U.S. Department of Commerce
Bureau of Industry and Security
Office of Technology Evaluation

U.S. Rocket Propulsion Industrial Base Assessment

Final Results

2018

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Who We Are:

- **Bureau of Industry and Security (BIS)**

Mission: Advance U.S. national security, foreign policy, and economic objectives by ensuring an effective export control and treaty compliance system and promoting continued U.S. strategic technology leadership.

  - Develops export control policies
  - Issues export licenses
  - Prosecutes violators to heighten national security
  - Develops and implements programs that ensure a technologically superior defense industrial base

- **Office of Technology Evaluation (OTE)**

Mission: OTE is the focal point within BIS for assessing the capabilities of the U.S. industrial base to support the national defense and the effectiveness of export controls.

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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OTE Industry Surveys & Assessments Background

- Under Section 705 of the Defense Production Act of 1950 and Executive Order 13603, ability to survey and assess:
  - Economic health and competitiveness
  - Defense capabilities and readiness
- Data is exempt from Freedom of Information Act (FOIA) Requests
- Enable industry and government agencies to:
  - Share data and collaborate in order to ensure a healthy and competitive industrial base
  - Monitor trends, benchmark industry performance, and raise awareness of diminishing manufacturing and technological capabilities

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Rocket Propulsion Survey Assessment Background

- Partnership with NASA's Marshall Space Flight Center, and in collaboration with the Joint Army, Navy, NASA, Air Force (JANNAF) Working Group
- The principal goal is to gain an understanding of the supply chain network supporting the development, production, and sustainment of products and services supporting both USG and commercial propulsion-related systems
- Objectives:

a) Map the propulsion industrial base supply chain in detail;

b) Identify interdependencies between respondents, suppliers, customers, and USG agencies;

c) Benchmark trends in business practices, competitiveness issues, financial health, etc. across many tiers of the propulsion industrial base; and

d) Share data results with USG stakeholders to aid planning, outreach, and problem resolution

Methodology

- The scope of the survey and assessment was limited to U.S. based organizations with Propulsion-related activities, defined as:
  - "Any activity/component/subsystem/test/product/service that contributes to U.S. Government or Commercial propulsion systems (including the propulsion of a launch vehicle, missile, and in-space spacecraft propulsion). The activity/component/subsystem/test/product/service does not have to be specifically intended to support propulsion applications."
- Survey exemptions were provided on a case-by-case basis with careful consideration provided by the BIS and relevant stakeholders
- Organization size was established based on sales from Propulsion related products manufactured in the U.S.:
  - Small: Under $10M in annual sales
  - Medium: $10M-$50M in annual sales
  - Large: Over $50M in annual sales

Survey Taxonomy

Propulsion Business Lines - 24

1. Composite Materials
2. Composite Materials Processing
3. Electrical Systems
4. Engineering Services
5. Fabrication, (sub)system assembly
6. Instrumentation, sensors, transducers
7. Insulation
8. Interconnects, fasteners, standards, seals
9. Launch services
10. Liquid propellant materials
11. Machining
12. Maintenance/aftermarket/refurbishing services
13. Material preparation
14. Material processing/finishing
15. Mechanical controls
16. Ordnance/ignition components or systems
17. Raw materials
18. Research and development
19. Solid rocket linear material
20. Solid rocket propellant material
21. System integration
22. Test equipment
23. Testing services
24. Other

Propulsion Business Categories - 7

1. Large liquid propulsion
   a) Large chemical liquid propulsion systems
   b) All engines with turbopumps
   c) Features of the MPS that reside in the tanks
   d) Booster/upper/in-space transit stages, propellant, pressurant
2. Small liquid propulsion
   a) Small chemical liquid propulsion systems
   b) Pressure-fed engines
   c) Spacecraft propulsion
   d) Pressurant and propellant tanks, flow-control components, dedicated sensors, and engines
3. Large solid rocket motor
   a) 40” and larger motors requiring more than one mix to cast a single motor and relatively limited production rate
4. Small solid rocket motor
   a) 40” and smaller motors allowing casting of multiple motors from a single mix and relatively limited production rate
5. Science and technology
   a) Interagency collaboration for propulsion science and technology across all segments of the rocket propulsion industrial base (e.g. strategic missile boosters to space lift, in-space chemical and electric propulsion for satellites, to tactical missiles and missile defense)
6. Test and evaluation
   a) Connected with the National Rocket Propulsion Test Alliance
7. Electric propulsion
   a) Electrothermal rocket propulsion
   b) Electrostatic or ion propulsion engine
   c) Electromagnetic or magneto plasma engine

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Overview of Survey Data 2013-2016

Data is aggregated to allow public distribution of business confidential responses

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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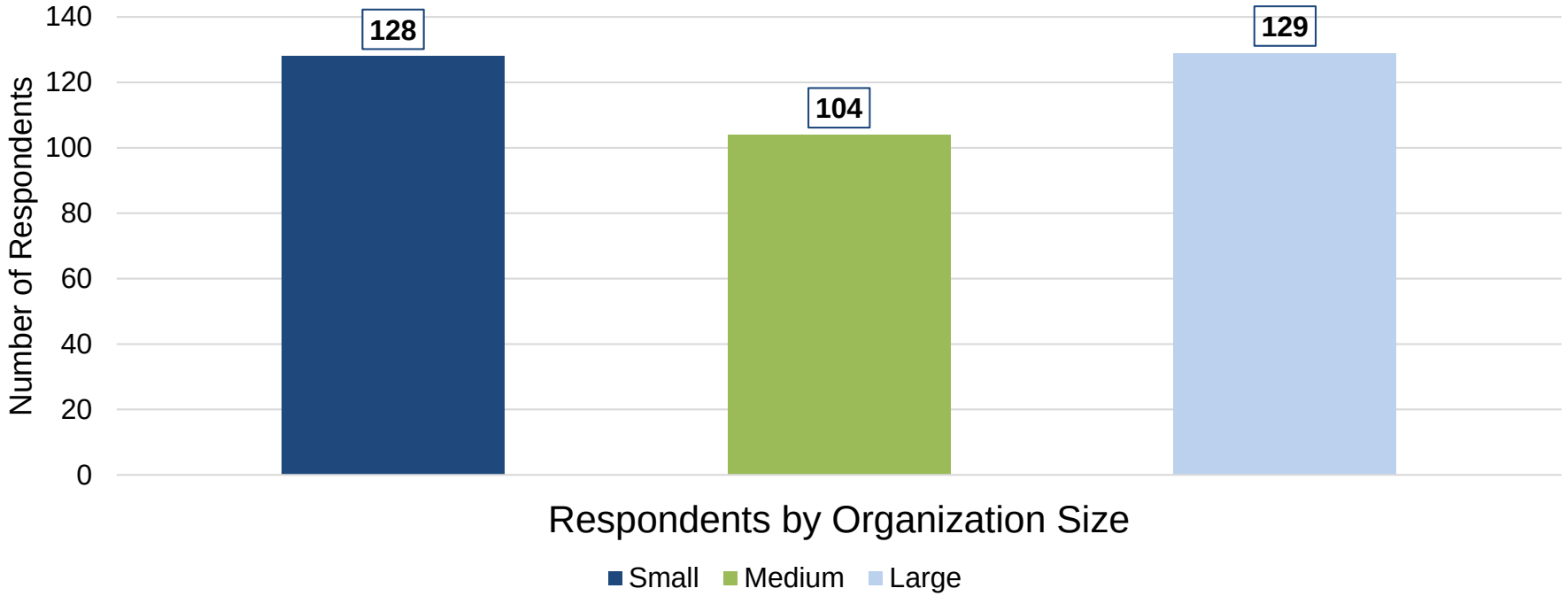
Respondent Profile

- The data presented in this assessment represents the submissions of 361 organizations with 531 owned/internal facilities



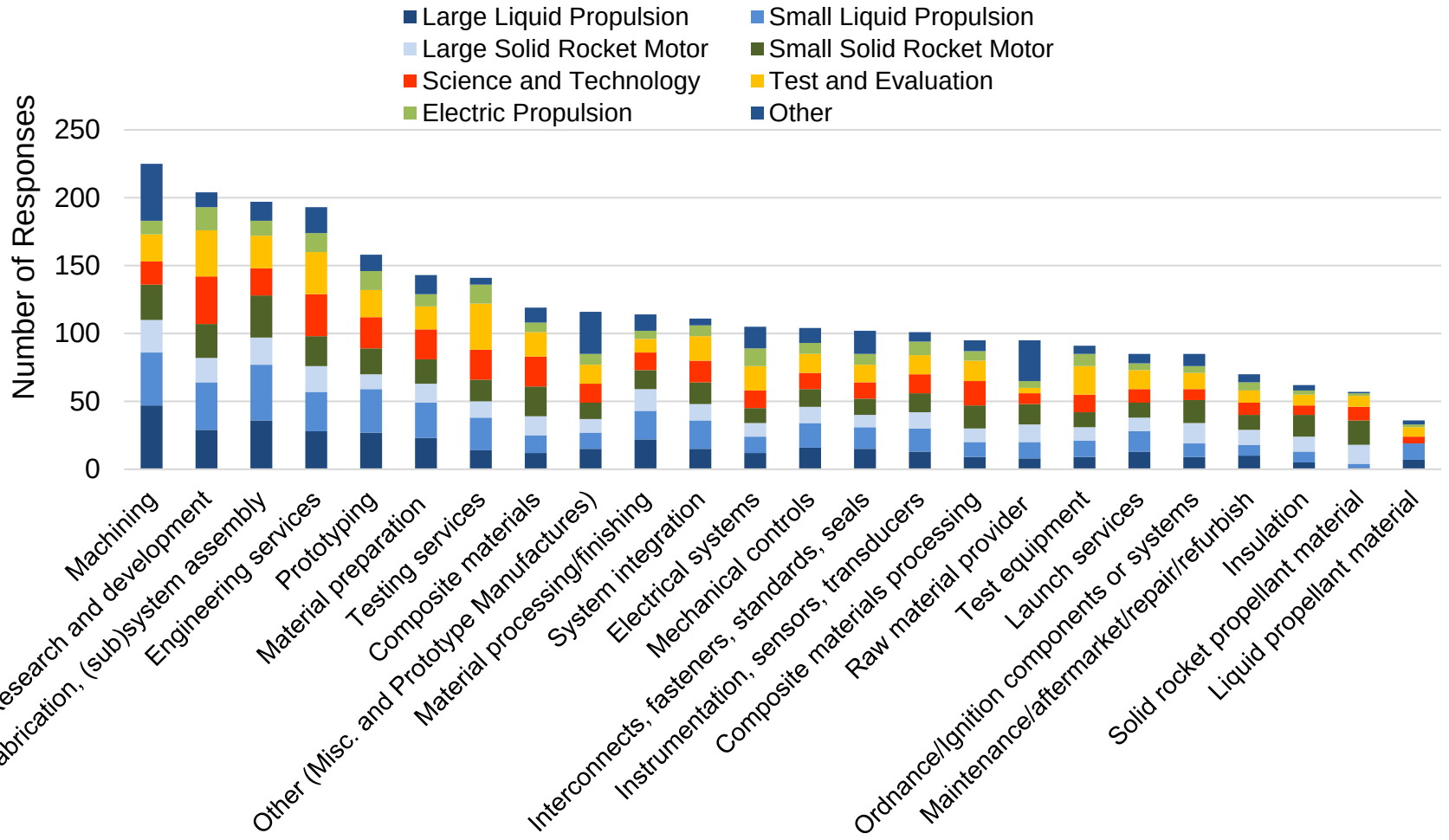
Small: Under $10M in annual sales Medium: $10M-$50M in annual sales Large: Over $50M in annual sales

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 respondents

Propulsion Business Lines - 24

Involvement by Industrial Base Business Category (8 Total)



Q1c, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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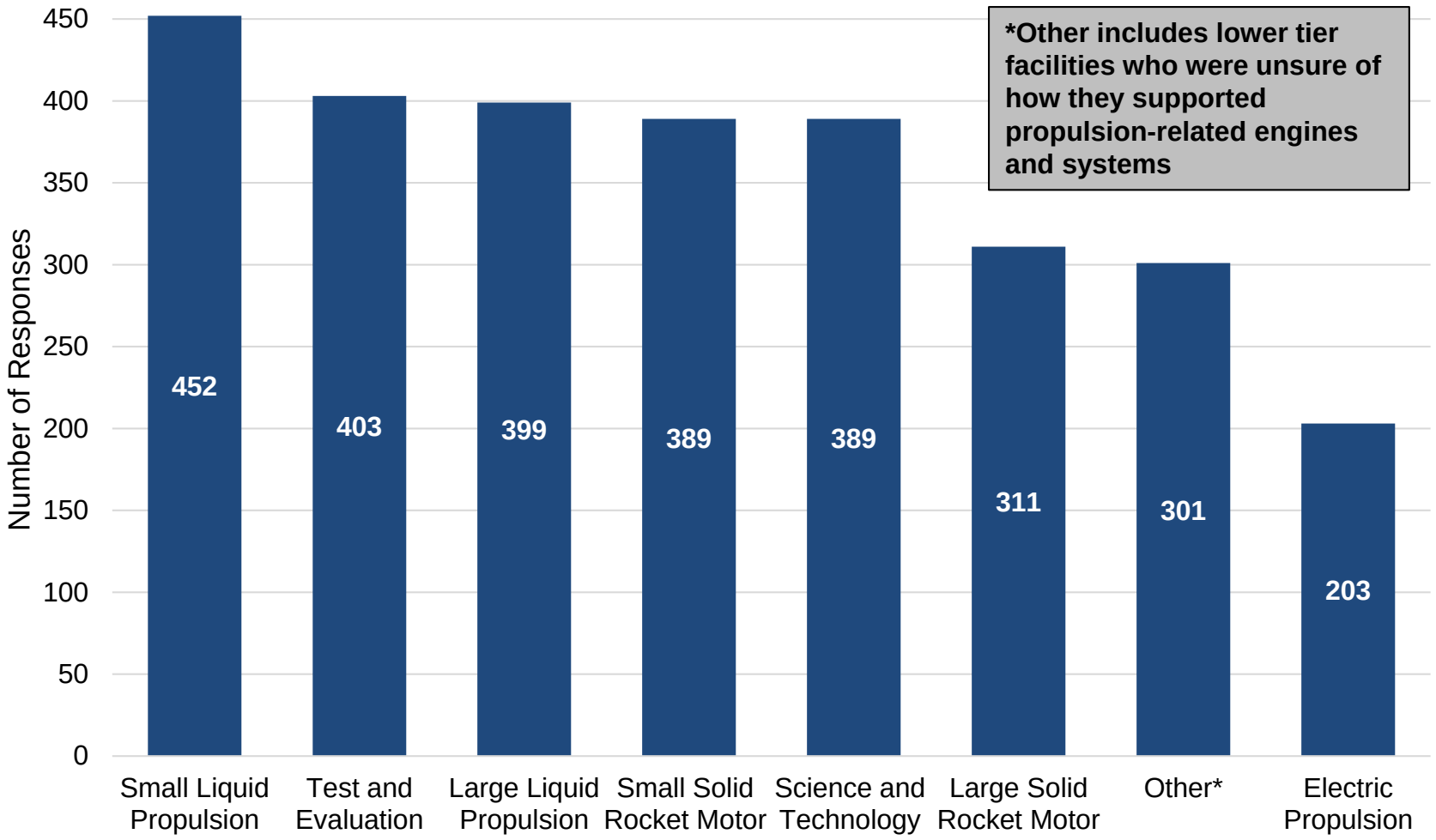
Propulsion Business Categories – 8 Total

Company Participation by Category



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Organization Information

Countries (16) with Equity Ownership in U.S.-based Propulsion-Related Companies (33)	
United Kingdom	9
Japan	6
Germany	3
Norway	3
Cayman Islands	2
Switzerland	2
France	2
Belgium	2
Netherlands, Canada, Austria, Sweden, United Arab Emirates, India, Israel and Luxembourg	1 each

33 respondents identified non-U.S. based organizations with equity ownership

4 respondents each had two countries with equity ownership, for a total of 37 non-U.S. based organizations with equity ownership

16 unique countries were identified with equity ownership

Q1a, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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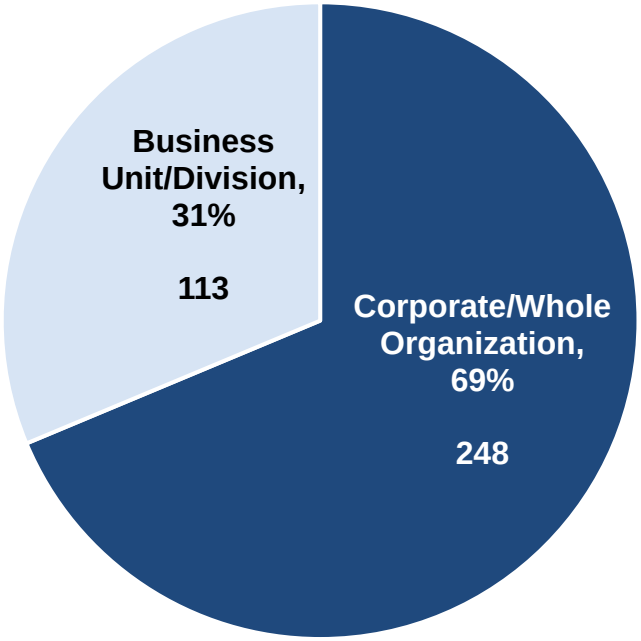
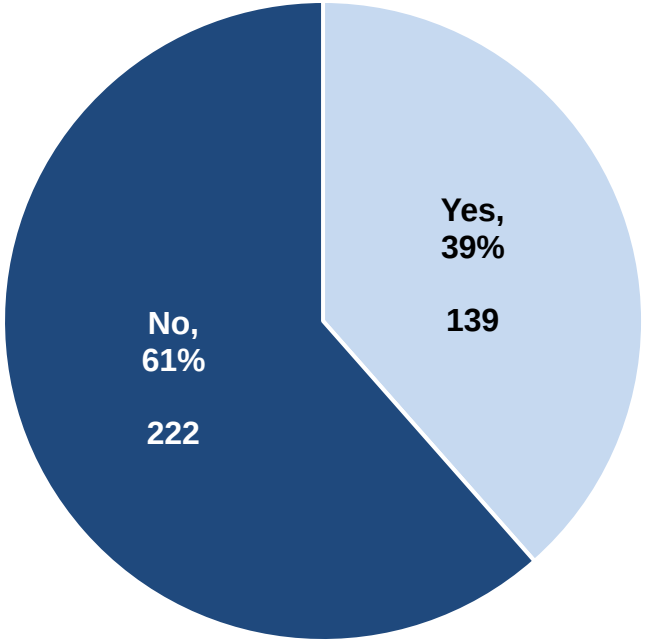
33 respondents

