total respondents		

Preliminary Findings

HPC Centers: Provide Access on Demand to Industrial Users?

Profiles of the HPC Centers: Is the Access on Demand?

	Number of Responses	Percentage of Responses
Access On Demand: YES	10	28.6%
Access On Demand: NO	24	68.6%
Not Sure/Don't Know	1	2.8%
N = 35 total respondents		

Preliminary Findings

HPC Centers: Provide Technical Support?

Profiles of the HPC Centers: Is Technical Support Provided?

	Number of Responses	Percentage of Responses
Tech Support Provided: YES	34	97.1%
Tech Support Provided: NO	0	0.0%
Not Sure/Don't Know	1	2.9%
N = 35 total respondents		

Preliminary Findings

HPC Centers: Provide Industrial Domain Expertise?

Profiles of the HPC Centers: Is Domain Expertise Provided?

	Number of Responses	Percentage of Responses
Domain Expertise YES	29	82.9%
Domain Expertise NO	5	14.3%
Not Sure/Don't Know	1	2.9%
N = 35 total respondents		

Next Steps

- Hyperion will interview more small/midsized academic centers for better balance
- Add section on what's most relevant for NSF and the NSF community
- Final review and publication

Questions?