ADVANCED MANUFACTURING INNOVATION CENTER (AMIC)

"This study was prepared under contract with the St. Louis Economic Development Partnership, Missouri, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects to views of the St. Louis Economic Development Partnership and does not necessarily reflect the views of the Office of Economic Adjustment."

November 16 2017

DRAFT

AECOM

AGENDA

01 Project Initiation: Introduction & Economic Context

02 Interviews and Visioning

03 Site Selection

04 Space and Functional Programming

05 Conceptual Design

06 Cost Estimate

THE CRITICAL PATH AMIC QUESTIONS

01 What does industry need?

02 At what do the regions industries excel?

03 Who is the Champion?

04 What manufacturing innovation model do we pursue?

05 Who are other public, workforce, and higher education partners?

06 Where does consequential funding come from?

07 What about all that expensive fabrication equipment?

08 Does “place” matter?

"Building new markets is slow, hard work. You don't just wake up one morning and say....

... I think I'll take the Chinese market today."

Philip Hammond
British Chancellor of the Exchequer

....”You build. You build your product’s presence, your business, your networks, your distribution capability, confidence in your brand.”

It all takes time

01 ECONOMIC INTRODUCTION

MFG MARKETS ARE IN TRANSITION

01 US Manufacturing is ~~recovering~~ Growing Robustly, but very different from what it was 10 years ago
- 2.5% growth in output/ 1.1% growth in jobs

02 Impact of the 4th Industrial Revolution- big data, advanced materials, additive manufacturing

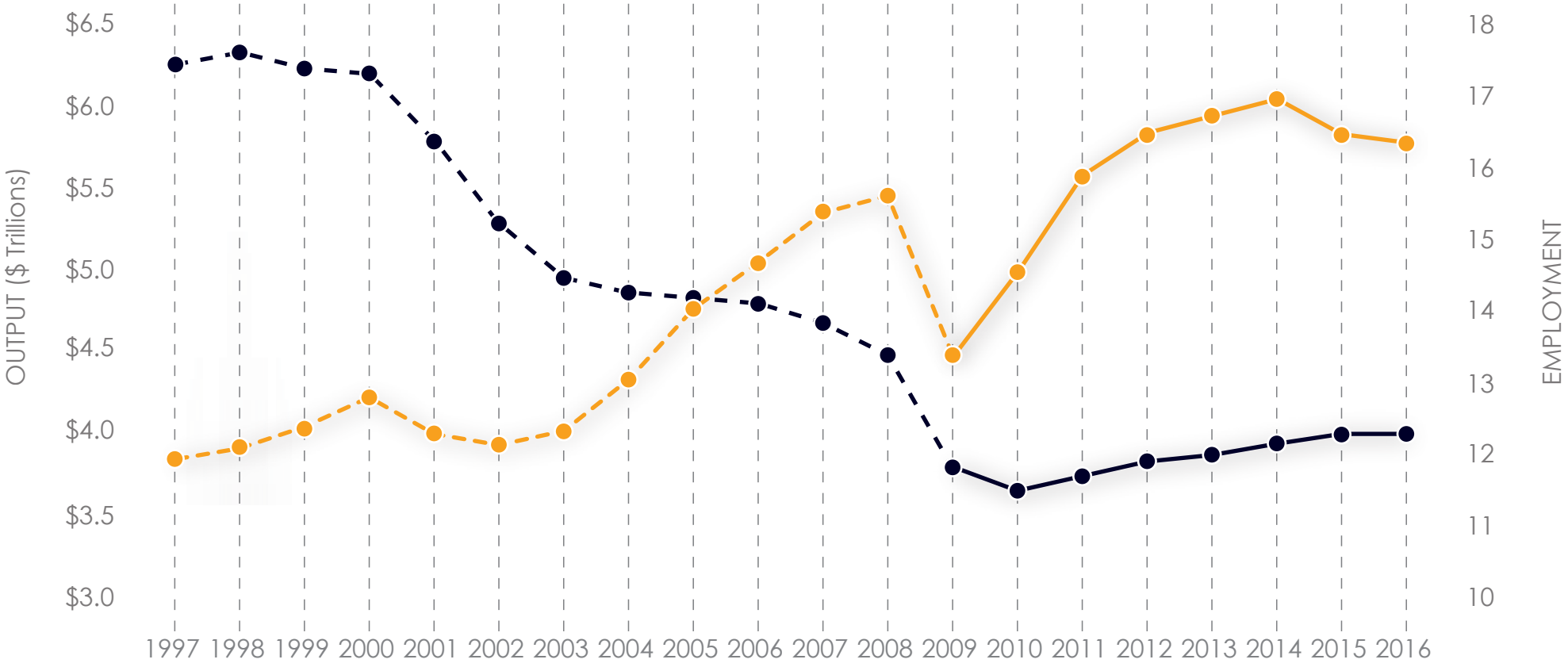
03 Food manufacturing and water

04 Impact of recent environmental regulation enforcement in China

05 There is no level playing field for global manufacturing

06 US manufacturing workforce policy is pivoting, but how to replace retiring workers remains the big question

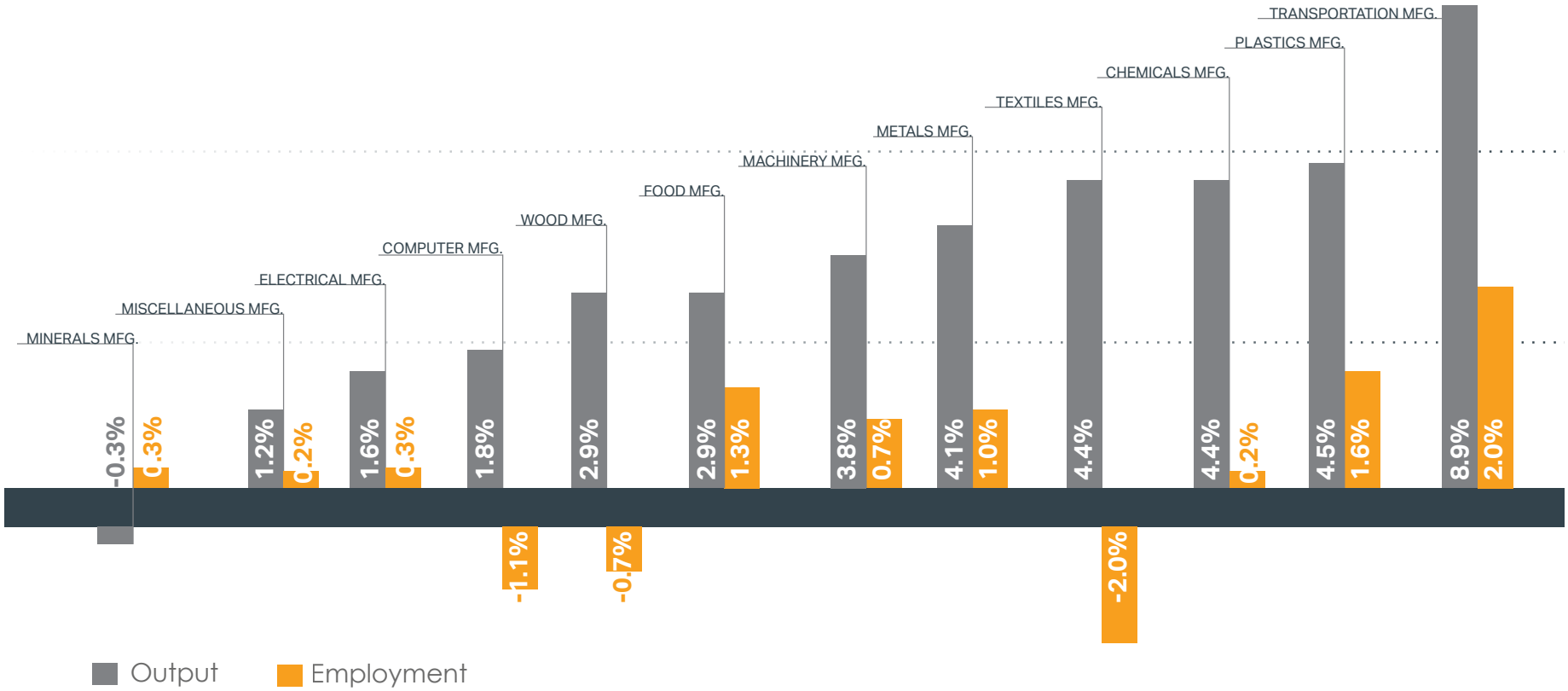
NATIONAL MANUFACTURING OUTPUT VS. EMPLOYMENT