Organization Reporting Level



Percentage of Respondents with Parent Organizations



Both questions are not mutually exclusive (e.g. respondents can report at the Business Unit/Division level and not have a parent organization)

Q1a, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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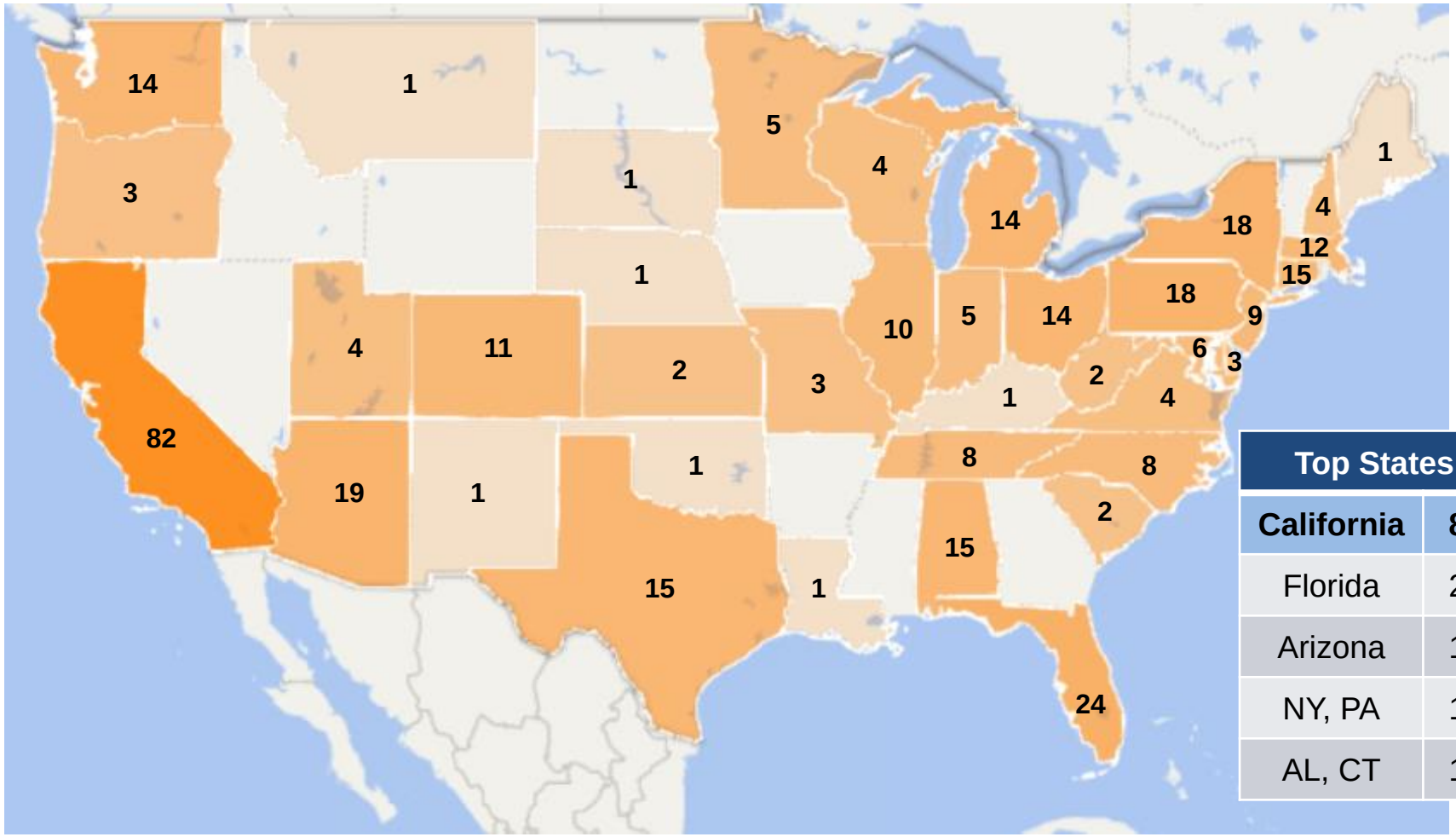
361 Respondents

Headquarter Location by State (361 Total)



Top States	
California	82
Florida	24
Arizona	19
NY, PA	18
AL, CT	15

Q1a, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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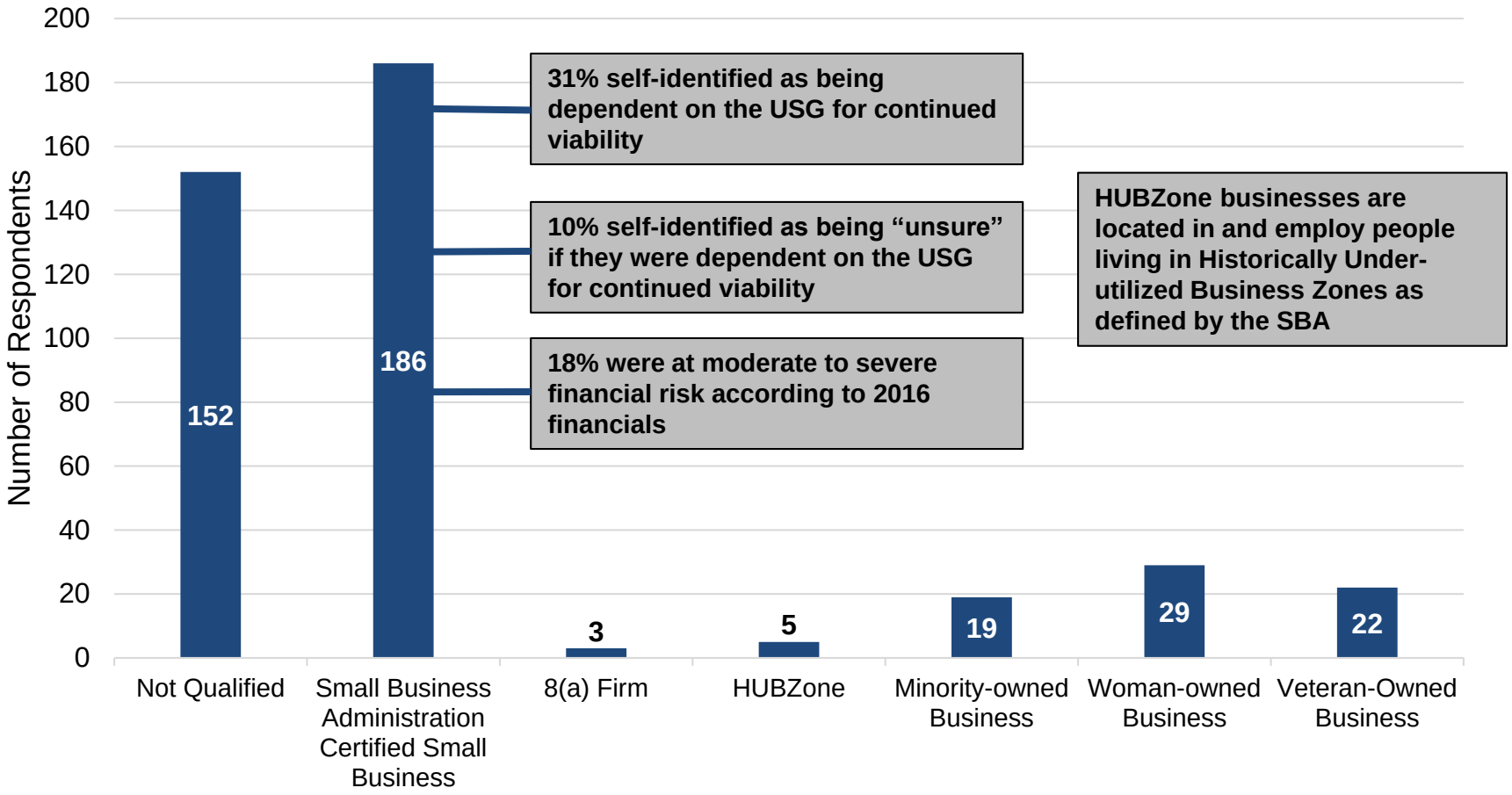
Special Small Business Types

Number of Respondents by Special Business Types



Q1a, D

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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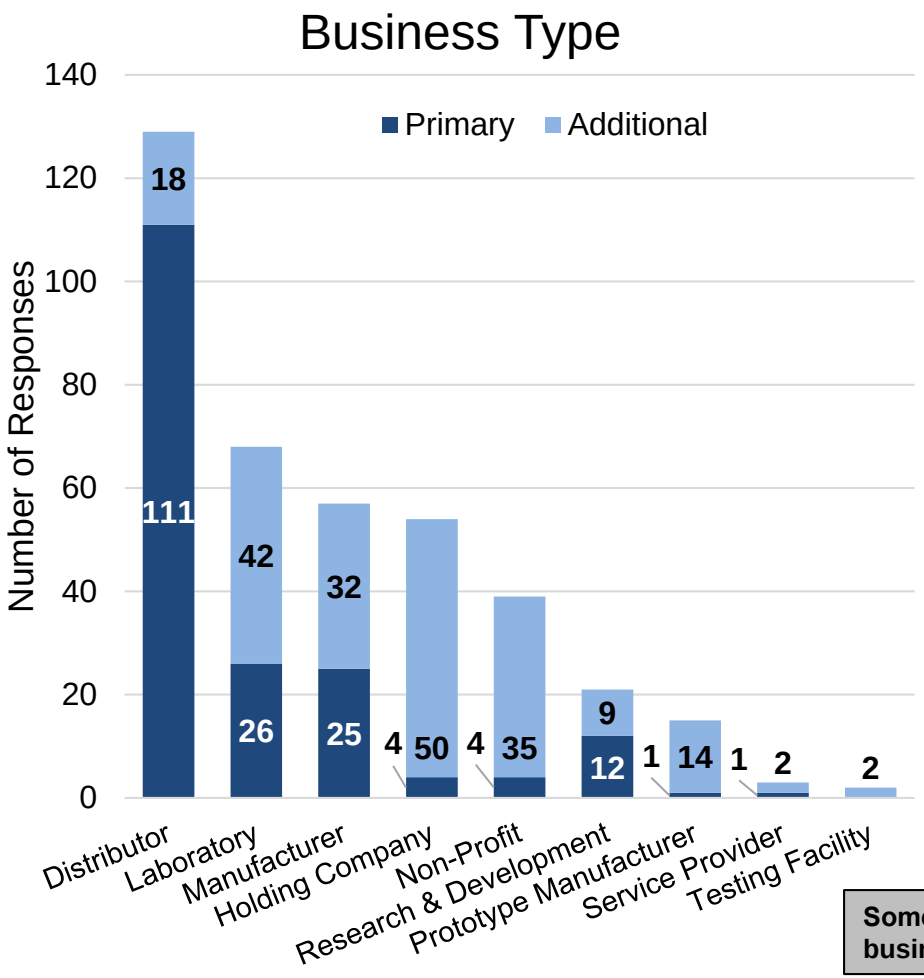
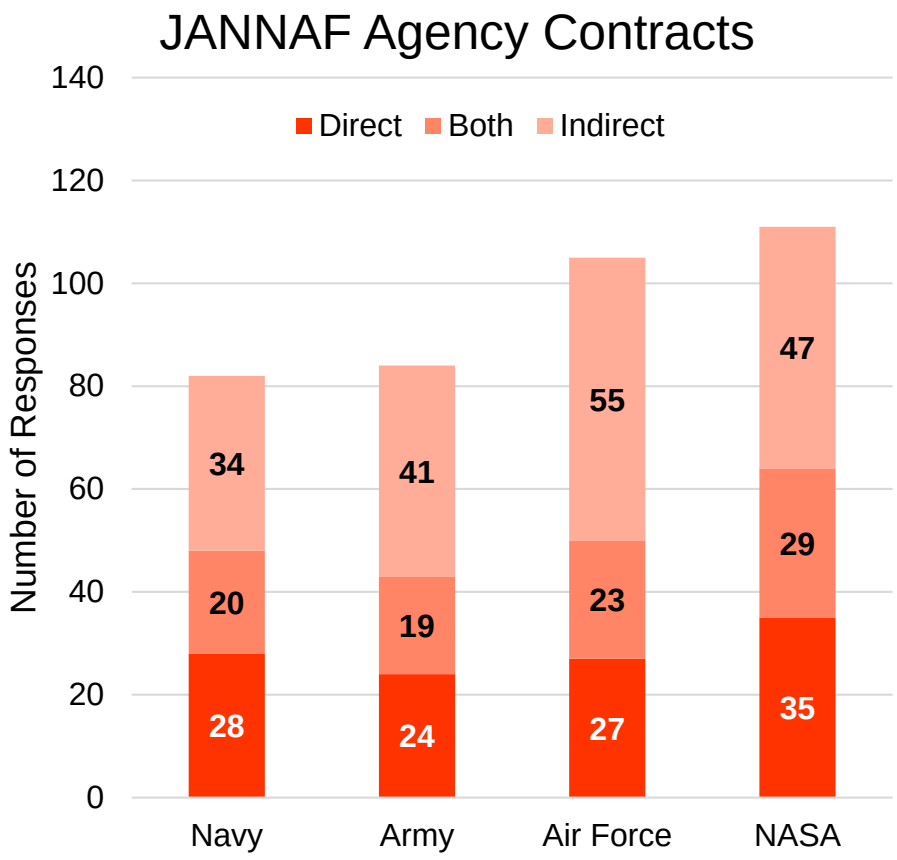
Special Small Business Types

Breakdown of 186 Certified Small Businesses





Some respondents identified multiple "Additional" business types and multiple agencies

Q1b, B

186 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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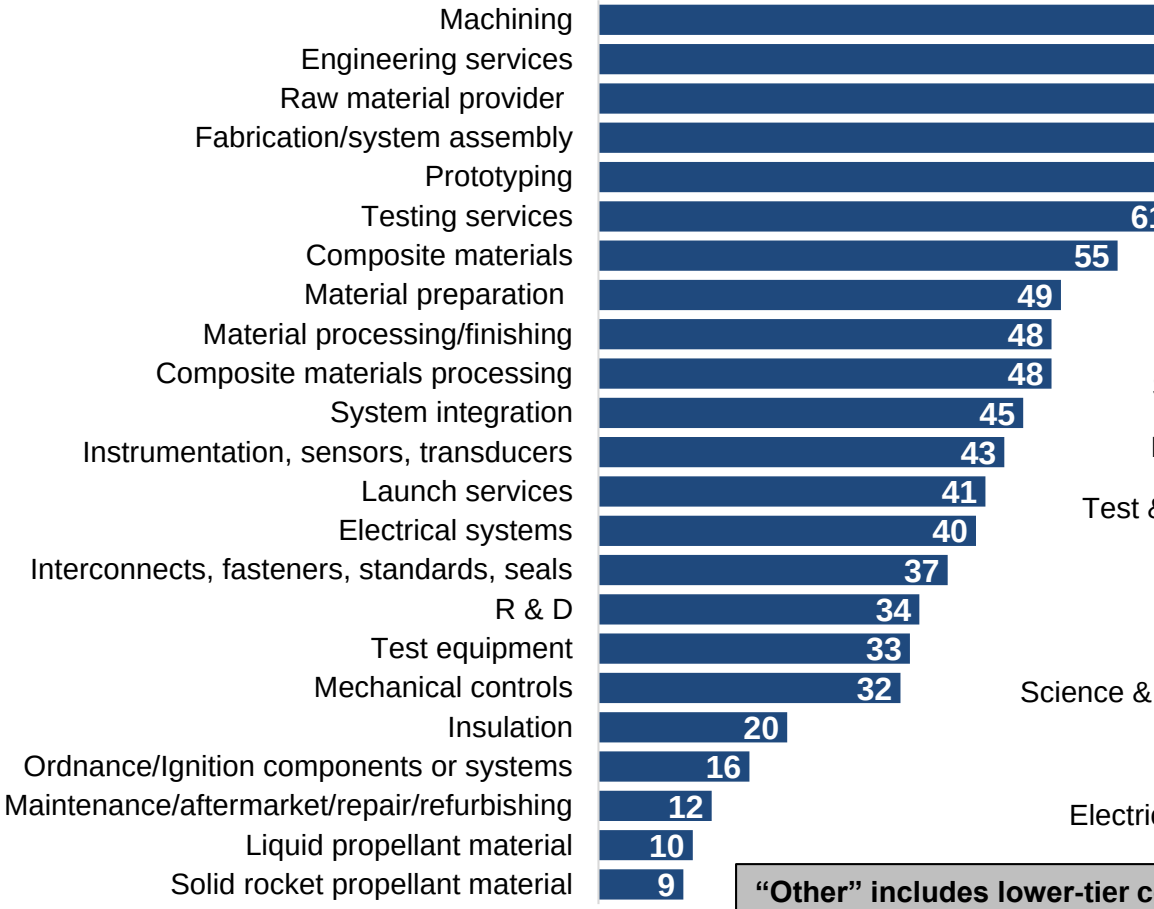
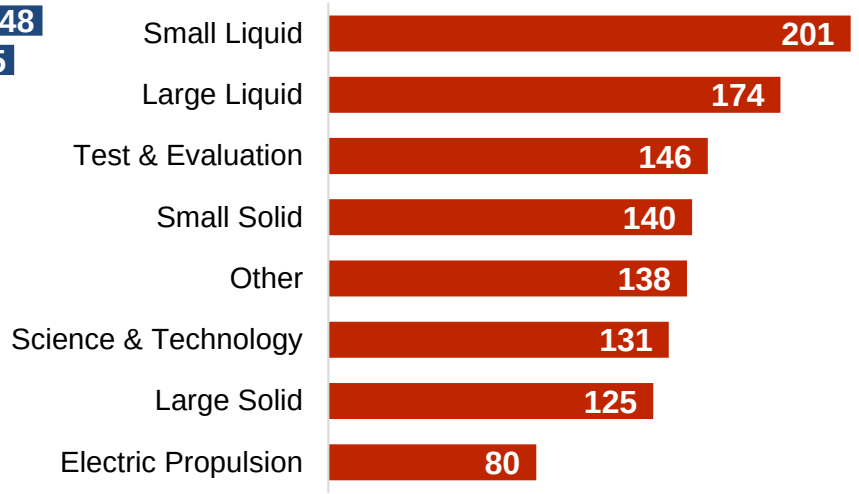
Special Small Business Types

Breakdown of 186 Certified Small Businesses

Number of Small Businesses by Business Line (some respondents identified multiple business lines)



Number of Small Businesses by Industrial Base Category (some respondents identified multiple industrial base categories)



"Other" includes lower-tier companies who were unsure how they supported propulsion-related engines and systems

Q1c, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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186 Respondents

Top 5 State Locations

By Organizations, Facilities, Suppliers, Customers

Organization Locations (158)	
California	**82**
Florida	24
Arizona	19
NY, PA	18
AL, CT	15

Internal Facility Locations (224)	
California	**122**
Florida	30
Alabama	28
AZ, PA	23
New York	21

California is the number one state in all four categories

Supplier Locations (850)	
California	**464**
New York	108
CT, PA	99
Texas	96
Arizona	83

Customer Locations (713)	
California	**354**
Alabama	103
Virginia	91
Florida	90
Colorado	75

A significant portion of the supply chain is located in Alabama, Arizona, Florida, New York, and Pennsylvania

Q1A, Q2A, Q6B, & Q10B

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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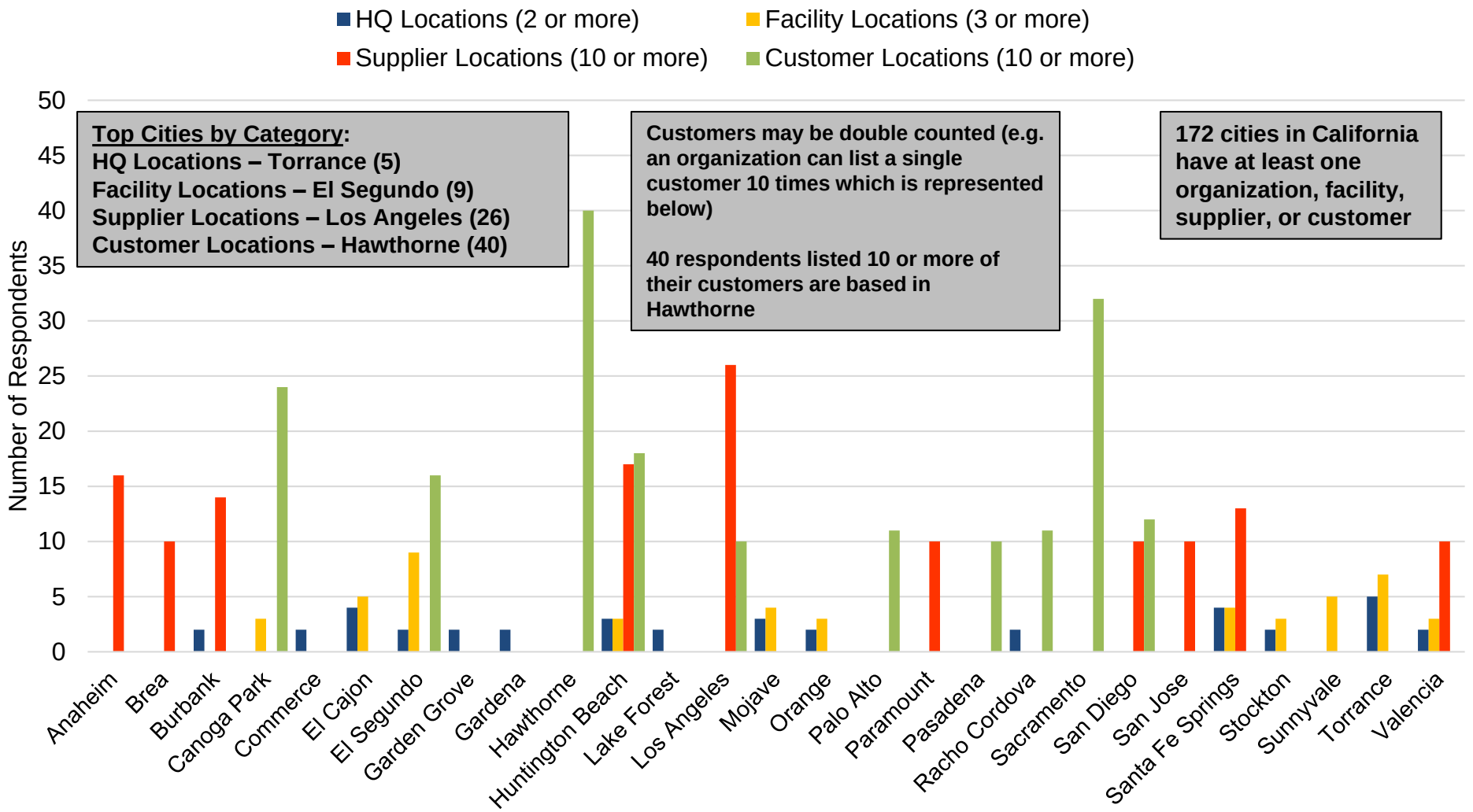
Highlight: California

By Top Cities (27 total)



Q1A, Q2A, Q6B, & Q10B

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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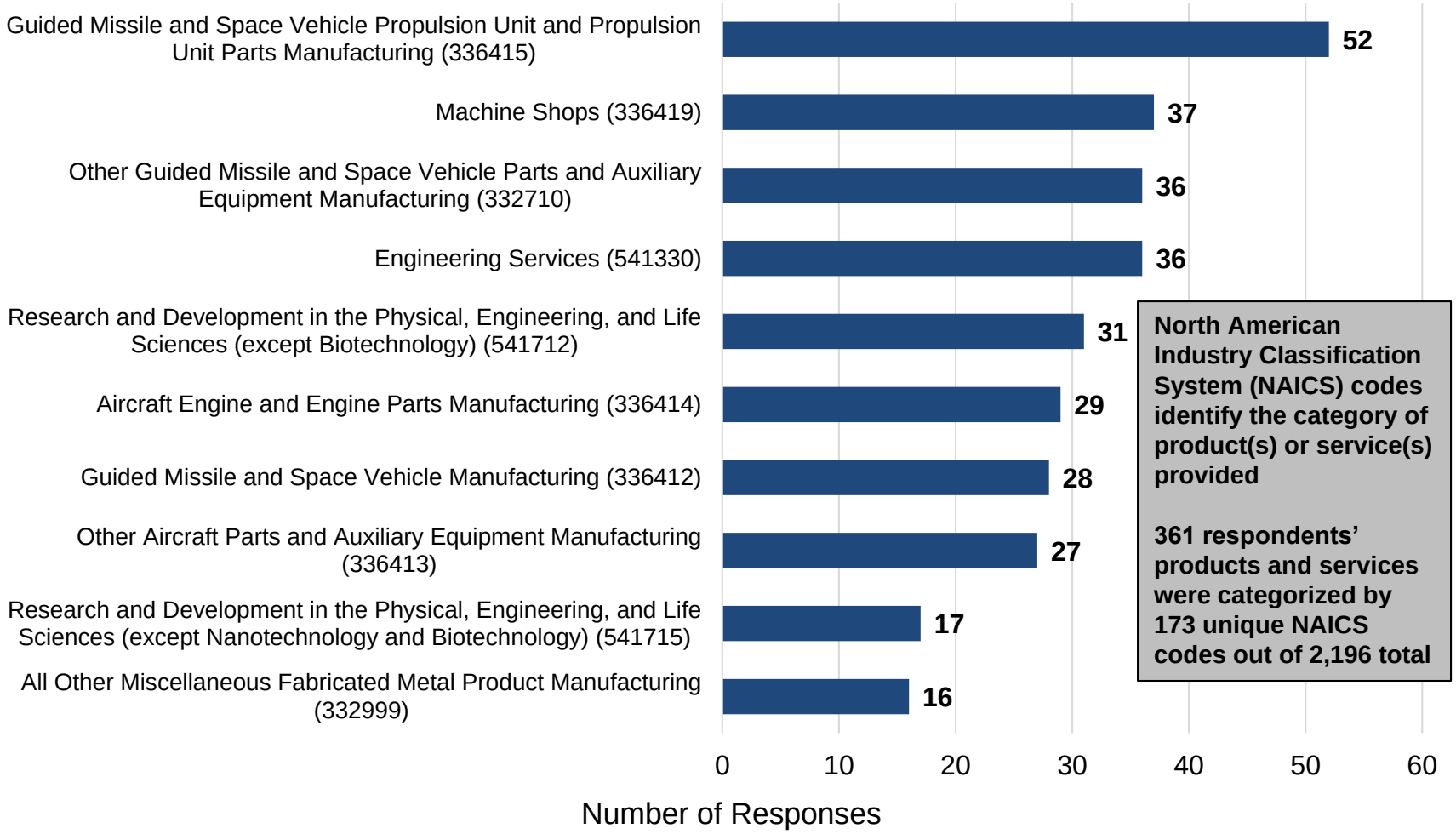
Propulsion-Related NAICS Codes

Top 10 Most Common NAICS Codes



Q1b, A

361 respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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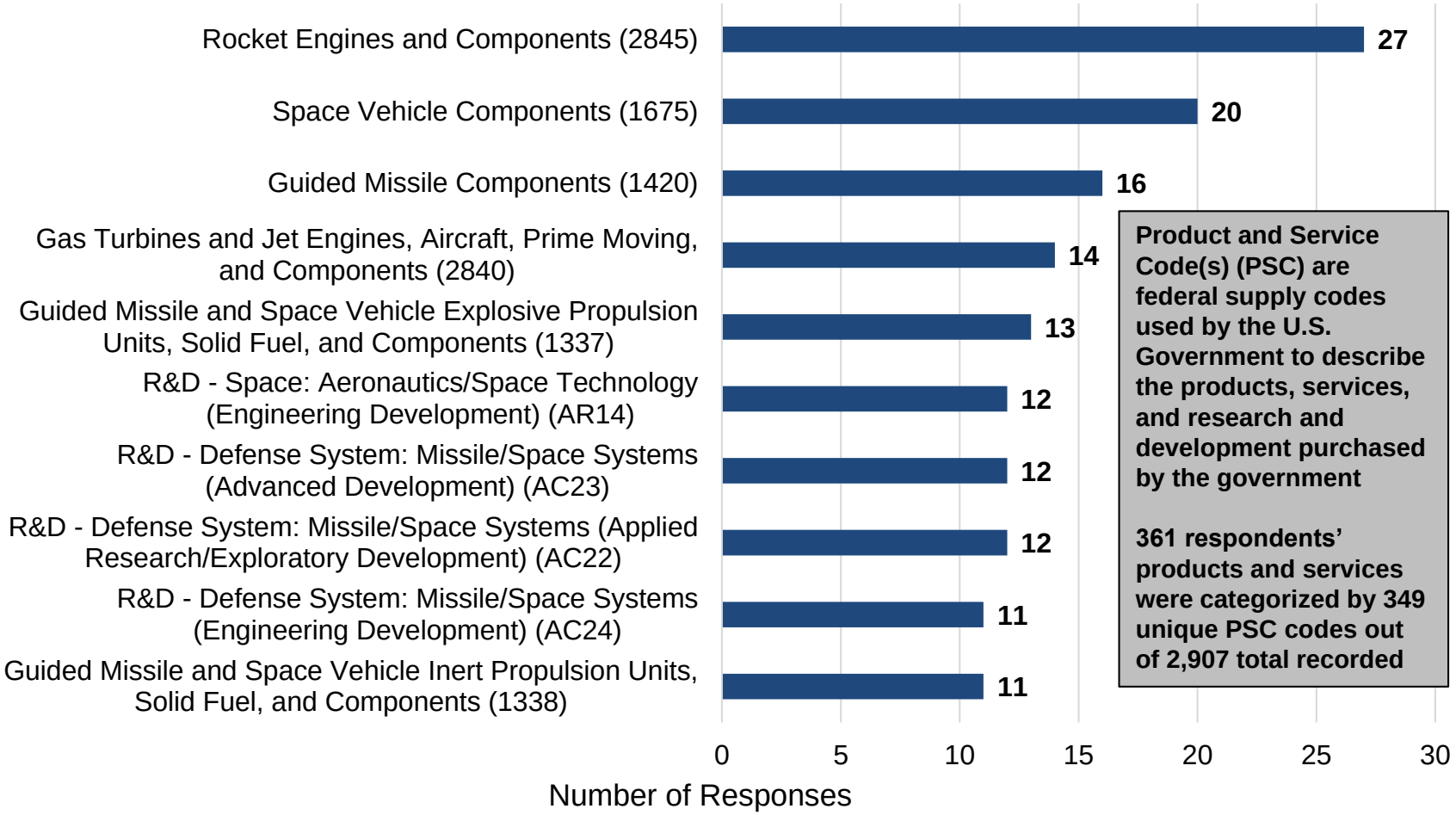
Propulsion-Related Product & Service Codes (PSC)

Top 10 Most Common PSC Codes



Product and Service Code(s) (PSC) are federal supply codes used by the U.S. Government to describe the products, services, and research and development purchased by the government

361 respondents' products and services were categorized by 349 unique PSC codes out of 2,907 total recorded

Q1b, A

361 respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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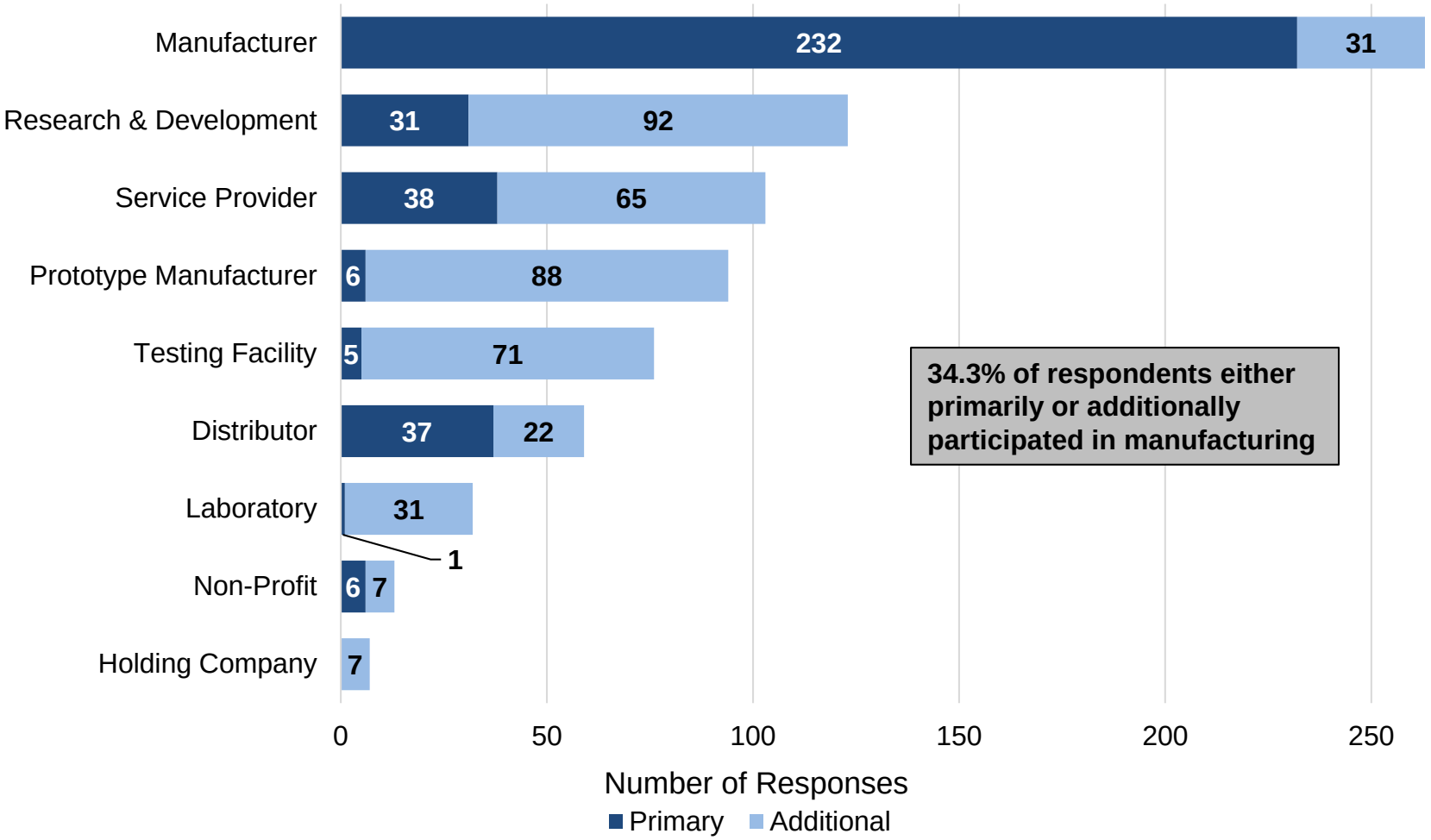
Business Categories – 9 Total