01 Policy implications of divergence between output and employment in manufacturing

AECOM

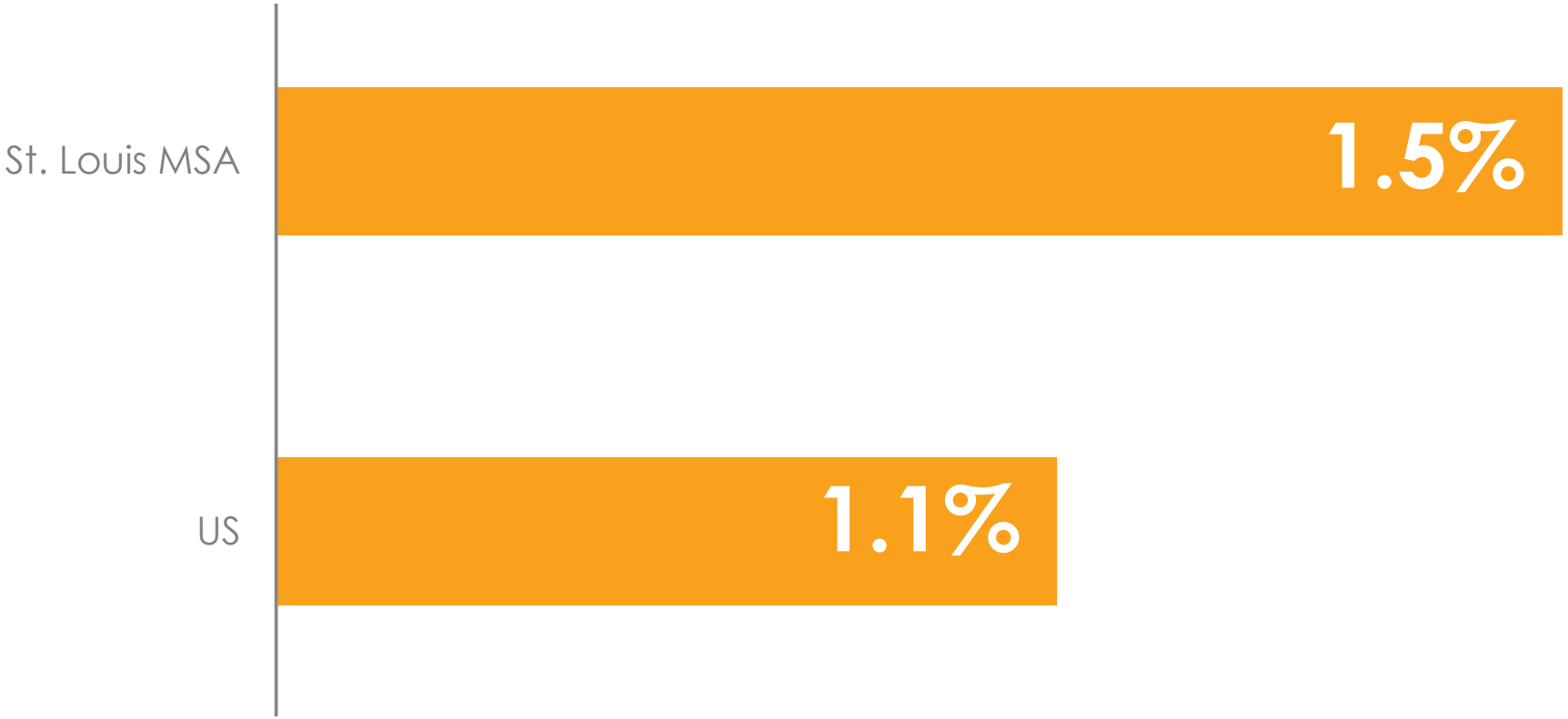
NATIONAL MANUFACTURING EMPLOYMENT & OUTPUT CAGR (2010-2016)



01 Food and Beverage MFG has been the most consistently growing sector, but growth in output per worker is modest

02 Transportation MFG has grown strongly, but change is in the air

ST. LOUIS MANUFACTURING EMPLOYMENT CAGR (2010-2016)



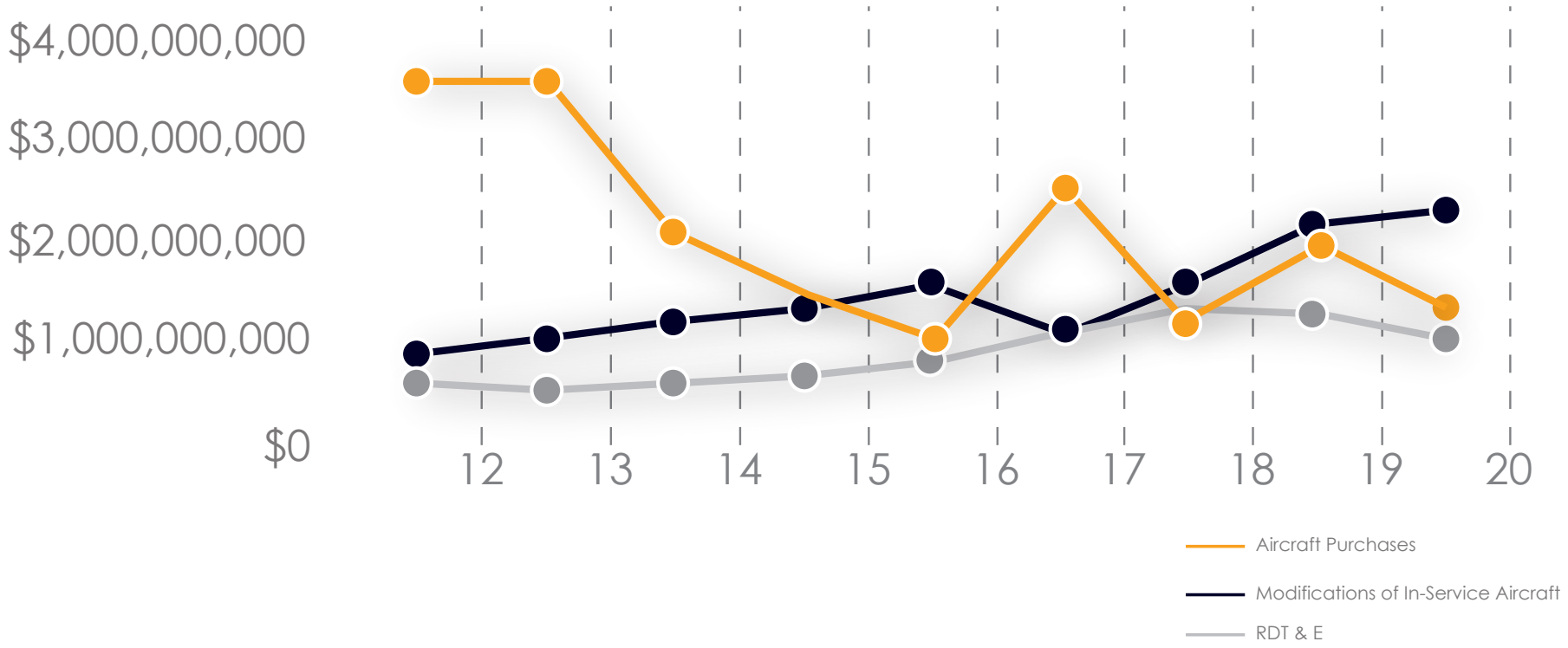
Source: BLS QCEW

01 For St. Louis, manufacturing growth post recession has been impressive, faster than US average

02 Aerospace and automotive have led the way

US NAVY/ USAF AIRCRAFT PROCUREMENT

F/A-18, EA-18, C-17, AS OF MAY 2017; EXCLUDES FOREIGN MINISTRY SALES



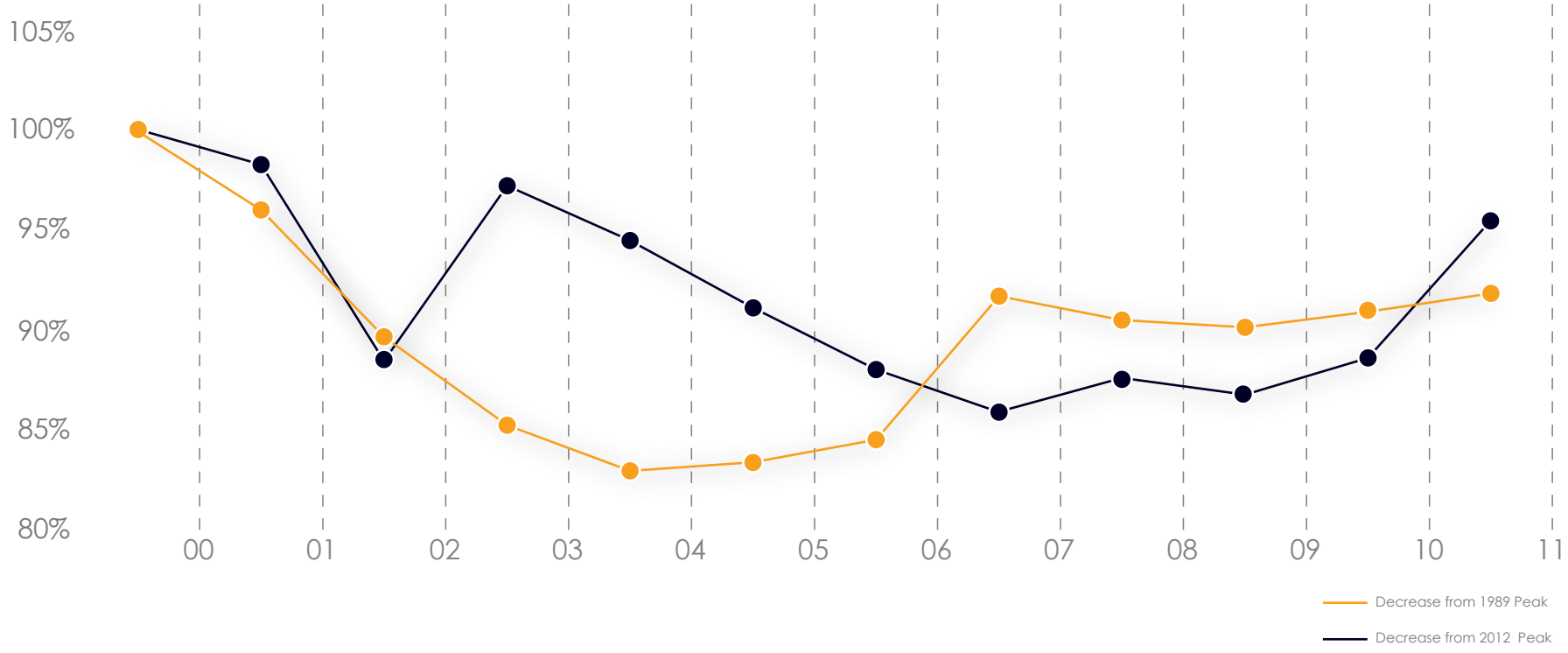
01 Department of Defense Funding for F/A-18 has improved since we last talked

- $4.8 billion more new builds budgeted FY 15-18 + $650 million less in airframe mods