Business Category by Primary and Additional Focus



Q1b, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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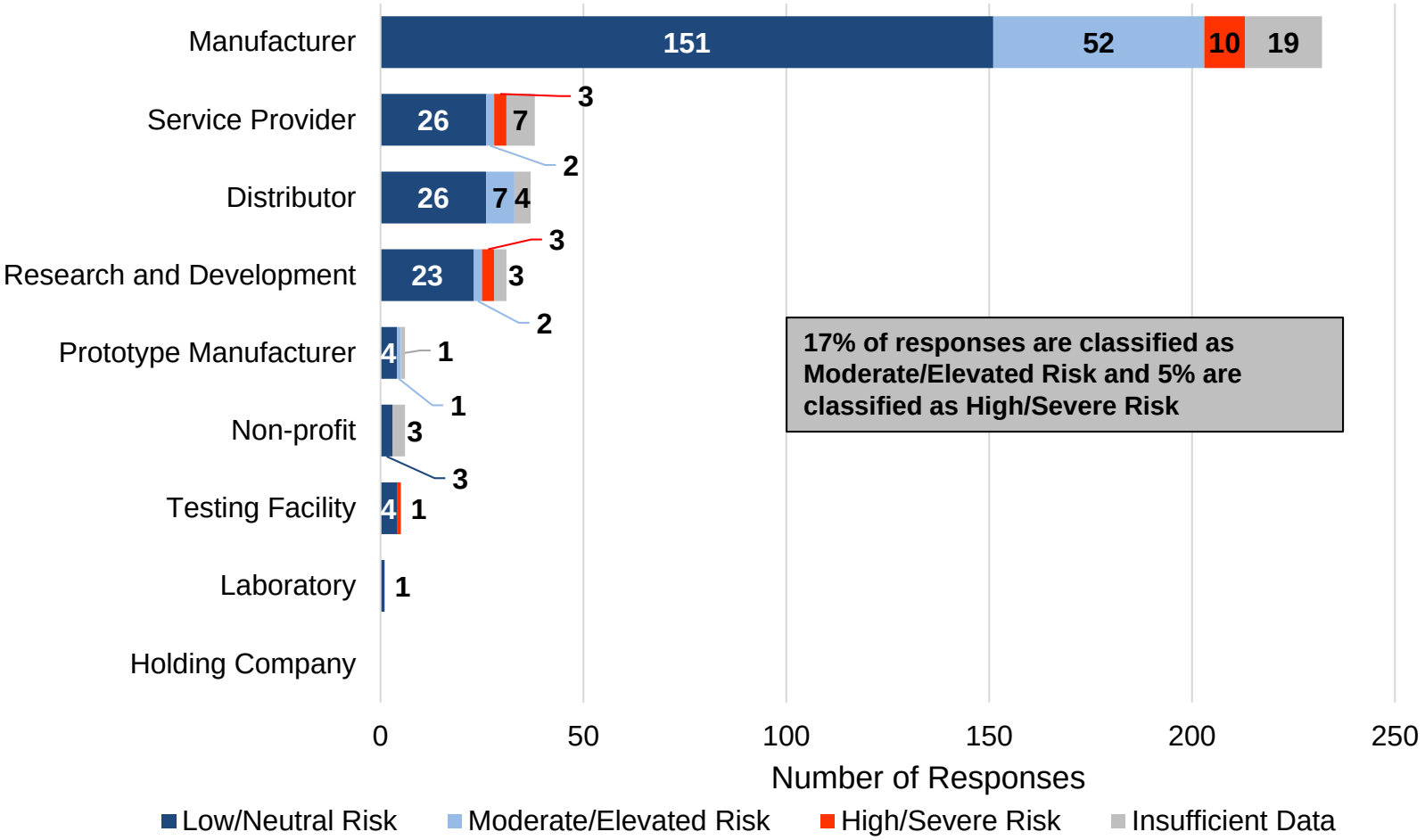
361 respondents

Business Categories by Financial Risk

"Primary" Business Category by Financial Risk Levels



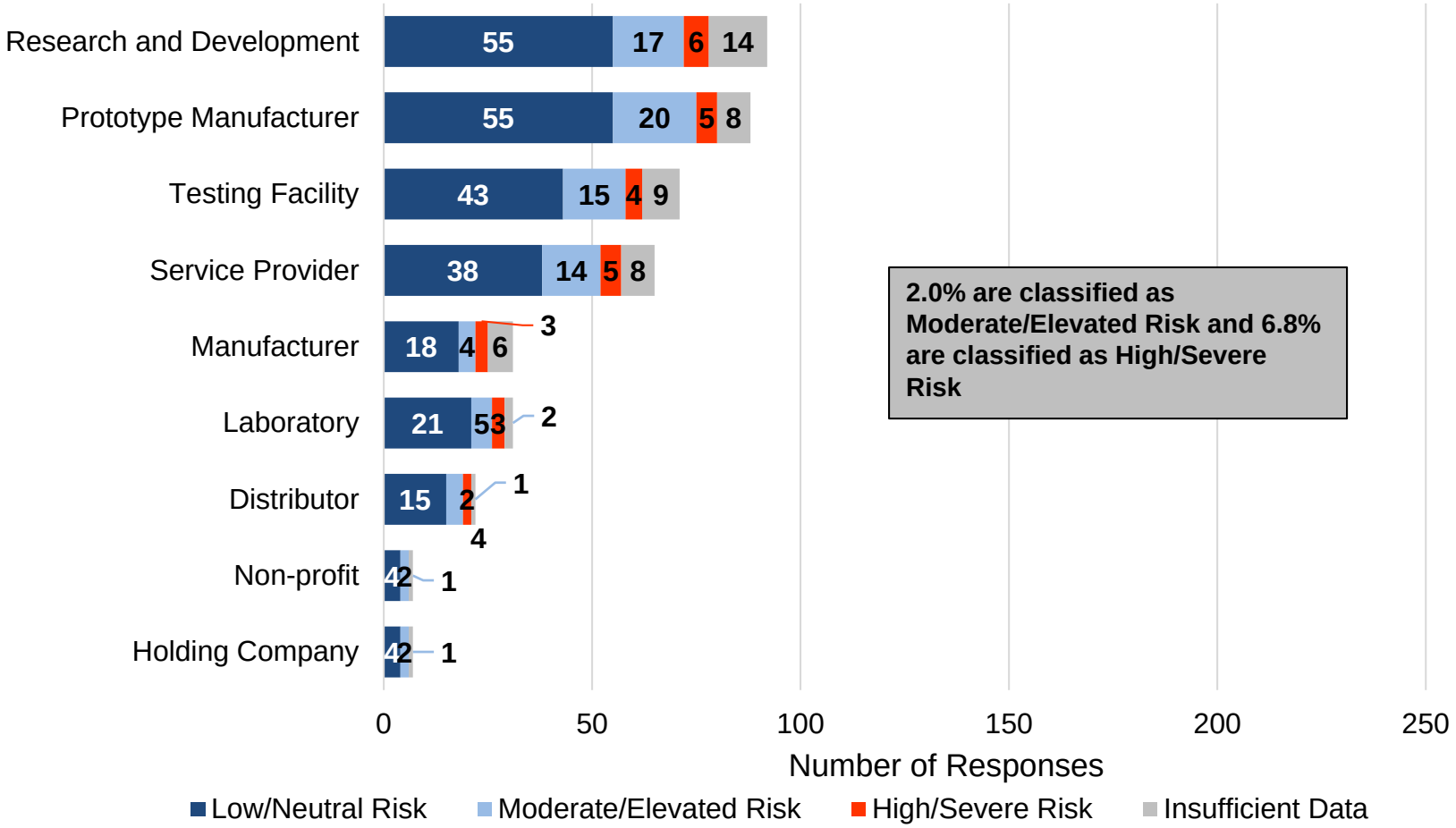
Q1b, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 respondents

Business Categories Financial Risk

"Additional" Business Category by Financial Risk Level



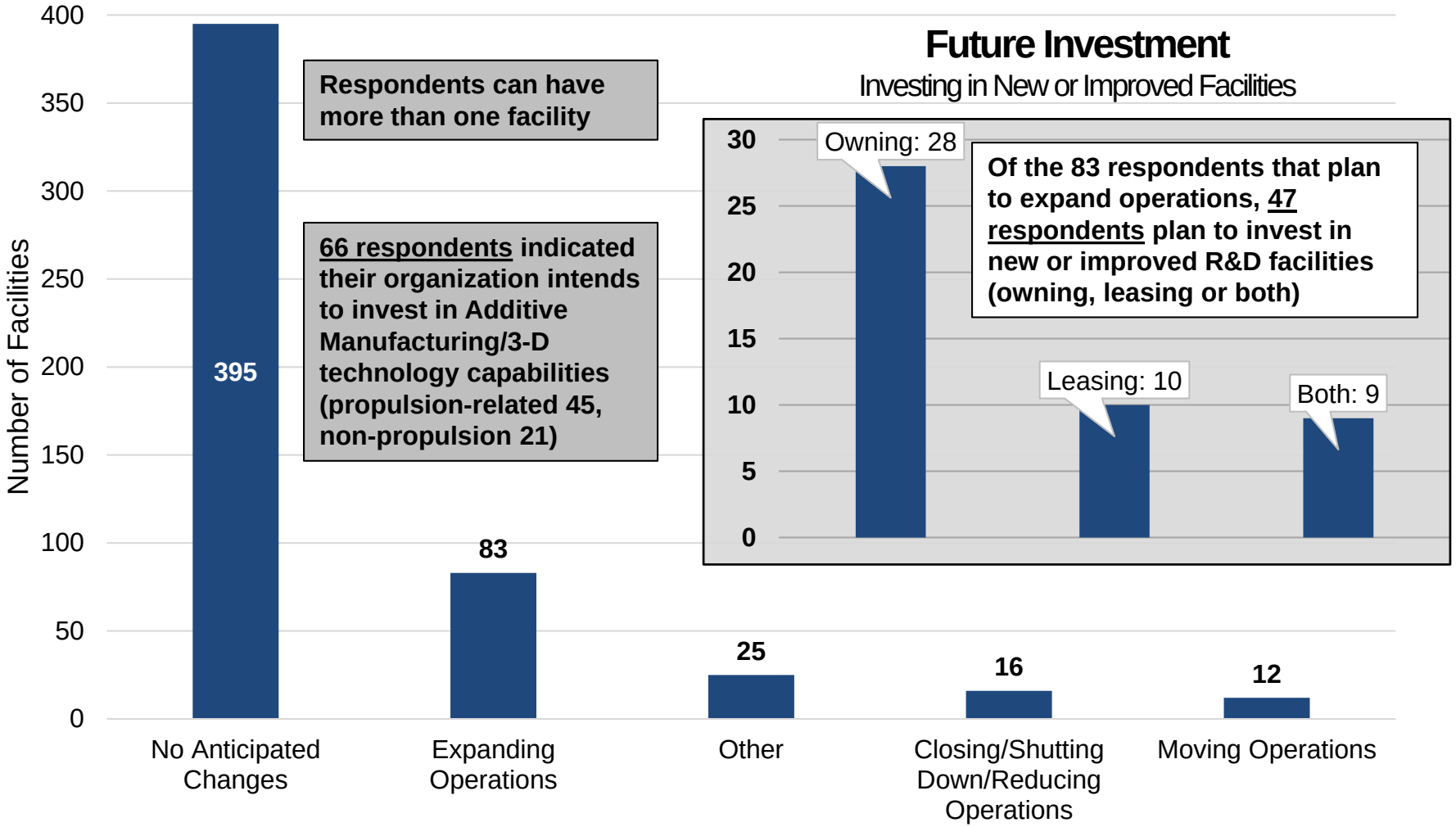
Q1b, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 respondents

Internal/Owned Facilities

Anticipated Change (2017-2021)



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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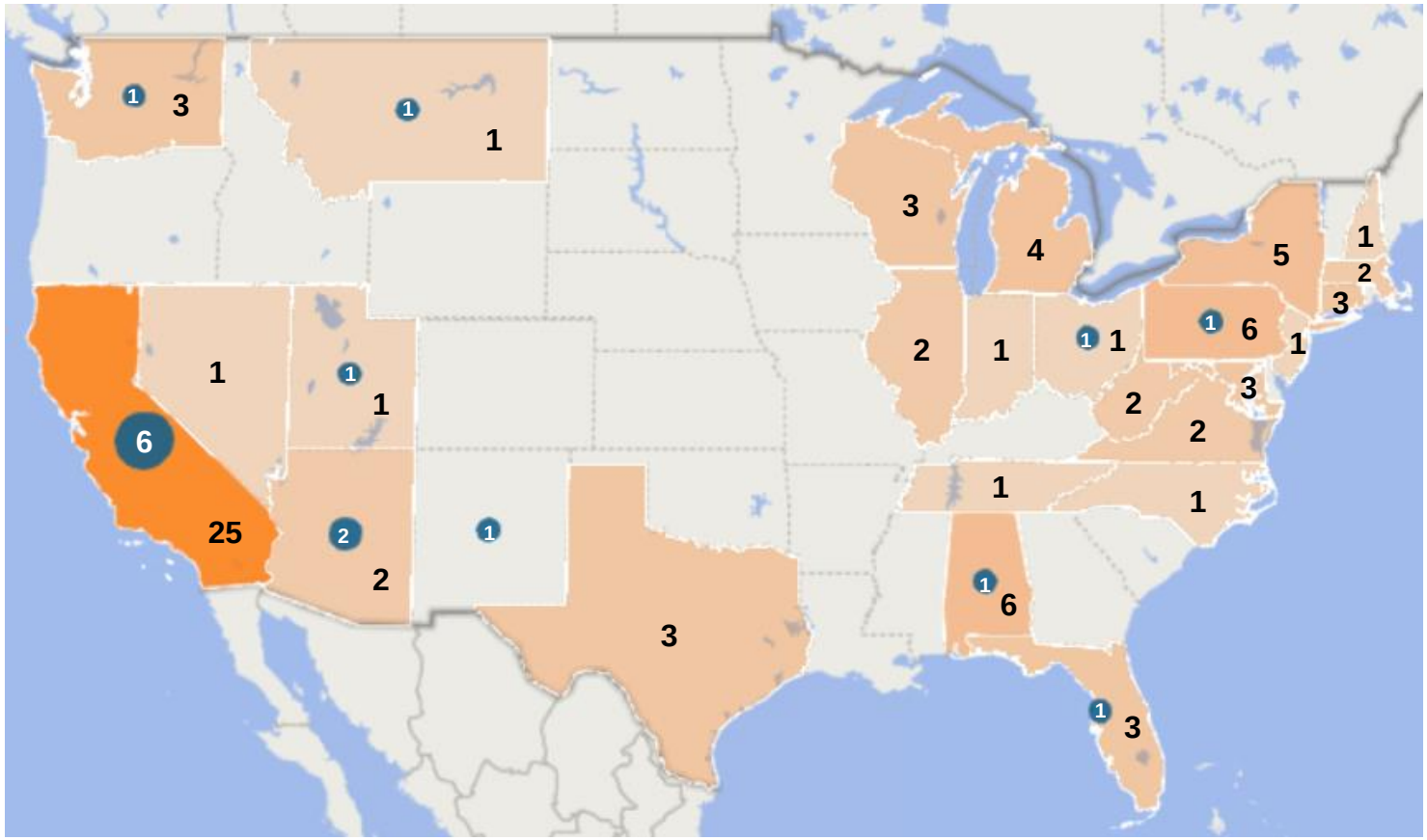
Internal/Owned Facilities