02 Buys the region some time; F-15 and F/A-18 will eventually go away

CHANGE IN DEFENSE OUTLAY FROM PEAK YEAR

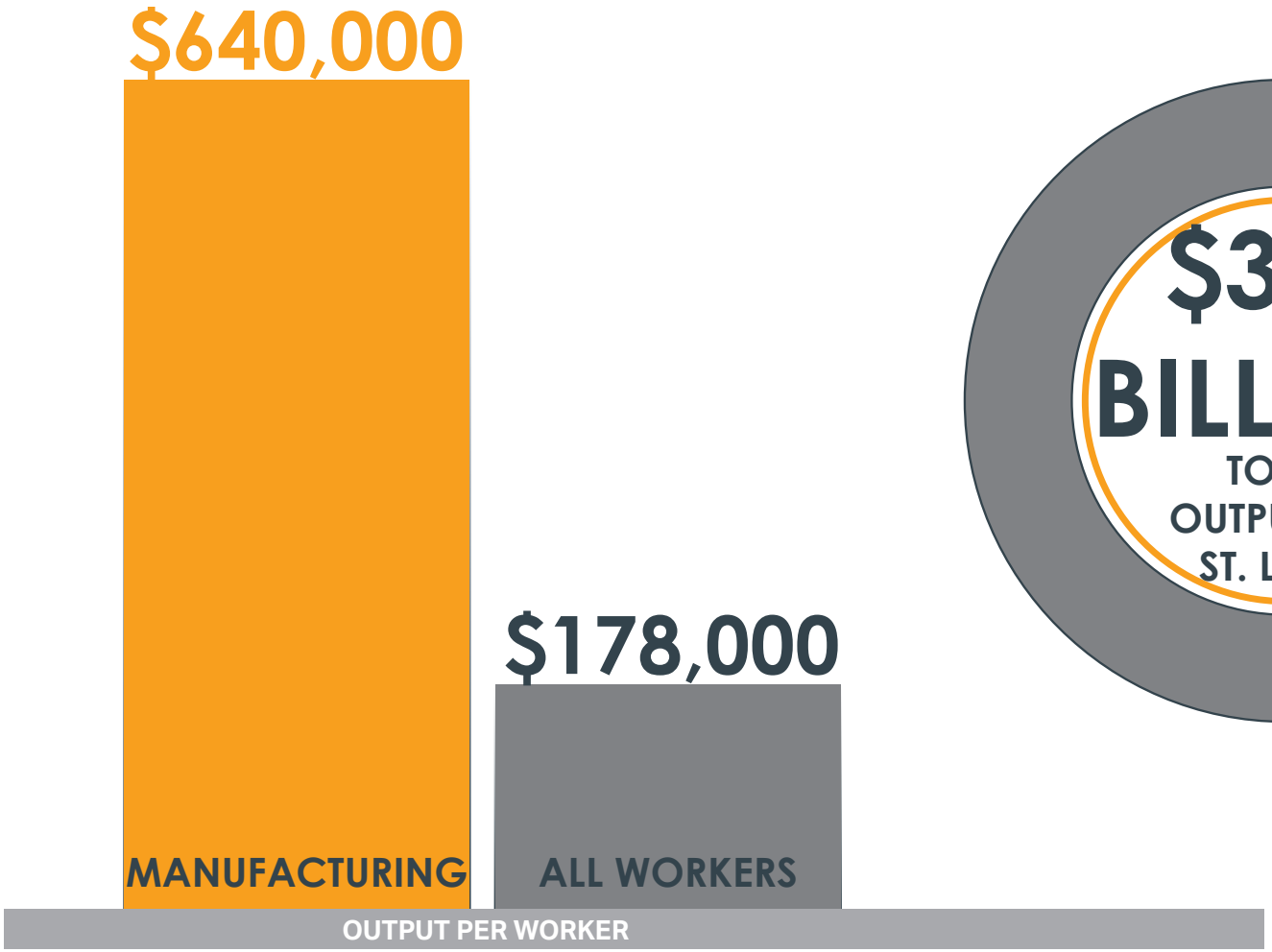
1989 AND 2012



01 While DoD funding is beginning to improve toward 2012 threshold, the pace of recovering remains behind the 1989 trajectory

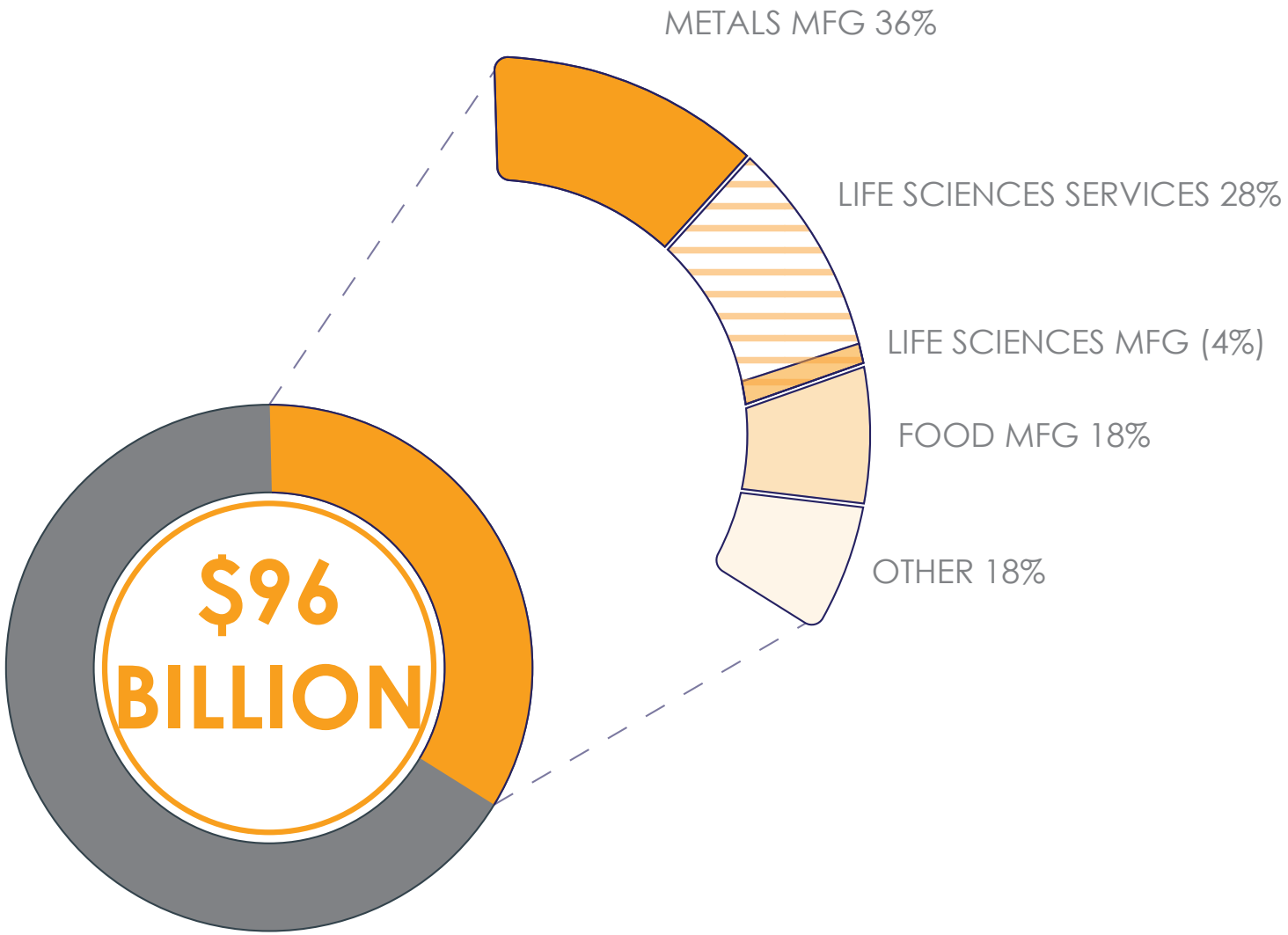
02 Defense contractors remain under pressure

31%
OF TOTAL REGIONAL OUTPUT IS MANUFACTURING & LIFE SCIENCES



SOURCE: IMPLAN

OUTPUT PER WORKER IS 3X ALL JOBS



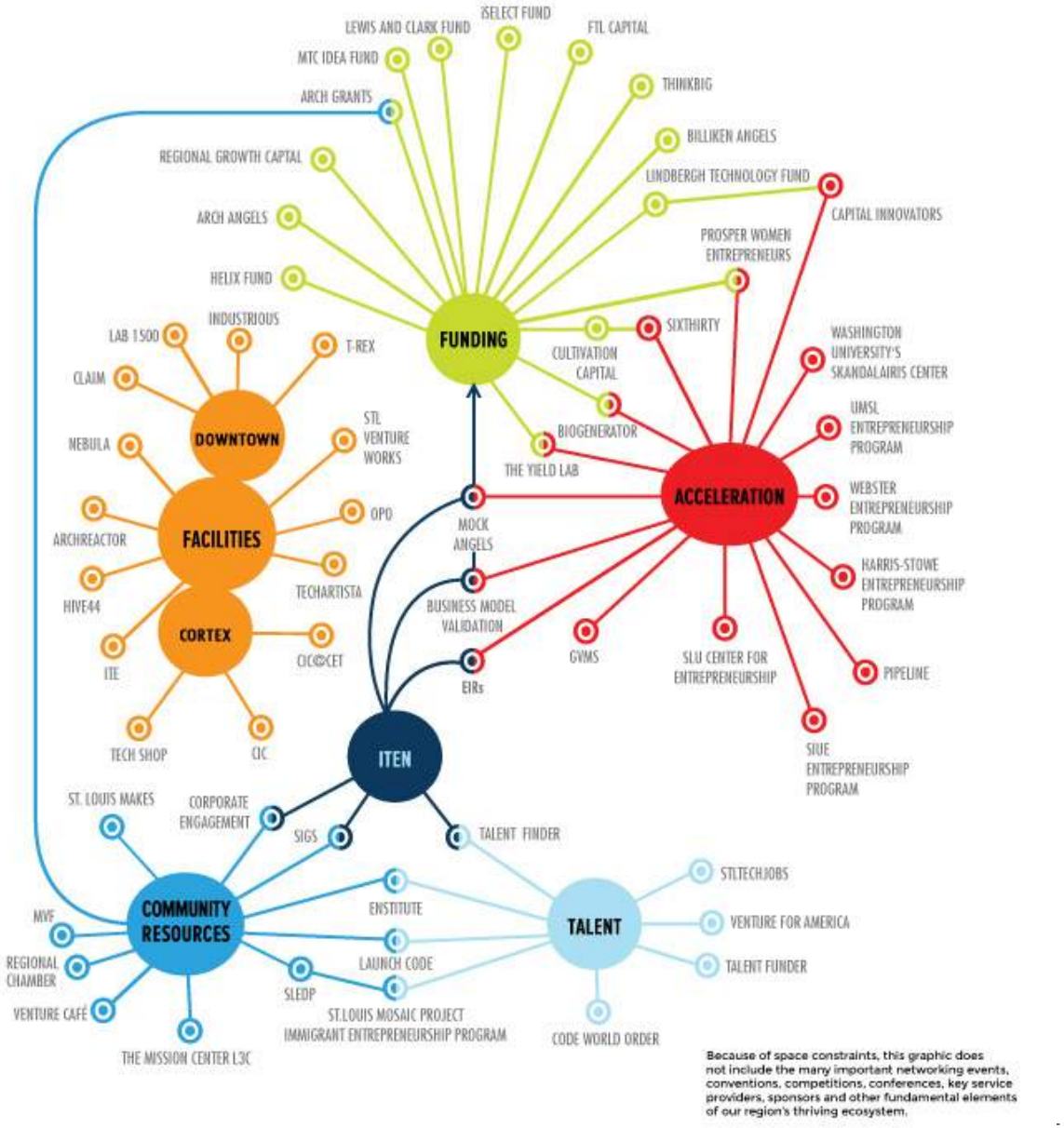
01 Metal Fabrication, including aerospace, automotive, and associated tooling is highly concentrated in St. Louis

02 Metal Fabrication is the single largest regional cluster in terms of output, larger than the plant and life sciences....