Expanding vs Closing/Reducing Operations



Expanding Operations - 83

Closing Operations/Reducing Operations - 16

Q2, A

99 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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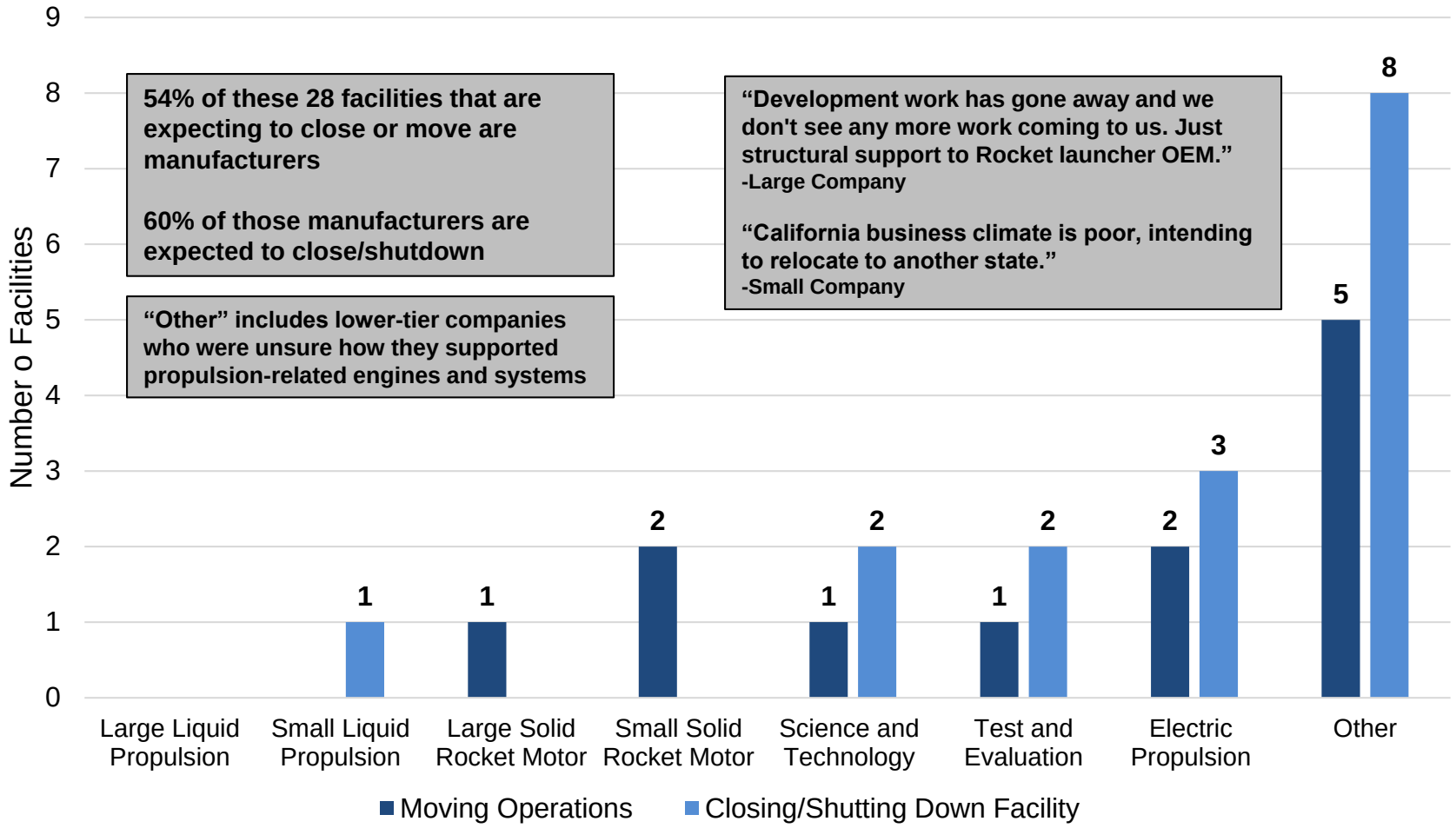
Internal/Owned Facilities

Moving vs Closing/Reducing Operations



Q2, A

28 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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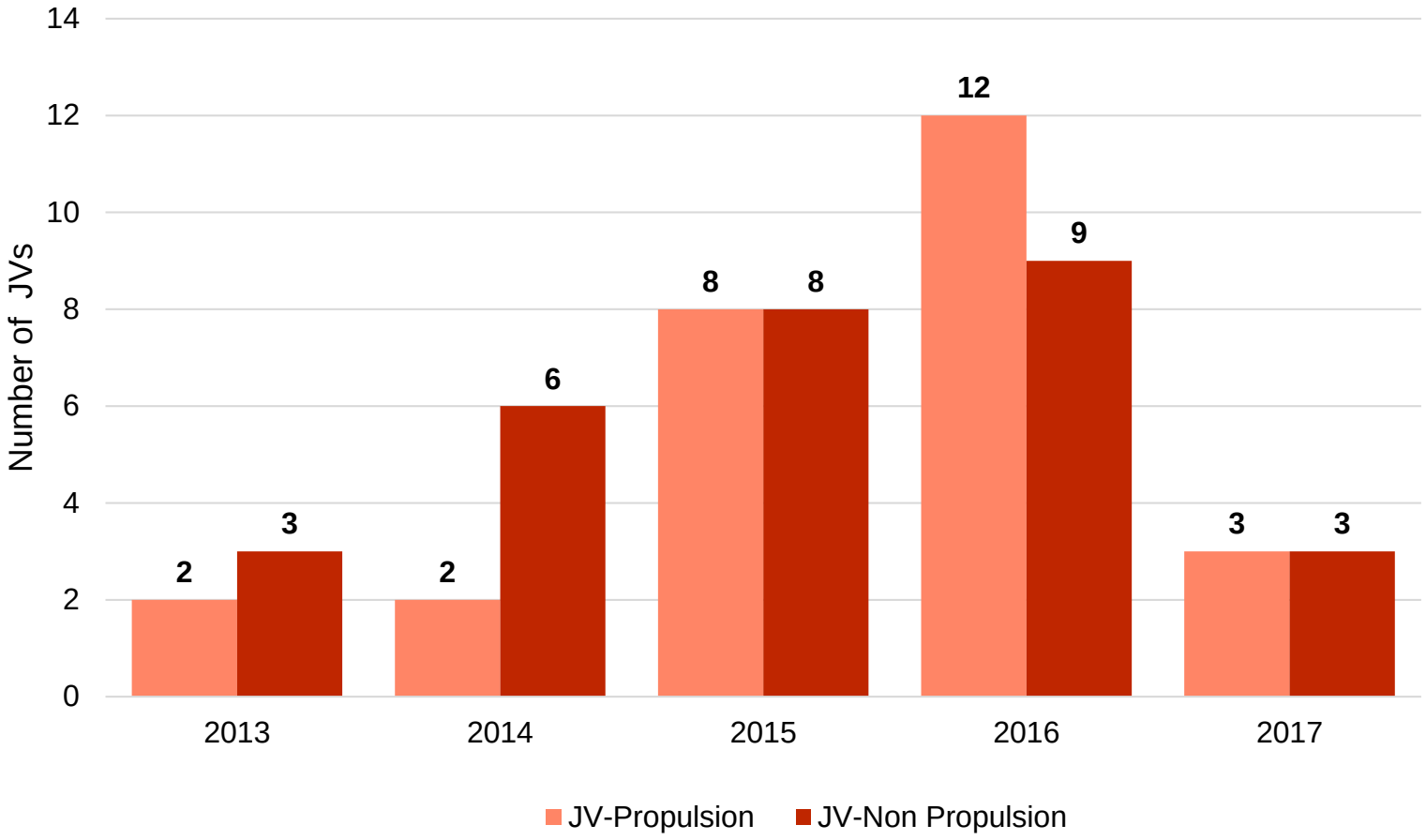
Joint Ventures (JVs)
U.S. and Non-U.S. - 2013-2017



Q3, B

108 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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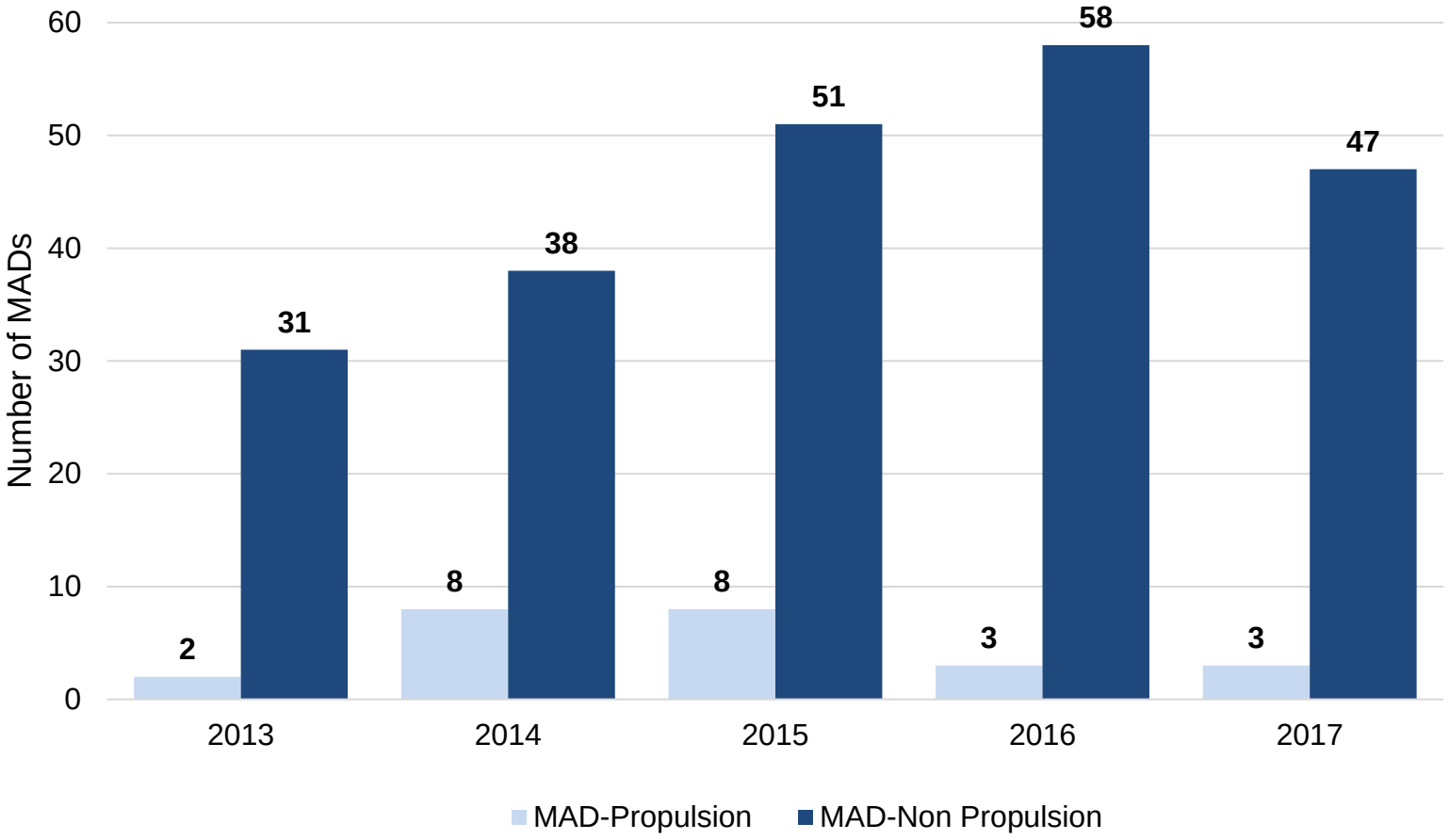
Mergers, Acquisitions, and Divestitures (MADs) U.S. and Non-U.S. - 2013-2017



Q3, B

108 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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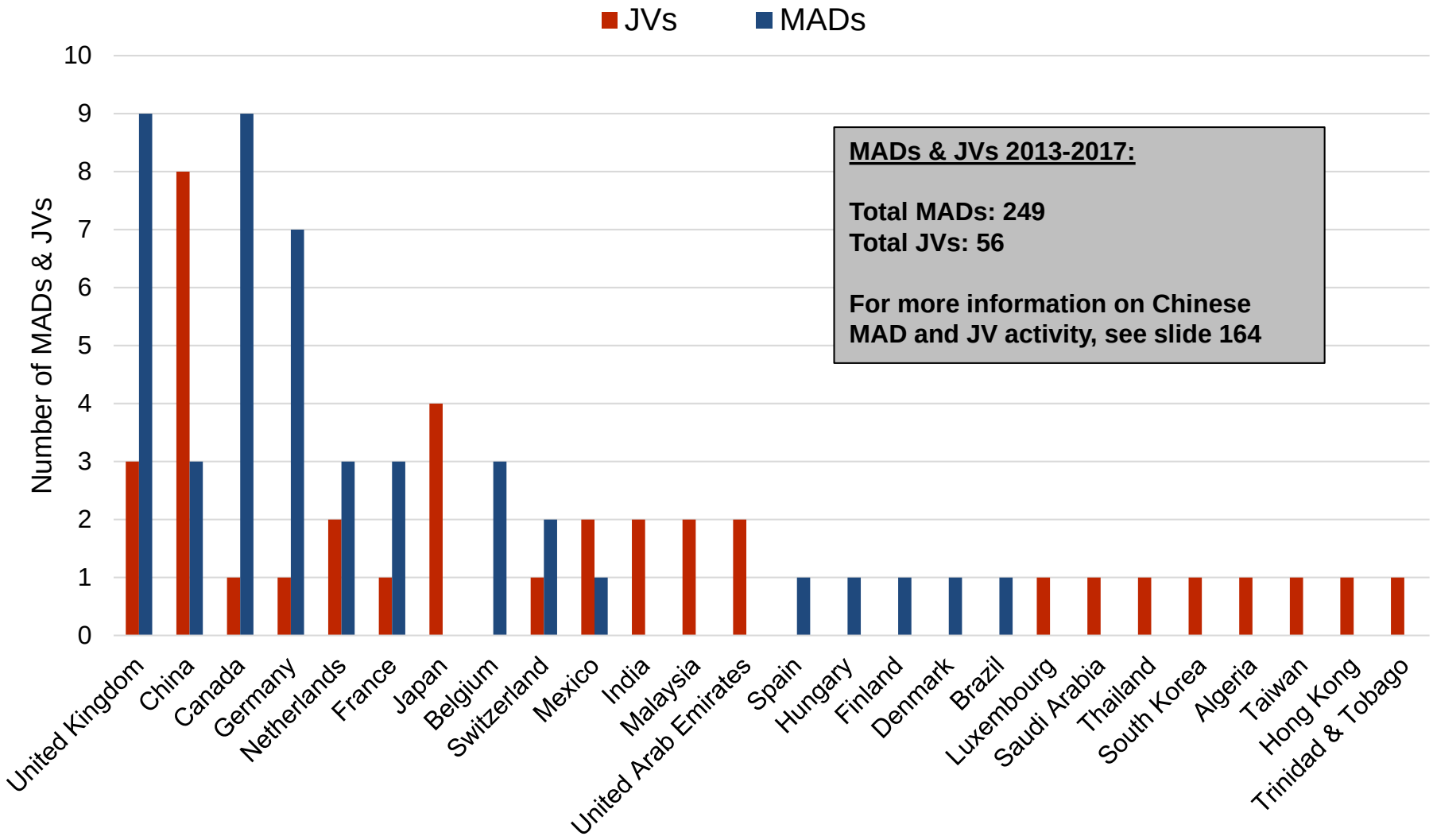
Mergers, Acquisitions, and Divestitures (MADs) and Joint Ventures (JVs) – by Country 2013-2017



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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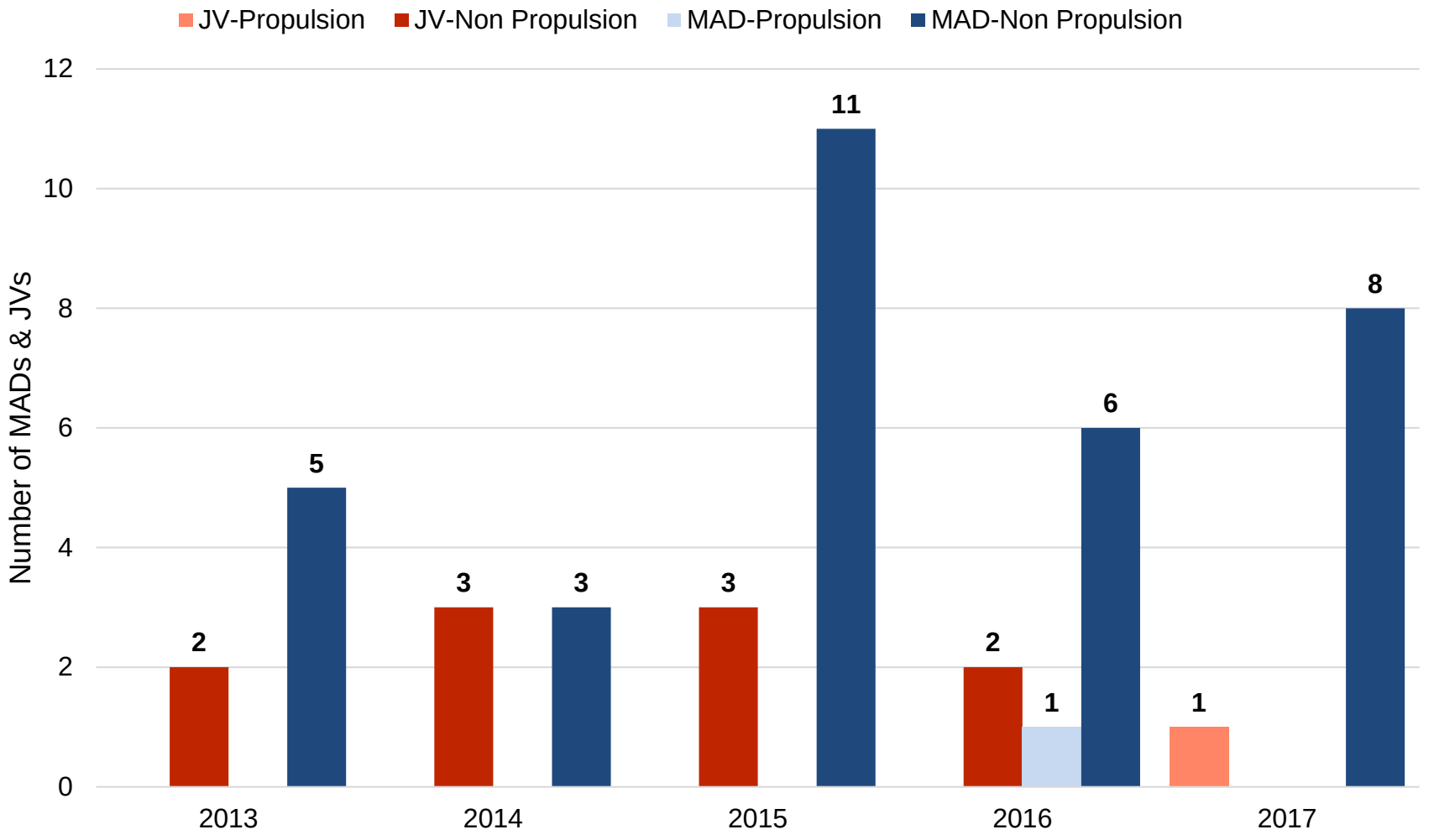
Q3, A-B