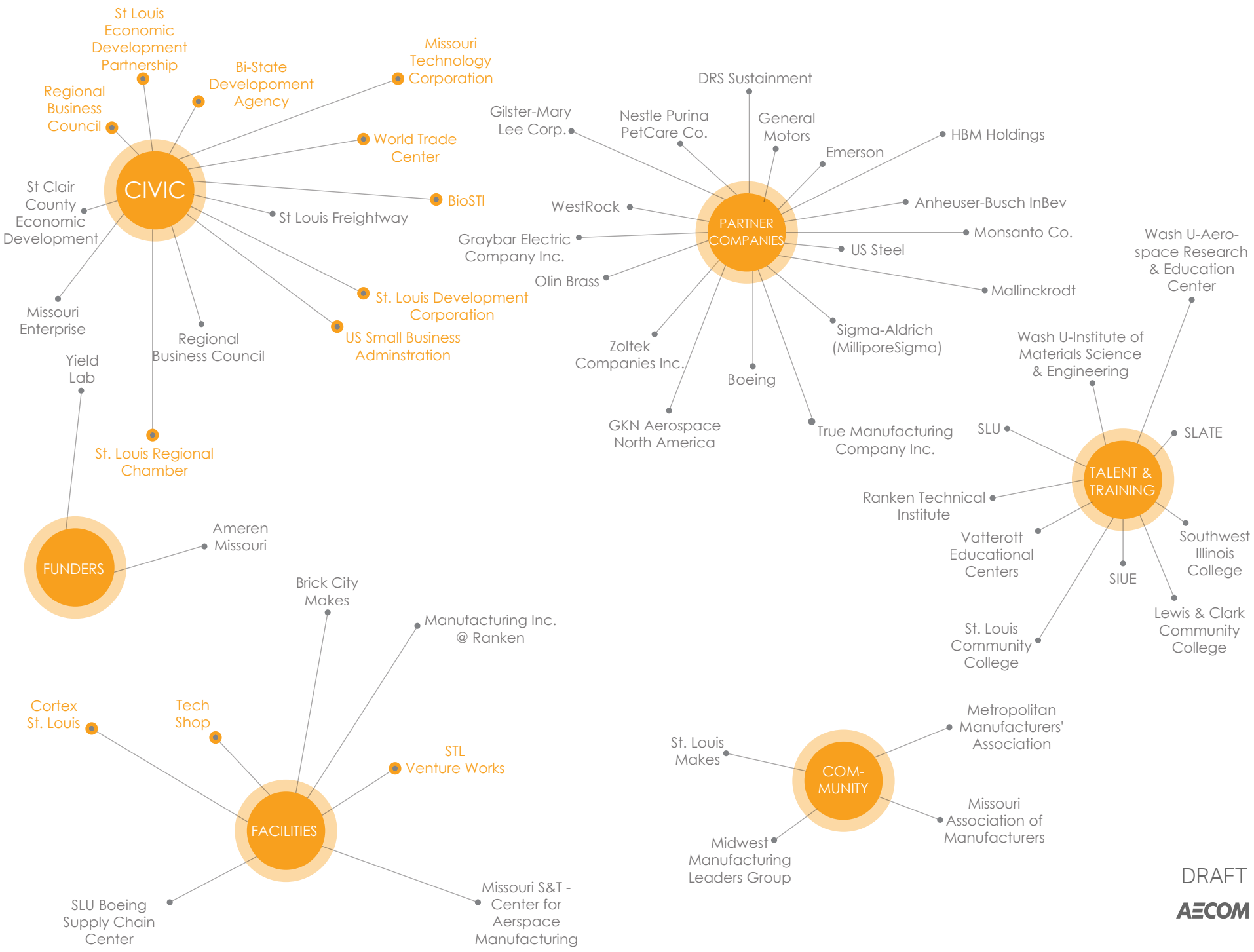
STL PLANT AND LIFE SCIENCES ECOSYSTEM

The region has spent 20 years investing in plant and life sciences and tech, and is now reaping the rewards for a focused strategy....

In comparison, manufacturing is highly fragmented...



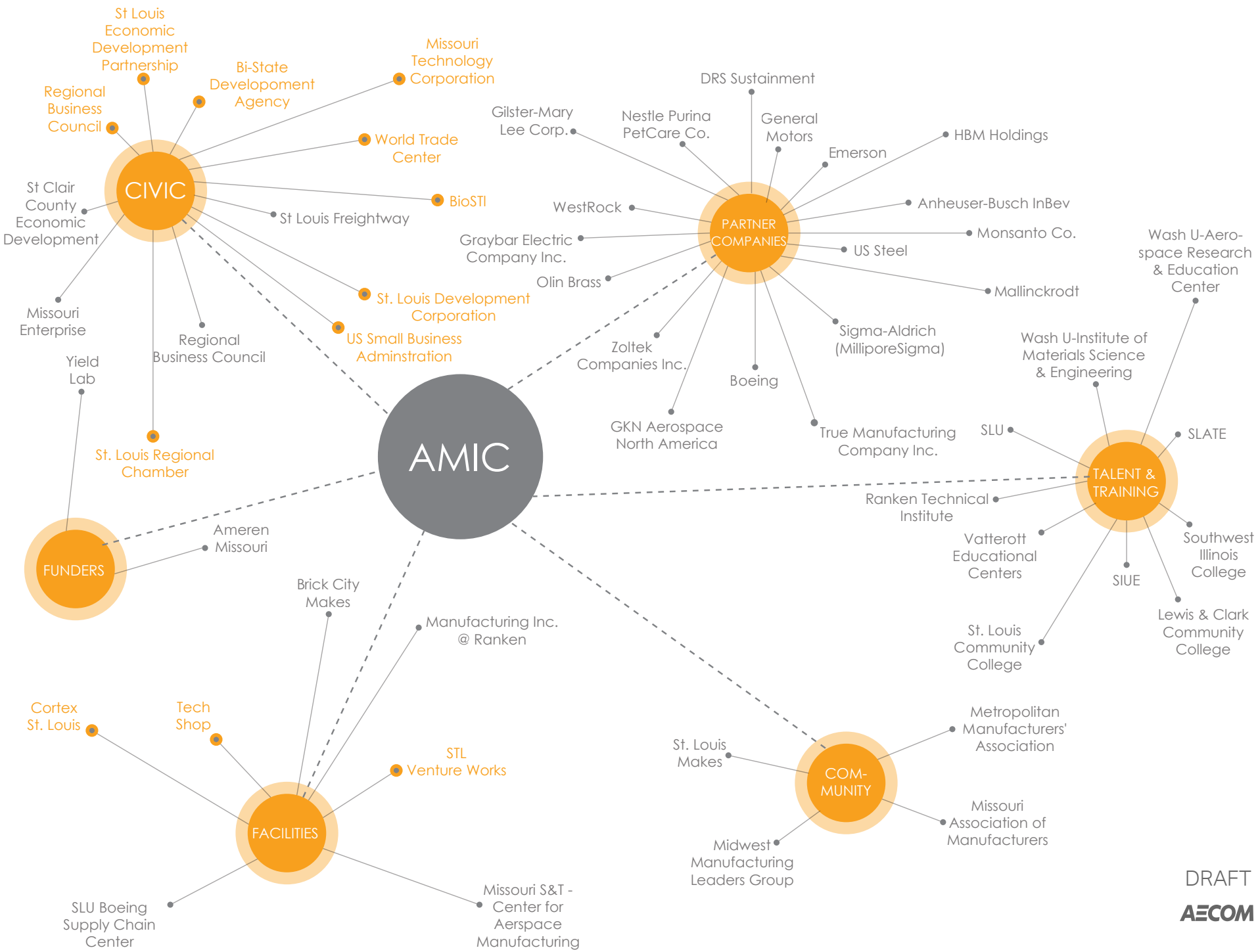
REGIONAL MANUFACTURING ECOSYSTEM MAP TODAY



DRAFT

AECOM

REGIONAL MANUFACTURING ECOSYSTEM MAP



DRAFT

AECOM

MANUFACTURING GROWTH RATE

GROWTH RATE COMPARISON: 2010-2015 MISSOURI

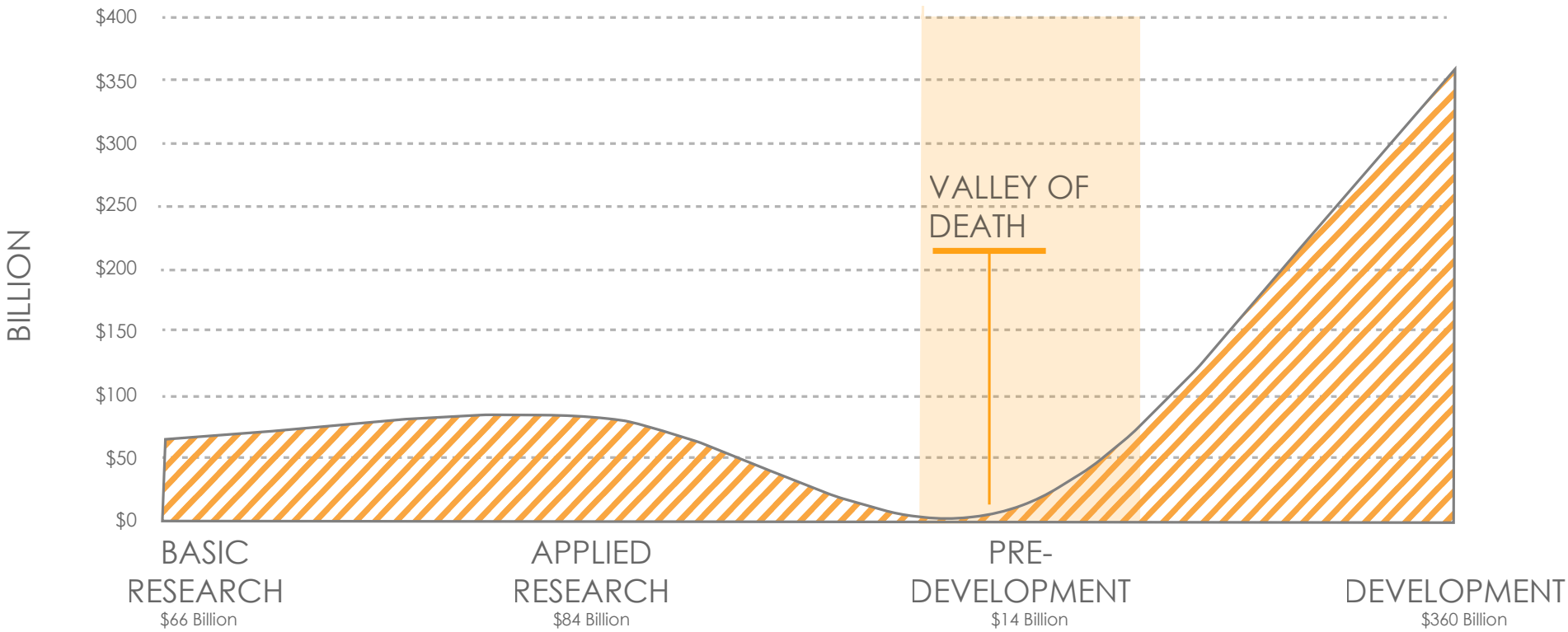
Metric	2010	2015	CAGR
Population	5,988,927	6,076,204	0.3%
Employment	2,658,400	2,796,900	1.0%
GDP	$255,865,000,0000	$292,718,000,000	2.7%
R & D Funding	$4,464,770,500	$5,545,616,100	4.4%

01 R&D funding in Missouri has increased faster than most economic metrics

02 Positive R&D trends in the State bode well for innovation in Missouri

NATIONAL R&D FUNDING BY INNOVATION PROCESS PHASE

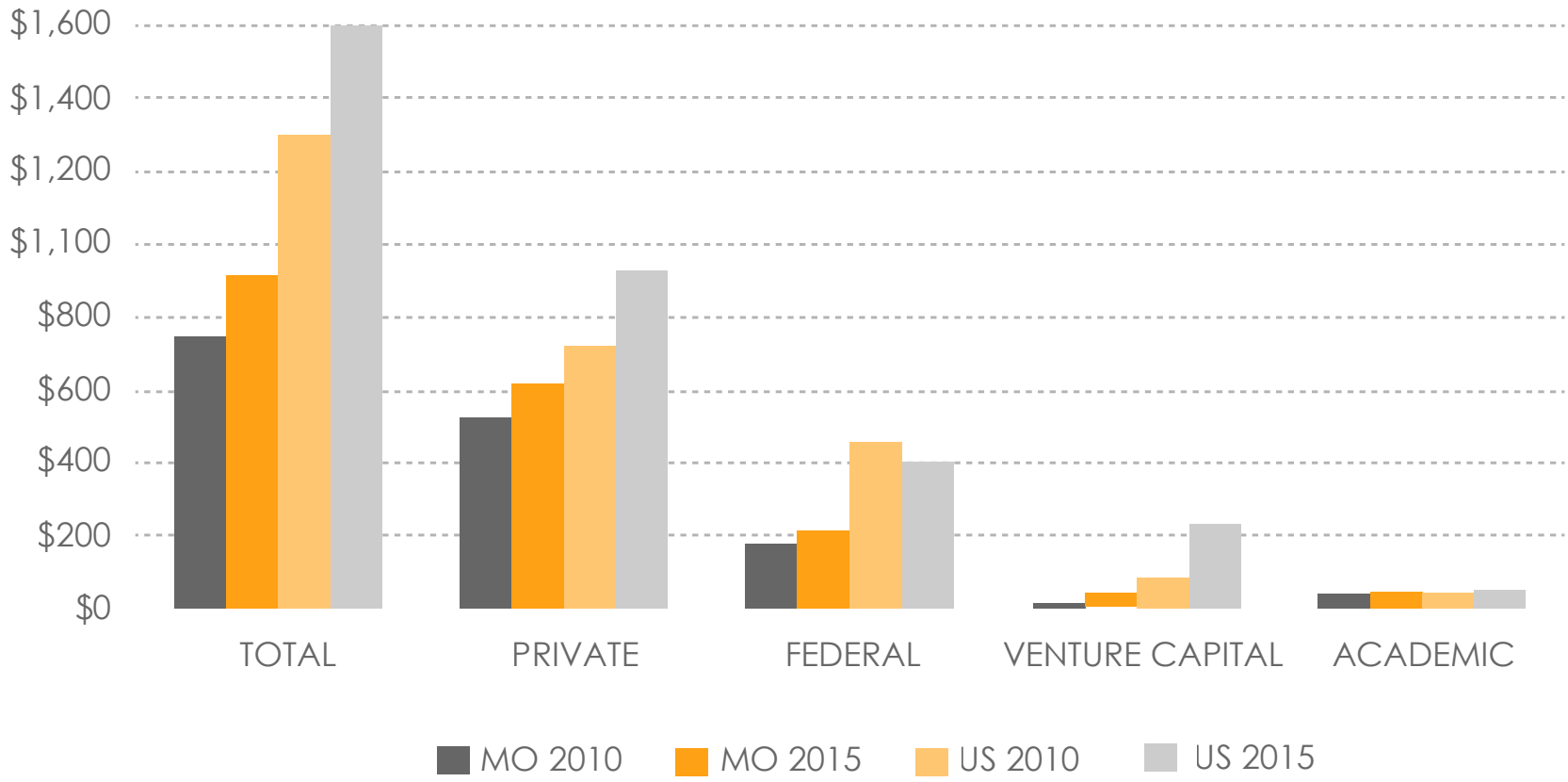
PRE-COMMERCIALIZATION: 2015



01 Transitioning innovations from a theoretical state to a practical application is challenging

02 A resource gap between research and development complicates this process further

PER CAPITA R&D RATES



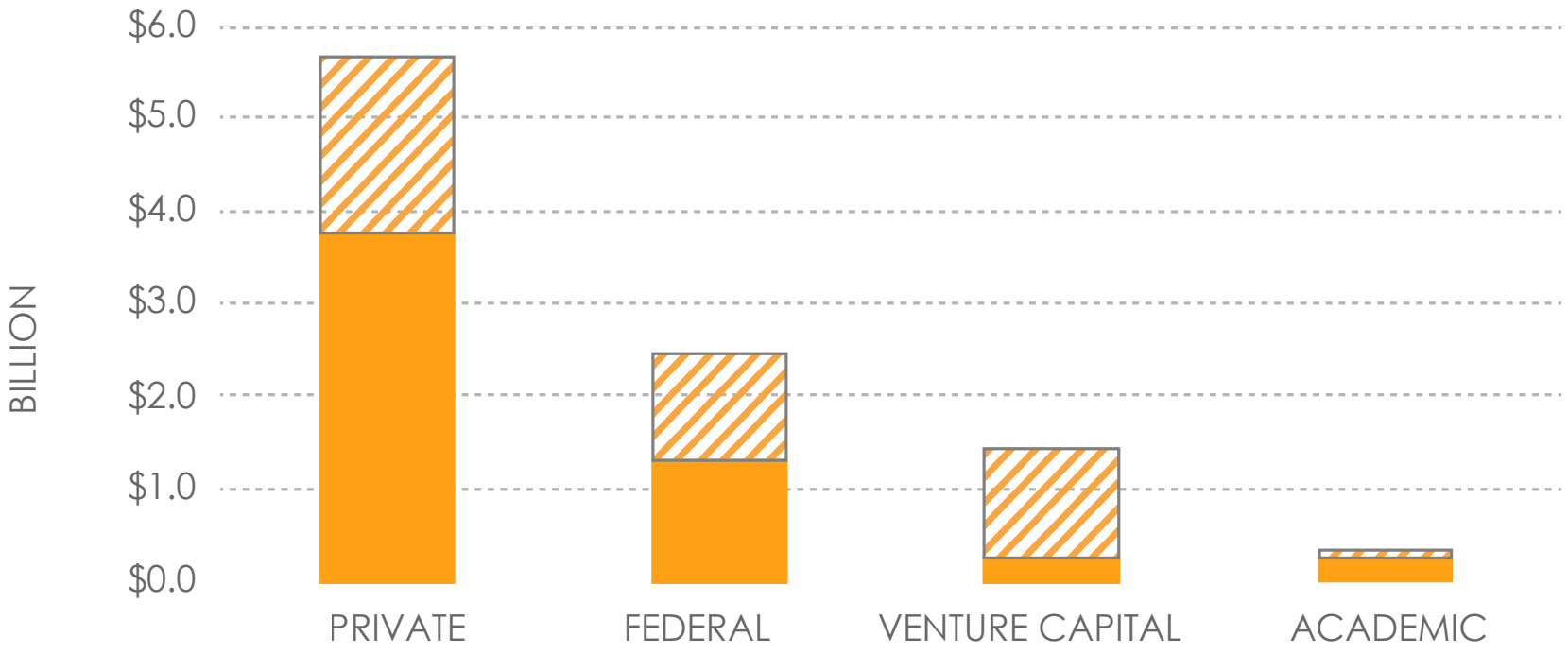
01 Despite positive trends in R&D funding post-Recession, Missouri still receives less R&D funding per capita than the US