17 Respondents

All Foreign Mergers, Acquisitions, and Divestitures (MADs) and Joint Ventures (JVs) - 2013-2017



Q3, B

17 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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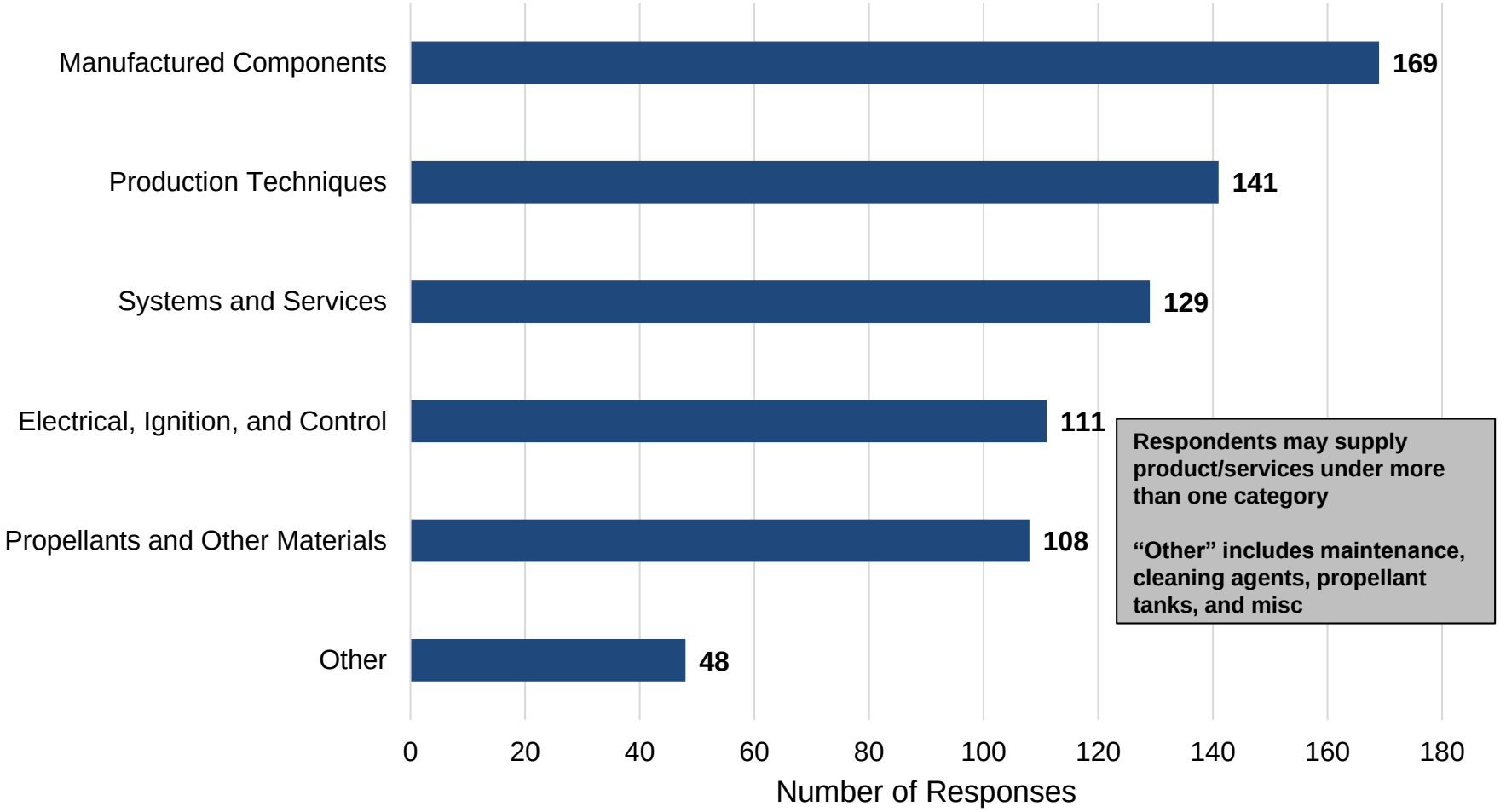
Products and Services

Organization Participation by Propulsion-Related Product/Service Category (6 Total)



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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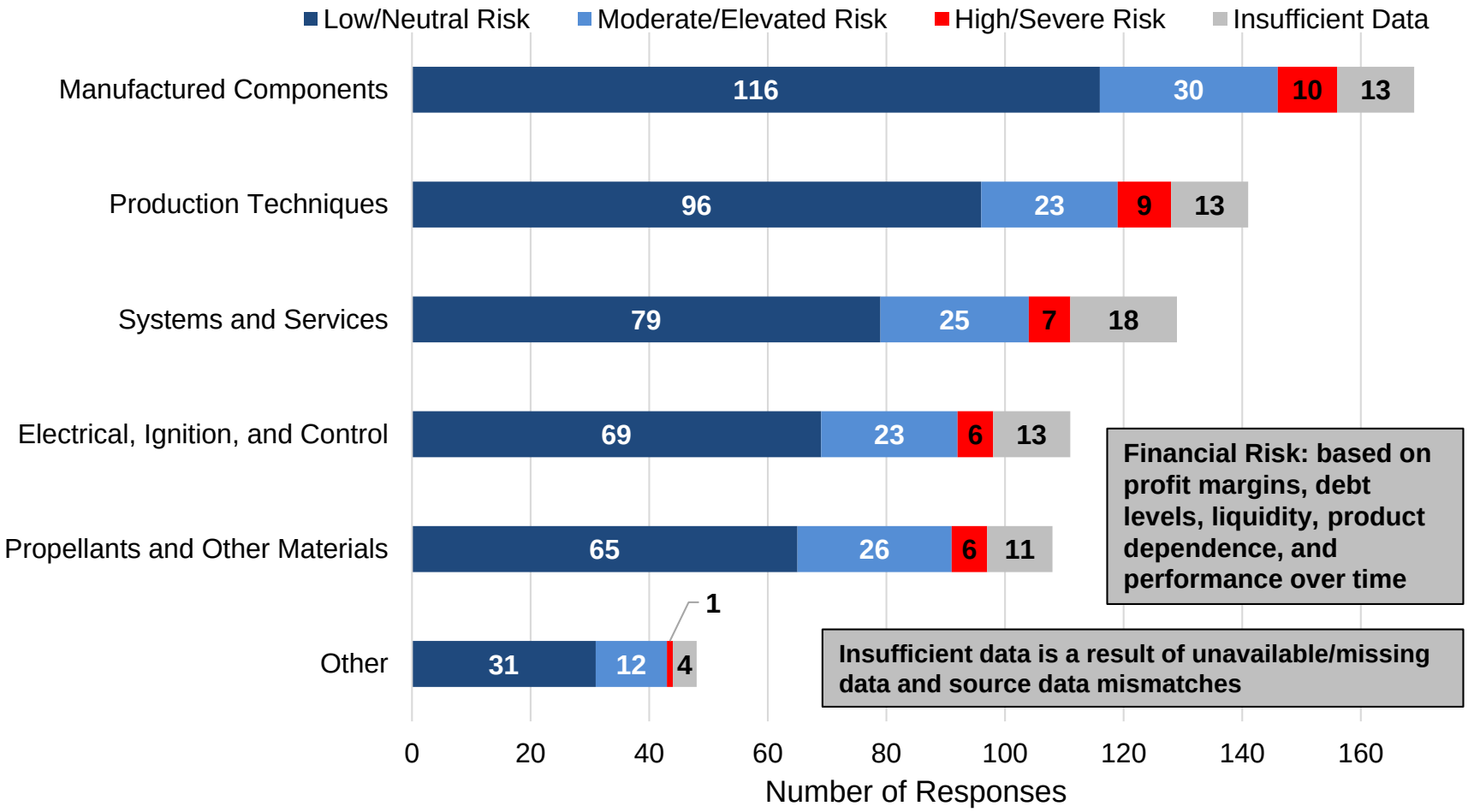
Q4a, A-F

361 Respondents

Products and Services

Respondent Financial Risk by Propulsion-Related Product/Service Categories



Q4a, A-F

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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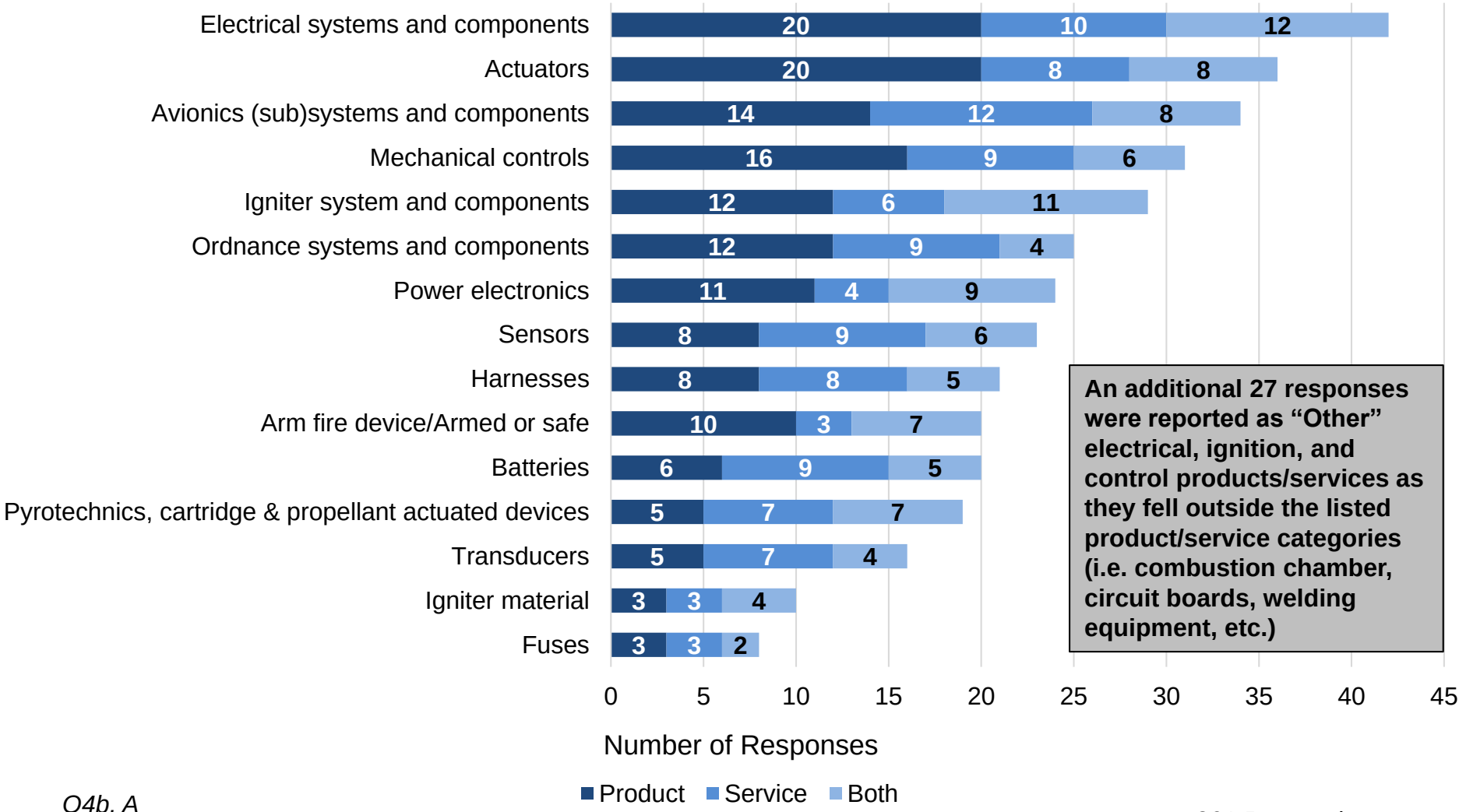
Respondent Capabilities

By Electrical, Ignition, and Control – 385 Total



An additional 27 responses were reported as "Other" electrical, ignition, and control products/services as they fell outside the listed product/service categories (i.e. combustion chamber, circuit boards, welding equipment, etc.)

Q4b, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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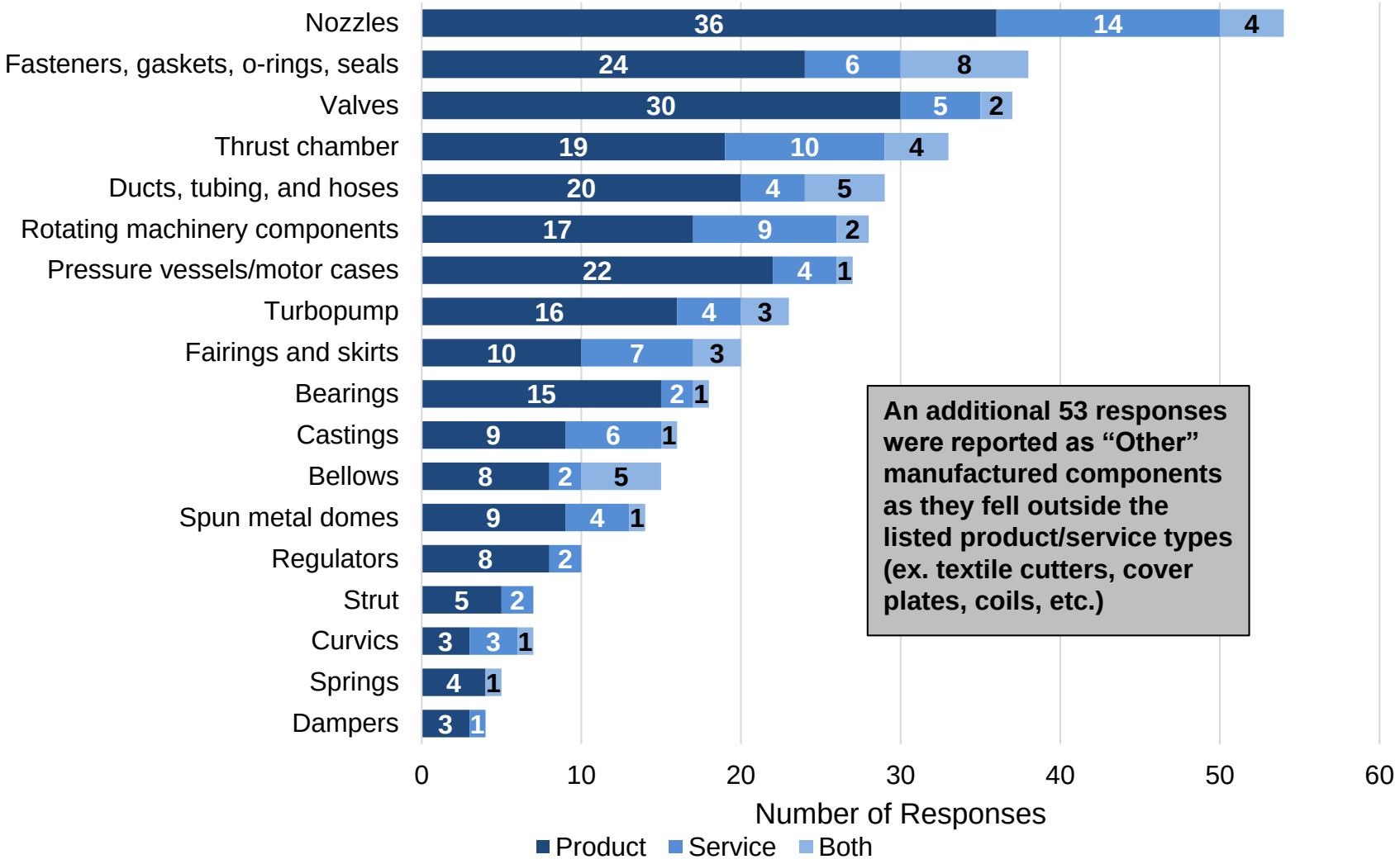
Respondent Capabilities

By Manufactured Components – 438 Total



Q4b, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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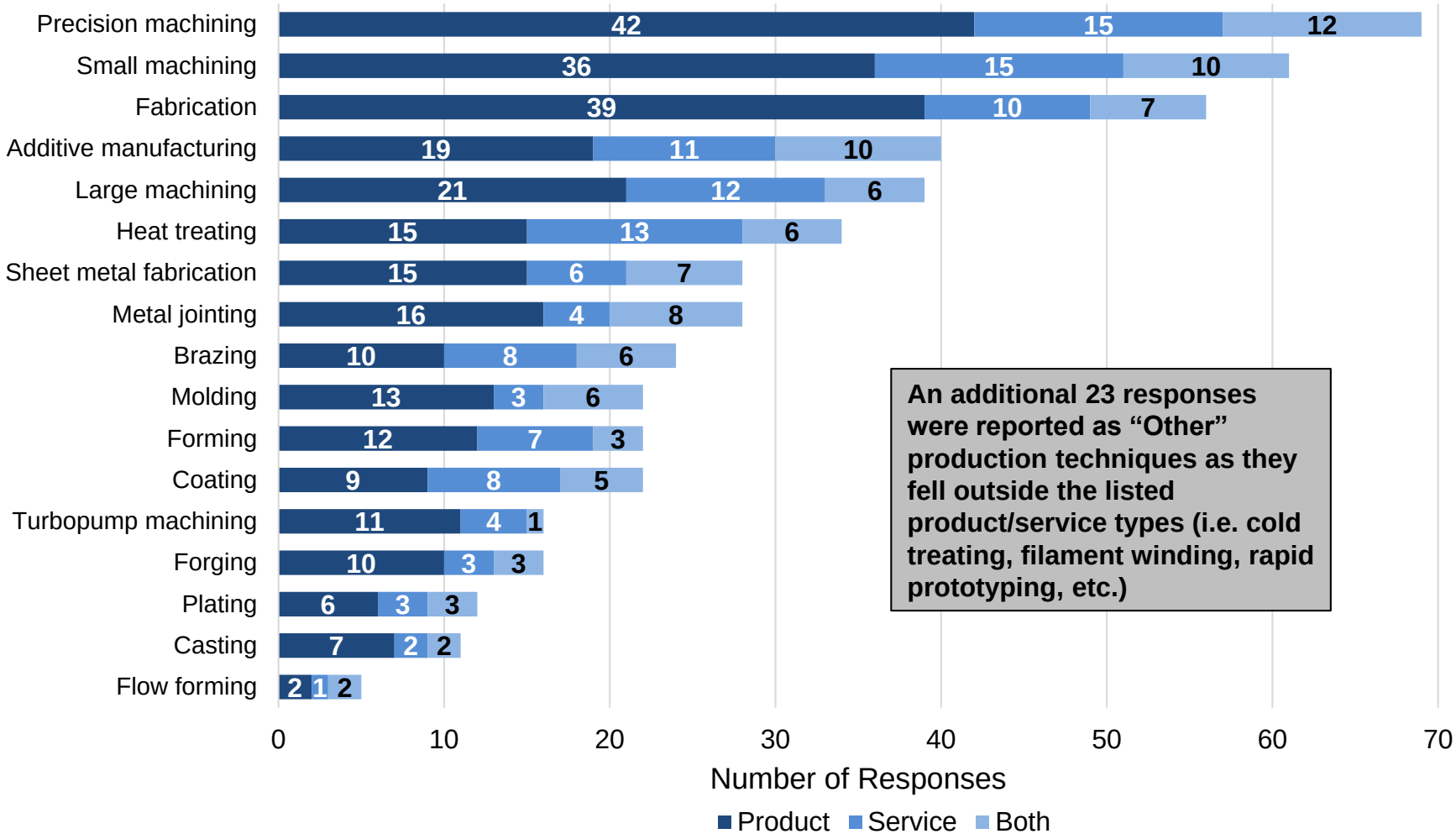
361 Respondents

Respondent Capabilities

By Production Techniques – 528 Total



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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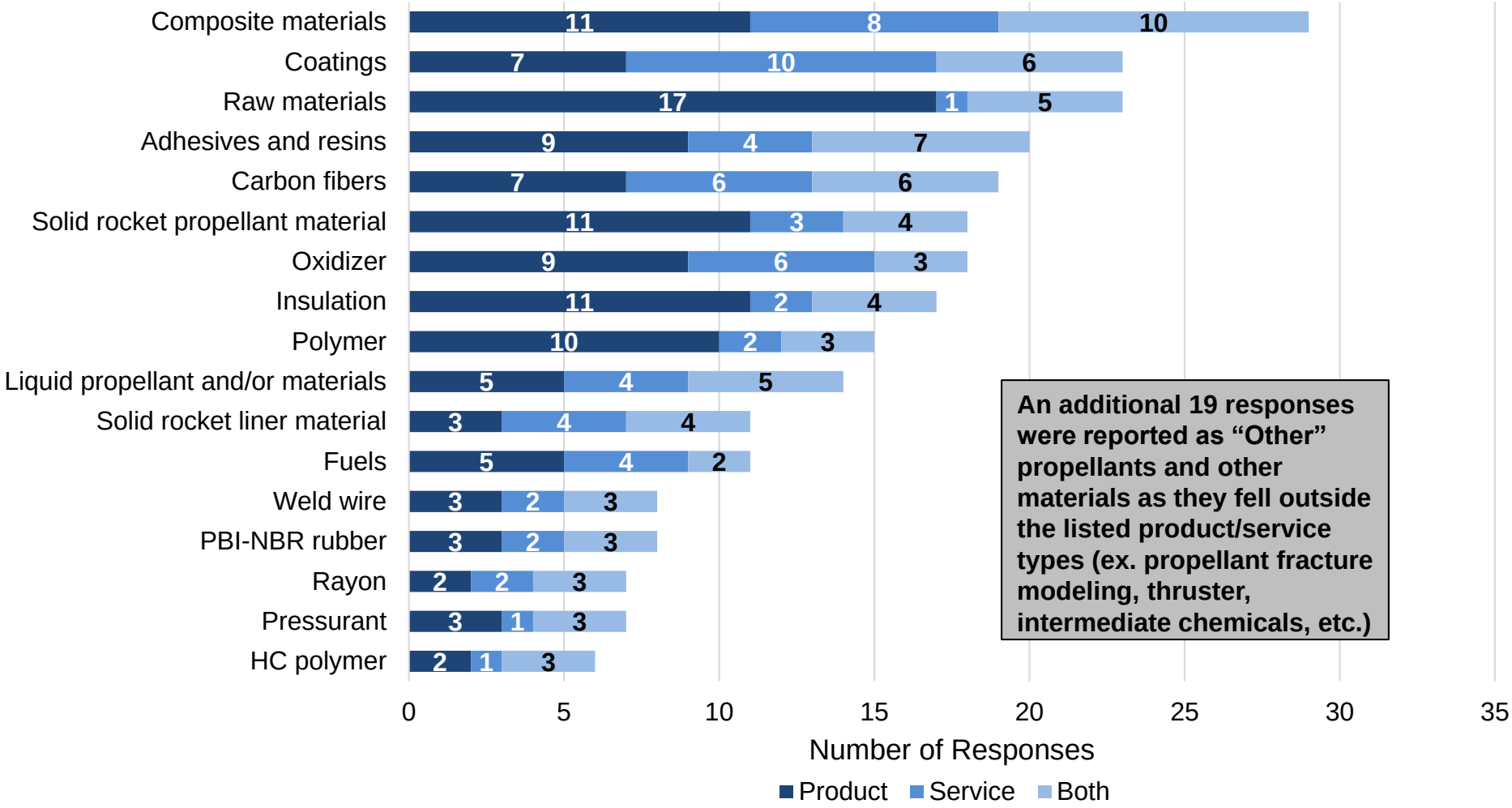
Q4b, C

361 Respondents

Respondent Capabilities

By Propellants and Other Materials Category – 273 Total



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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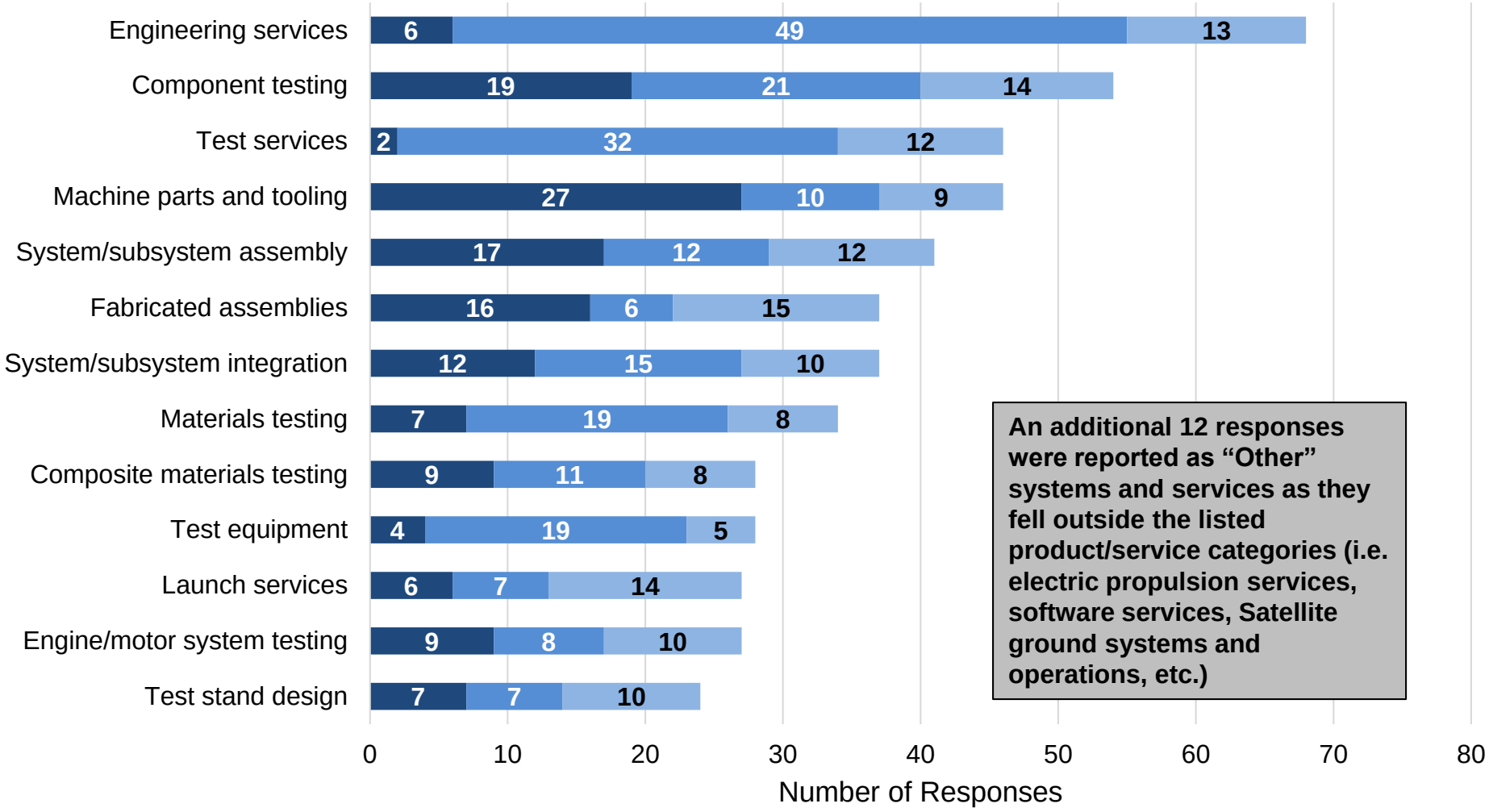
Q4b, D

361 Respondents

Respondent Capabilities

By Systems and Services – 509 Total



An additional 12 responses were reported as "Other" systems and services as they fell outside the listed product/service categories (i.e. electric propulsion services, software services, Satellite ground systems and operations, etc.)

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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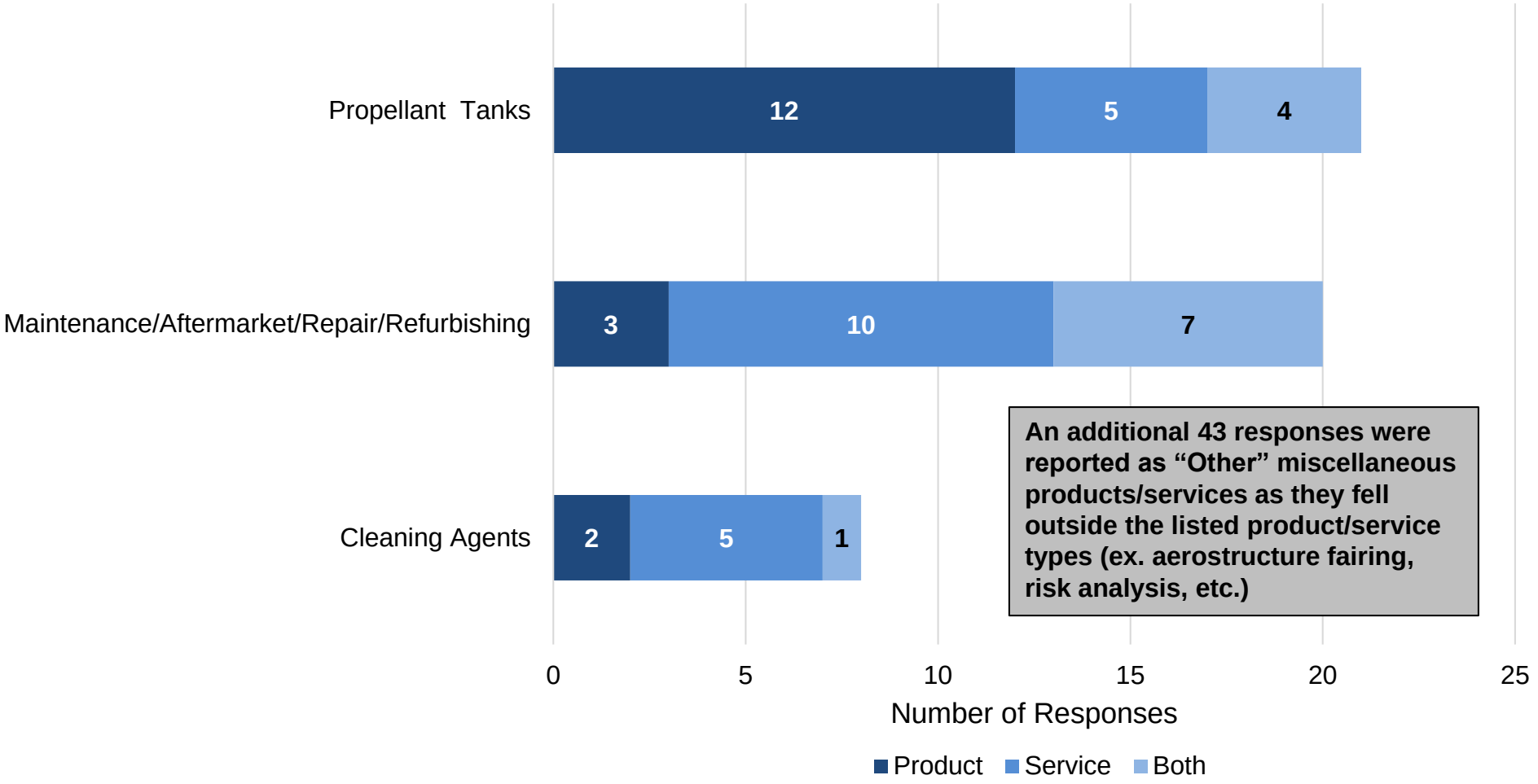
Q4b, E

361 Respondents

Respondent Capabilities

By "Other" Category – 92 Total



An additional 43 responses were reported as "Other" miscellaneous products/services as they fell outside the listed product/service types (ex. aerostructure fairing, risk analysis, etc.)

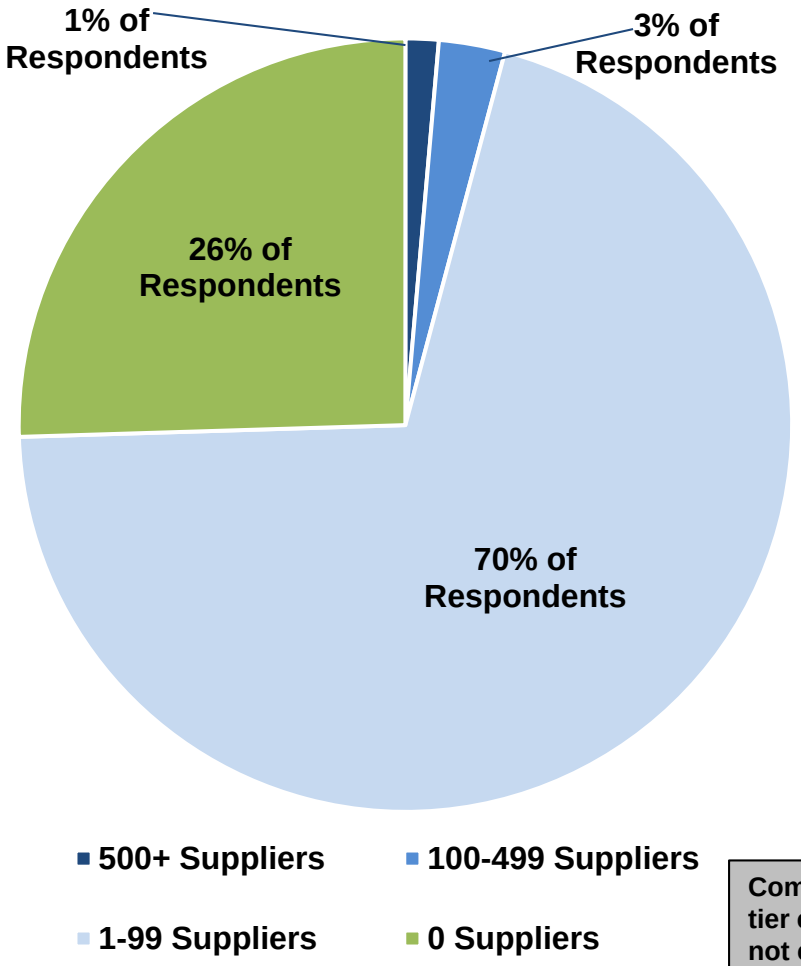
Q4b, F

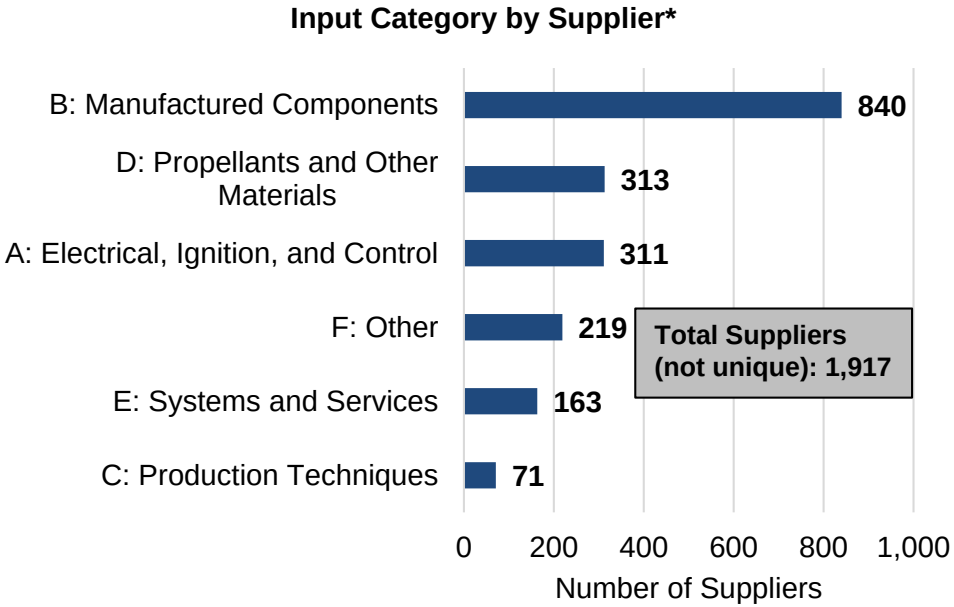
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Domestic & Foreign Suppliers