02 Universities in Missouri find R&D at a per capita rate comparable to the US average

03 All other major sources of R&D funding lag behind US per capita funding rates

MISSOURI TOTAL R&D FUNDING AND MISSED OPPORTUNITIES

2015

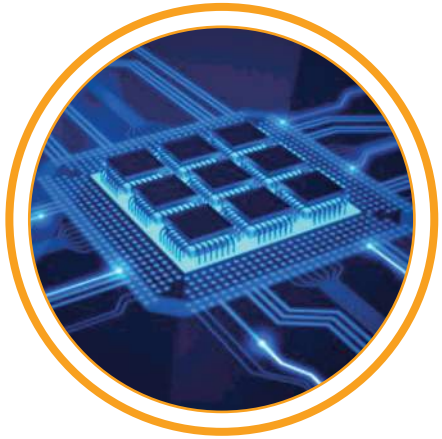


01 Net gap of about $4.5 billion in R&D statewide

CHALLENGES TO MANUFACTURING (BIG DATA)

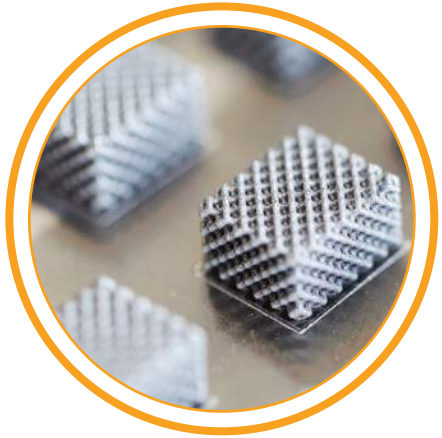
01 BUSINESS CHALLENGES

Finding and penetrating new markets



02 TECHNOLOGY IMPLEMENTATION

Integration of software and hardware, and premature obsolescence of new equipment



03 ADDITIVE MANUFACTURING

Tremendous potential and significant technical challenges; lack of standards

CHALLENGES TO MANUFACTURING (BIG DATA)

04 CHANGES IN STANDARDS

Adjust to new standards; ISO 9001:2015

05 CYBERCRIME

Growing importance of data in manufacturing has security implications

06 SUPPLY CHAIN COORDINATION

Impact of technology on supply chains

ENABLERS TO MANUFACTURING (BIG DATA)

01 3D PRINTING/ ADVANCED MATERIALS

Customization and improvements in product quality

02 LOGISTICS

Improved transportation links and efficient supply chains

03 ADDITIVE MANUFACTURING

Cloud computing, Internet of Things, Big Data, and Analytics

ENABLERS TO MANUFACTURING (BIG DATA)

04 STANDARDS

Industry standards, replicable processes and replaceable parts

05 INDUSTRIAL HARDWARE

Advanced sensors and semiconductors

06 DEMOGRAPHICS + INFRASTRUCTURE

Aging population, obsolete infrastructure, and urbanization

02 INTERVIEWS & VISIONING

INTERVIEWS AND VISIONING

Three Categories of Interviews:

01 Case Studies and Innovation Facilities

02 Manufacturers

03 Universities and Workforce Intermediaries

Critical Path Questions:

01 In what sectors do St. Louis firms have a clear competitive edge?

02 What challenges are local manufacturers facing?

03 Who is our champion?

INTERVIEWS- THE FUTURE OF ADVANCED MANUFACTURING

Alberici

BOEING

AMRC
ADVANCED MANUFACTURING RESEARCH CENTRE

EMERSON

Washington University in St. Louis

Bugeye Technologies, Inc.
Making your simulation solutions better

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

GKN Driveline

St. Louis Community College

JAMES S. MCDONNELL FOUNDATION

GM

SAINT LOUIS UNIVERSITY
EST. 1818

BI-STATE DEVELOPMENT AGENCY
Metro

MISSOURI S&T
University of Science & Technology

BIOSTL
Advancing St. Louis Bioscience

ESSEX INDUSTRIES

FlightSafety international

SWIP SYSTEMS
POWERFUL TECHNOLOGY SOLUTIONS

BIOMÉRIEUX

STL ECONOMIC DEVELOPMENT PARTNERSHIP

ST LOUIS REGIONAL FREIGHTWAY

FEDERAL RESERVE BANK of ST. LOUIS
CENTRAL TO AMERICA'S ECONOMY®

STAUDER TECHNOLOGIES

ST. LOUIS MAKES
stlouismakes.org

BRICK CITY MAKES

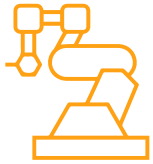
RANKEN TECHNICAL COLLEGE

MissouriEnterprise

THE YIELD LAB

INTERVIEWS- THE FUTURE OF ADVANCED MANUFACTURING

The industry is being transformed by additive technologies, specifically how parts and castings are made.



There is a movement away from prototyping and moving directly to production work.

This change in how manufacturers are interfacing with suppliers has unbelievably simplified the process, improved quality and shortened lead times.

Getting this additive technology in the hands of the region would be an immense help.

Training is essential for the next generation of workforce in the industry.

Small and midsized manufacturers may not know what they don't know.

EMERGING REGIONAL DIFFERENTIATORS

01 Impact and interest of our major manufacturing employers

02 Role of workforce intermediaries- Ranken Tech and Manufacturing Inc.

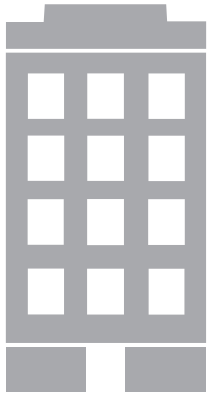
03 Emerging networks- St. Louis Makes/ Midwest Manufacturing Leaders/ SLU Supply Chain Center

04 Federal support and evolution of Manufacturing USA

05 Intangibles

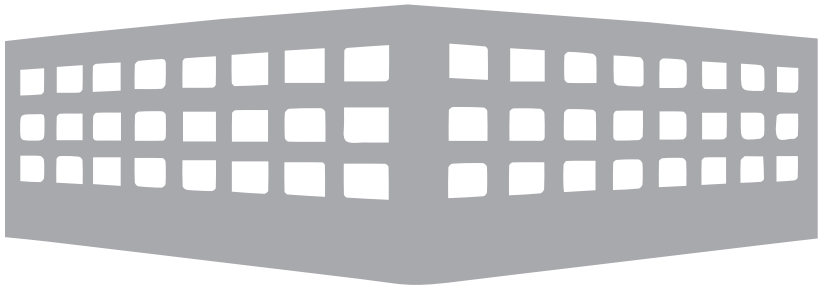
- BioStl
- Wash U Aerospace Research & Education Center
- Missouri S&T
- Innovation Triangle: NGA/ Cortex/ Ranken

CASE STUDIES



Track 01
Incubator Model

Manufacturing Incubator (ICNC)
- Basic incubator
- Manufacturers rent space
- Business support services are offered at the site, but the site does not engage in any research itself.



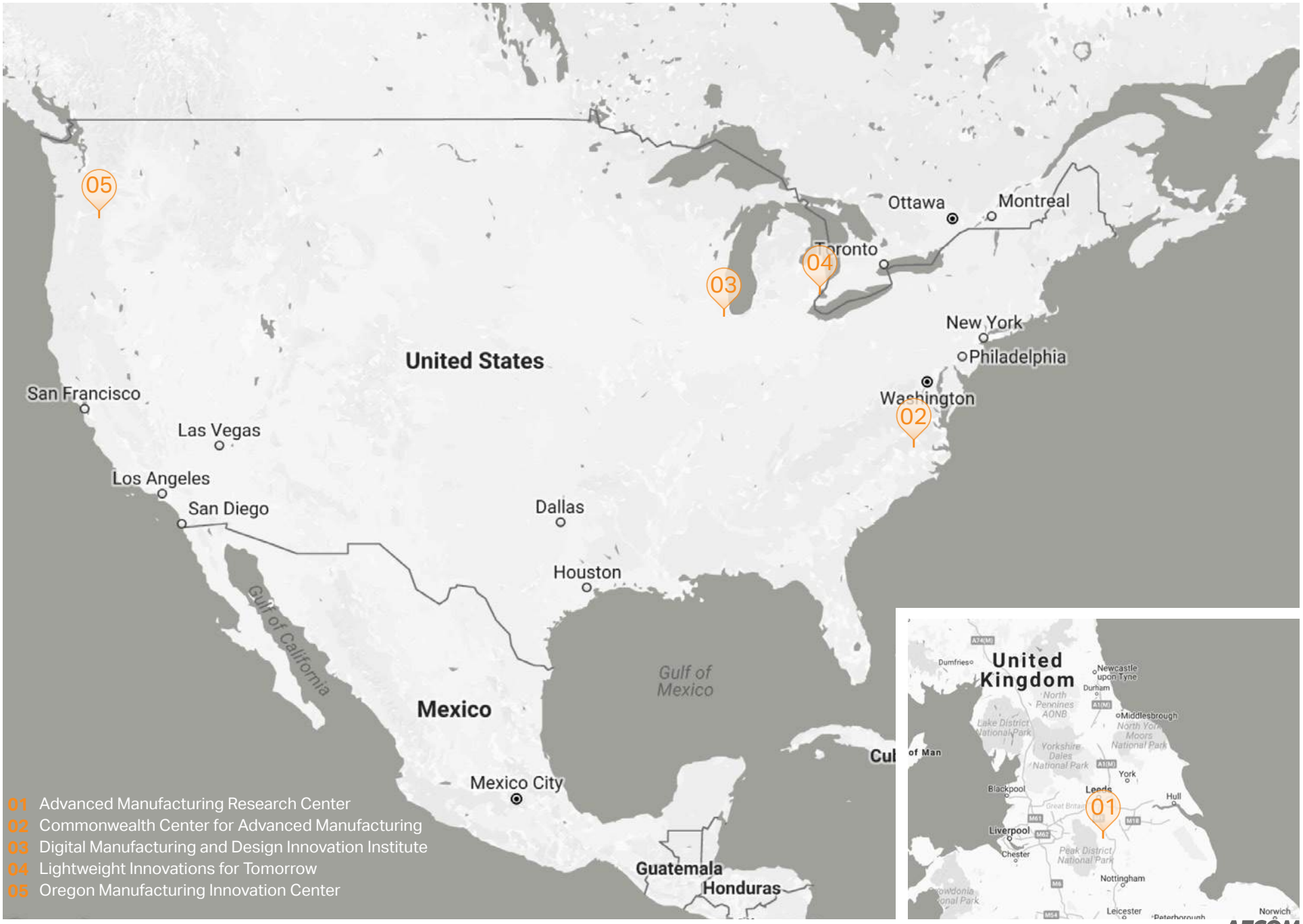
Track 02
Innovation/ Research Model

Manufacturing USA Model (LIFT)
- Public-private partnership, non-profit organization
- Hierarchy of membership
- Research conducted by all members- only 1 type

Hybrid Model (CCAM)
- Public-private partnership, private leader
- Tiered membership system
- 2 research types: generic and directed

Research Center Model (AMRC)
- Private-university partnership
- Tiered membership system
- 3 research types: generic, directed, and innovative

CASE STUDIES



AECOM

CASE STUDIES

01
Advanced Manufacturing Research Center (AMRC)

02
Commonwealth Center for Advanced Manufacturing (CCAM)

03
Digital Manufacturing and Design Innovation Institute (DMDII)

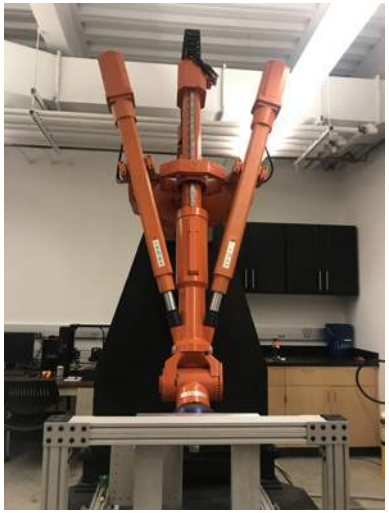
04
Lightweight Innovations for Tomorrow (LIFT)

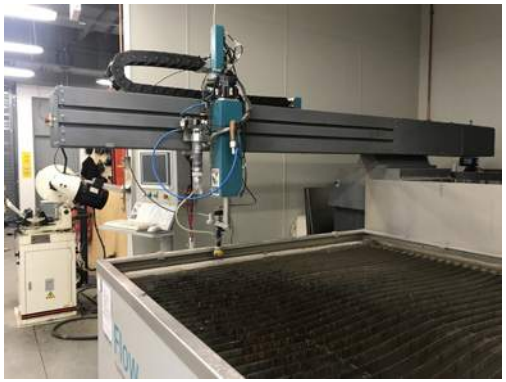
05
Oregon Manufacturing Innovation Center (OMIC)

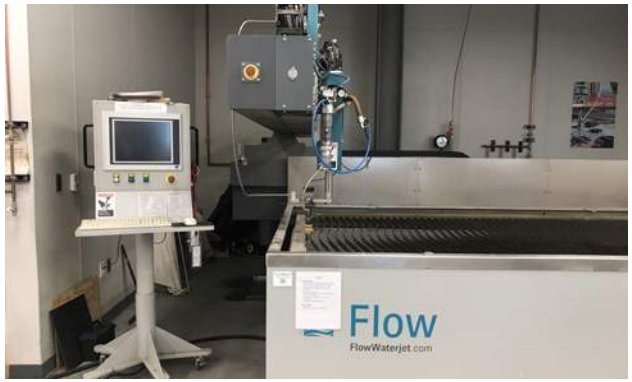
CASE STUDIES

	Advanced Materials Research Center (AMRC)	Commonwealth Center for Advanced Manufacturing (CCAM)	Digital Manufacturing and Design Innovation Institute (DMDII)	Lightweight Innovations for Tomorrow (LIFT)	Oregon Manufacturing Innovation Center (OMIC)
Location	Sheffield, England	Disputanta, Virginia	Chicago, Illinois	Detroit, Michigan	Scappoose, Oregon
Project Costs	$9.3 million	$17.6 million	$31 million	$58 million	$4.2 million
Building Gross Area	48,000 sf	62,000 sf	94,000 sf	100,000 sf	33,800 sf
Public/ Private Funding	100%/ 0%	28%/ 72%	100%/ 0%	50%/ 50%	50%/ 50%
University Partners	University of Sheffield	Old Dominion University University of Virginia Virginia Commonwealth University Virginia State University Virginia Tech	Iowa State University Northwestern University University of Illinois-Chi University of Illinois-Urb University of Michigan	University of Michigan EWI Worldwide Ohio State University	Oregon Tech Institute Oregon State University Portland State University
Corporate Partners	Boeing Rolls-Royce	Rolls-Royce Siemens Canon	Dow General Electric Rolls-Royce	Boeing General Electric Alcoa	Boeing
Research Focus	High performance machining, milling, and composites	Manufacturing systems, surface engineering, and coatings	Systems engineering, future factory, product development, and digital design	Melt processing, powder processing, thermo-mechanical processing, novel/ agile processing	Additive processes, hard metal manufacturing, automation and optimization, large integrated structures

EQUIPMENT







03 LOCATION FRAMEWORK

LOCATION FRAMEWORK

Intent:

01 Use Case Studies to identify salient factors that influence Innovation Center location decision

02 Identify St. Louis neighborhoods with characteristics that align with Case Study insights

Insight:

The private sector needs to contemplate locations that:

01 Align workforce and higher education participation

02 Allow for future expansion & manufacturing preservation

03 Create deliberate serendipity/ place matters

SITE CRITERIA -DETERMINED BY CASE STUDY RESEARCH

- Affordable and available building/land

- Site that can accommodate an existing or new 40,000-60,000 sf building and parking

- Adjacent to land or buildings that can be re-purposed for growth

- Zoned for industrial/ manufacturing and can be zoned as an innovation district

- Site can be accessed easily by semi-trailer

- Local government support/ access to financial resources

- Physical proximity to partner companies

- Physical proximity to workforce training/ education

- Physical proximity to urban core/ transit

LOCATION CATEGORIES

01 Infill

02 Redevelopment

03 Academic/ Workforce

04 Industrial/ Aerospace

LOCATION CATEGORIES | INFILL

39N
Monsanto

CORTEX

FOX PARK
Brick City Makes

LOCATION CATEGORIES | REDEVELOPMENT

ST LOUIS PLACE
Ranken

ST LOUIS PLACE
NGA

WELLSTON

LOCATION CATEGORIES | ACADEMIC + WORKFORCE

FLORISSANT VALLEY
St. Louis Community College

EAST ST LOUIS
East St Louis Community College

GRAND CENTER
St. Louis University

LOCATION CATEGORIES | ACADEMIC + WORKFORCE

GRAND CENTER
SLEDP Grand

CLAYTON
Washington University

LOCATION CATEGORIES | INDUSTRIAL + AEROSPACE

EAST ST LOUIS
East St. Louis Airport

WENTZVILLE
GM

AIRPORT NORTH
Boeing

04 SPACE & FUNCTIONAL PROGRAM

SPACE & FUNCTIONAL PROGRAM

Intent:

01 Use Case Studies to identify main program areas essential to the function needs of the Innovation Center

02 Develop final space and functional program needs based on local building code and zoning requirements

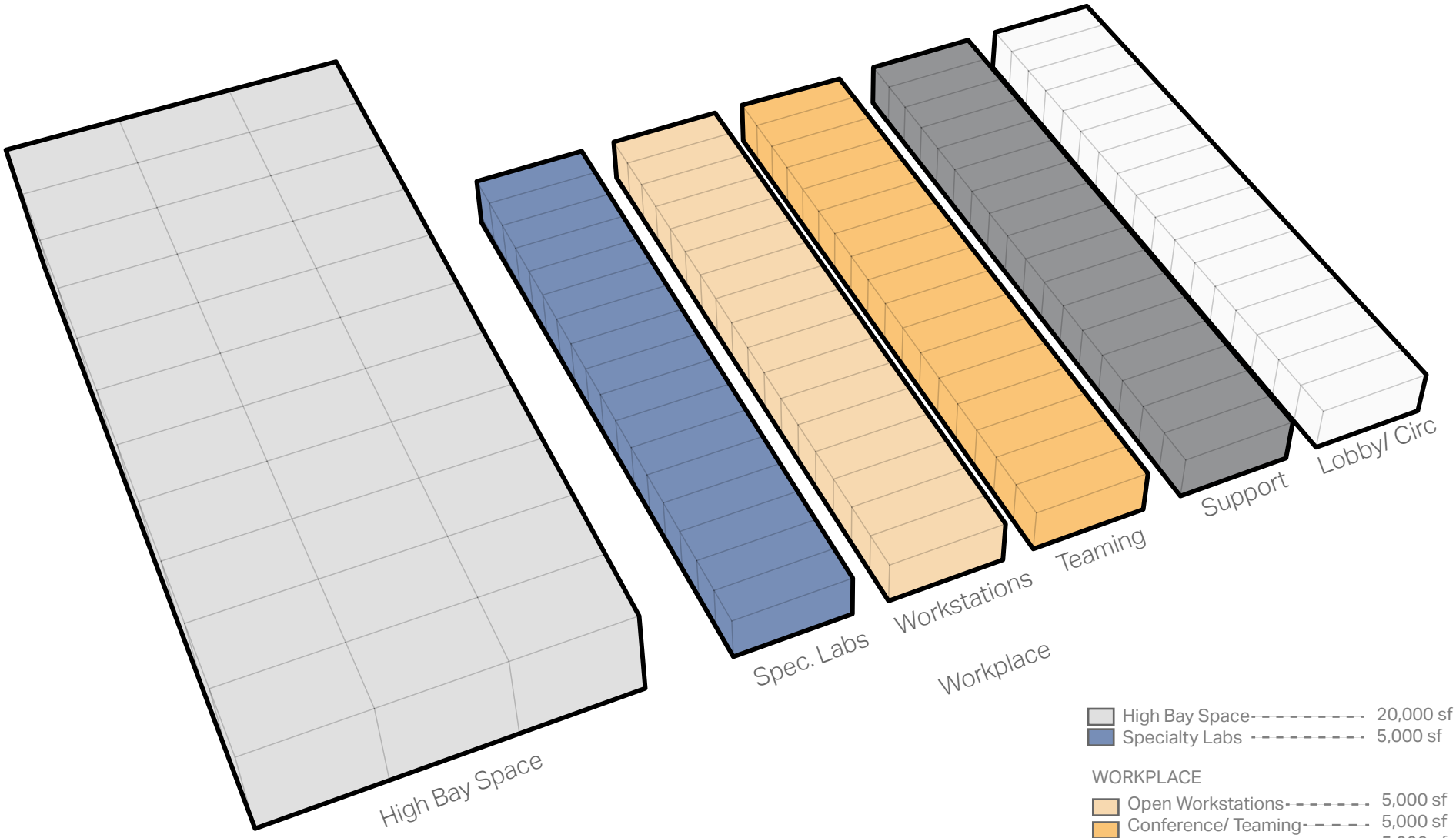
Three Main Program Areas:

01 High Bay Space- joint use manufacturing equipment

02 Specialty Labs- specific company owned equipment for testing and research

03 Workplace- collaborative working, teaming, and meeting spaces

PROPOSED AMIC PROGRAM



High Bay Space	20,000 sf
Specialty Labs	5,000 sf
WORKPLACE	
Open Workstations	5,000 sf
Conference/ Teaming	5,000 sf
Support	5,000 sf
Circulation/ Lobby	5,000 sf
TOTAL	**45,000 sf**

DRAFT

AECOM

05 CONCEPTUAL DESIGN

CONCEPTUAL DESIGN

Intent:

01 Generate preliminary massing and layout based on various Case Study models

02 Develop a conceptual design responding to the specific space and functional program identified for the facility

03 Convey a new aesthetic to represent how innovation and emerging technology are transforming the advanced

Conceptual Design:

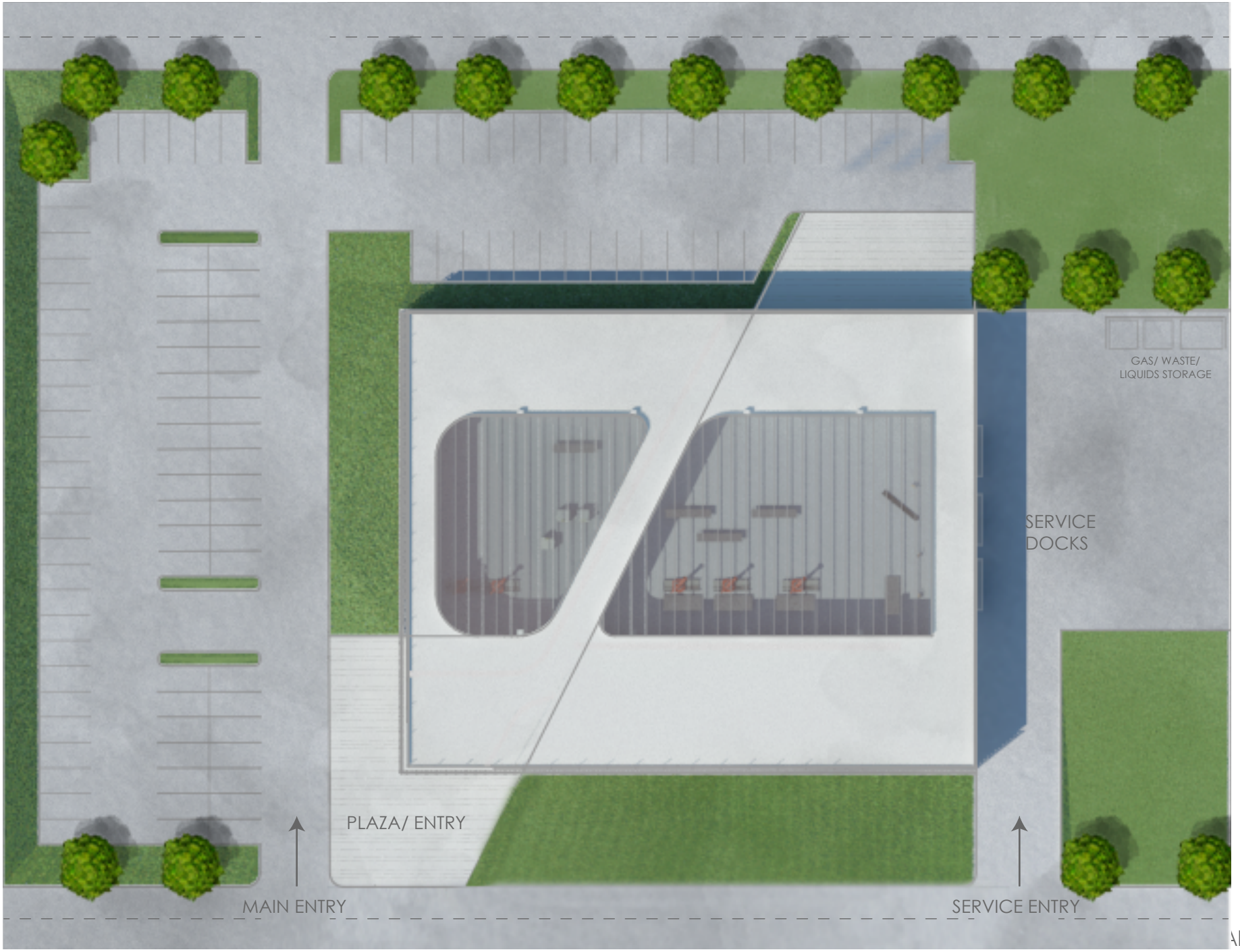
01 Site Plan

02 Exterior Perspective

03 Lobby View

04 High Bay View

SITE PLAN

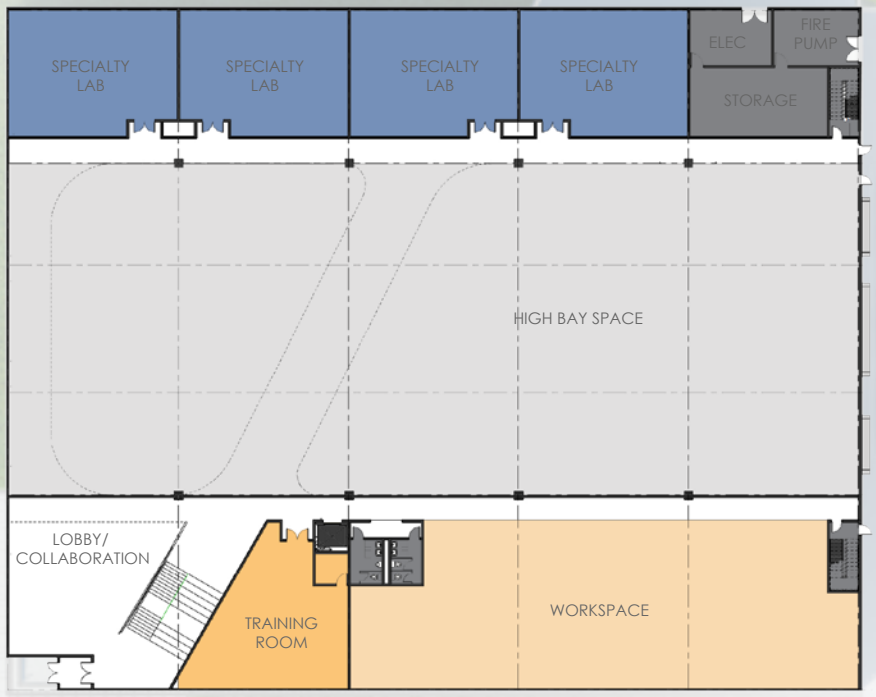


AFT

5 15 60
0 5 30

AECOM

FLOOR PLAN

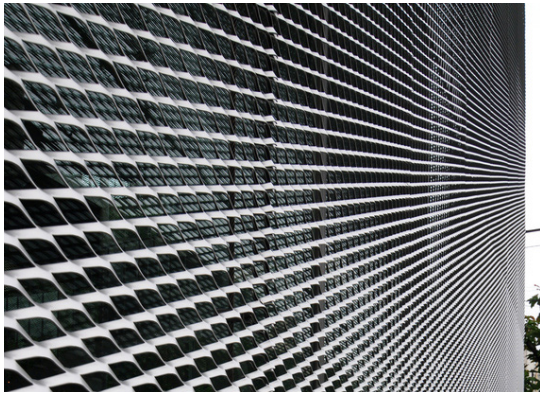


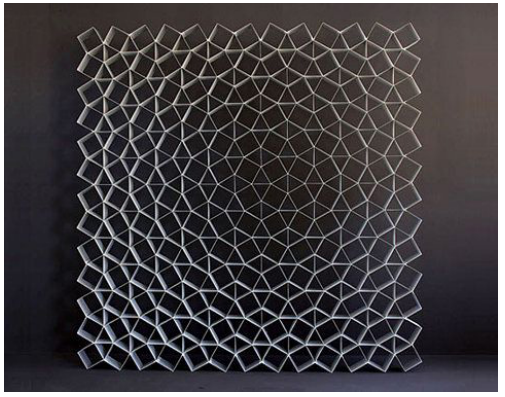
5 15 60
0 5 30

DRAFT

AECOM

EXTERIOR PERSPECTIVE





MATERIAL STUDIES

LOBBY/ COLLABORATION

HIGH BAY SPACE

06 CONCEPTUAL COST

POLICY

1. Focus on metals and additive MFG

2. Focus on "pre competitive research"

PARTNERS

1. A private sector champion and several partners

2. One or more universities

3. One or more workforce intermediaries

PHASE I FINANCIAL FRAMEWORK

1. Staffing 10 to 20 people

2. Labor budget: $750k to $1.5 million

3. Total operating budget: $1.5 million to $3 million

4. Capital costs: $12-16 million (building and site)

5. Operating equipment: $5 million

QUESTIONS