Number of Propulsion-Related Suppliers by Respondent





*269 respondents had 1 or more suppliers

"F: Other" includes maintenance, cleaning agents, propellant tanks, and misc

Companies that are service providers can report zero suppliers. Lower-tier companies can report zero propulsion-related suppliers if they do not consider themselves part of the supply chain

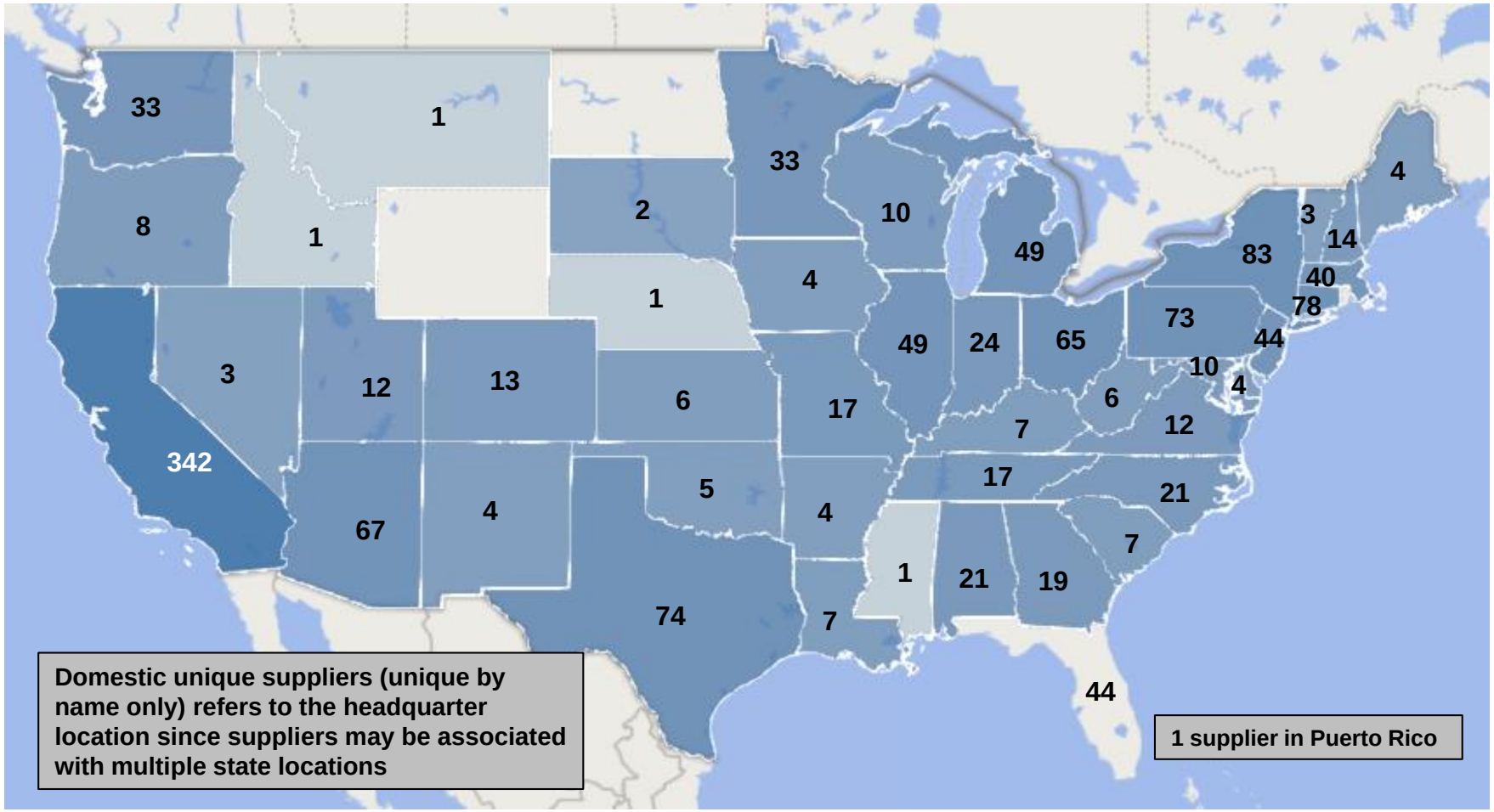
Q6, A

Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Suppliers

Domestic Unique Suppliers by State: 1,343



Q6, A

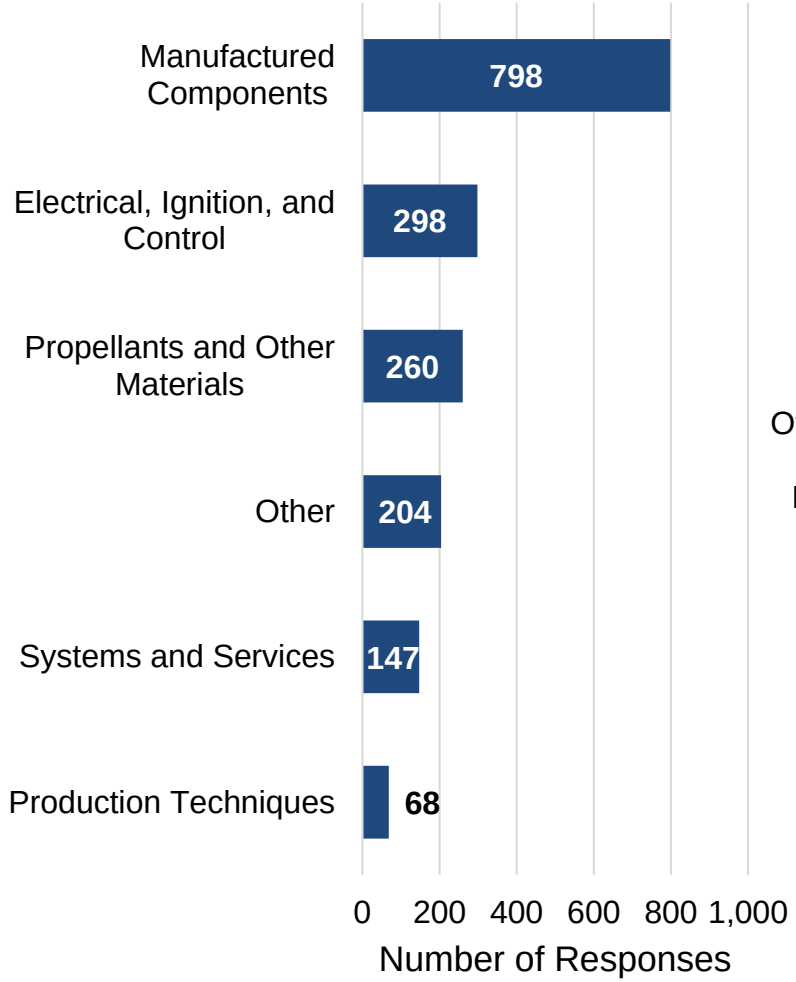
269 respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

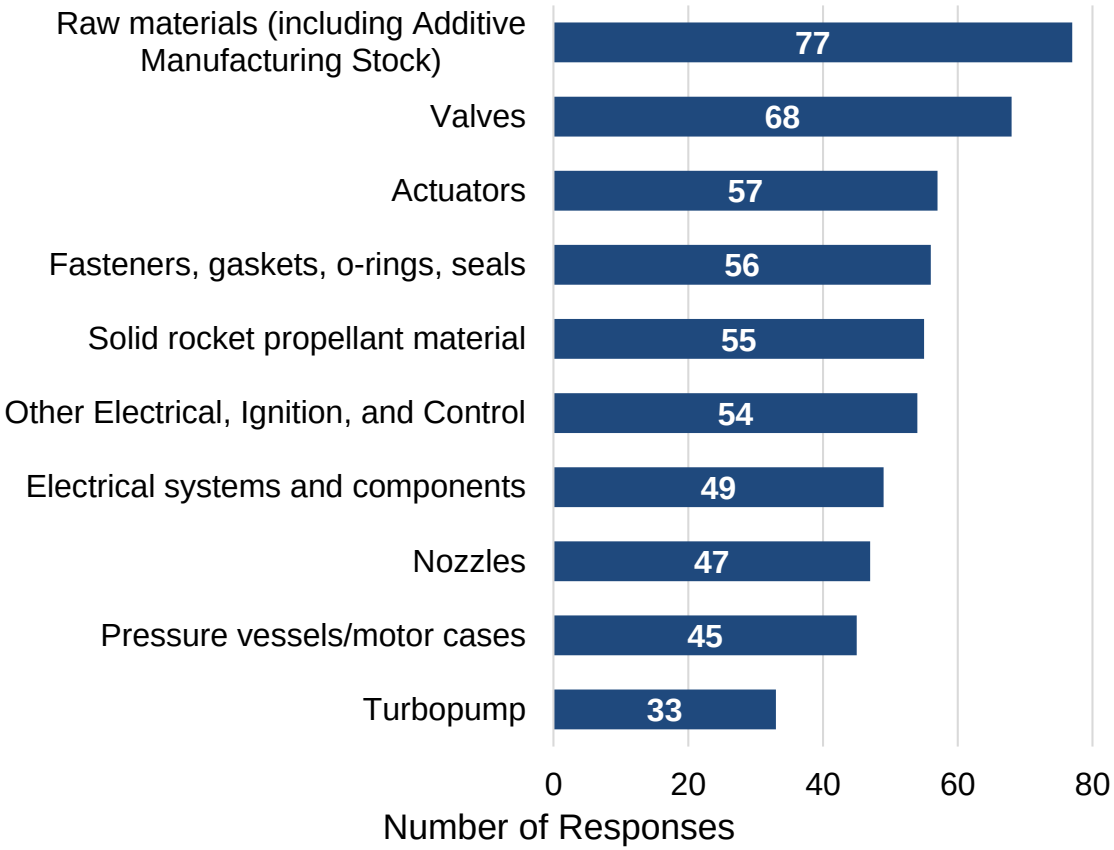
Propulsion-Related Suppliers

By Top Inputs Sourced from Domestic Suppliers

Domestic Inputs – By Category



Domestic Inputs – Top 10 Types



1,343 domestic suppliers (unique by name) supplied 1,775 products/services across 6 distinct input categories

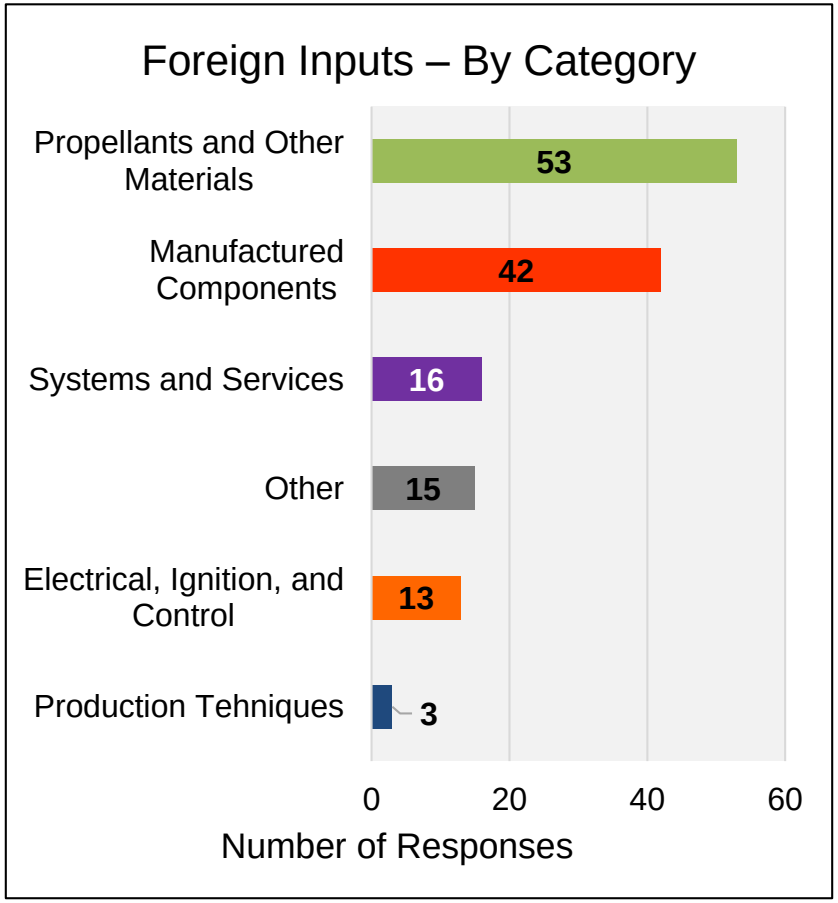
Q6, A

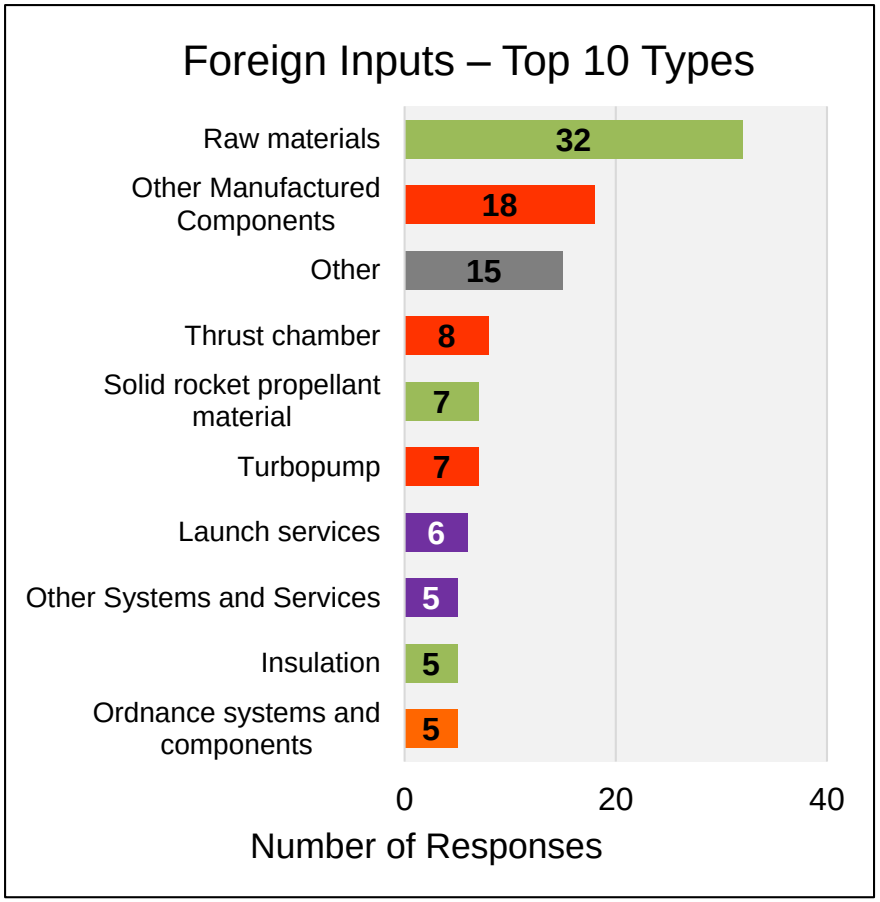
Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

269 Respondents

Propulsion-Related Suppliers

Top Inputs Sourced from Foreign Countries





97 foreign unique suppliers (unique by name) provided 142 products/services across 6 distinct input categories

"Other" includes maintenance, cleaning agents, propellant tanks, and misc.

Q6, A

269 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Propulsion-Related Suppliers

Foreign Unique Suppliers – (97) by Country – (28)

Country	Unique Suppliers	Country	Unique Suppliers	Country	Unique Supplier
Canada	19	Norway	2	Austria	1
Germany	12	Switzerland	2	Malta	1
China	10	Israel	2	Ireland	1
Japan	7	New Zealand	2	United Kingdom	1
France	6	Norway	2	Swaziland	1
Belgium	5	Taiwan	2	Malaysia	1
Italy	4	Finland	2	Thailand	1
Russia	3	Chile	2	Sweden	1
New Zealand	3	Mexico	1	Ukraine	1
India	2				

Foreign unique suppliers refers to the headquarters location since suppliers may be located in multiple countries

Q6, A

269 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Supply Chain Practices Defined

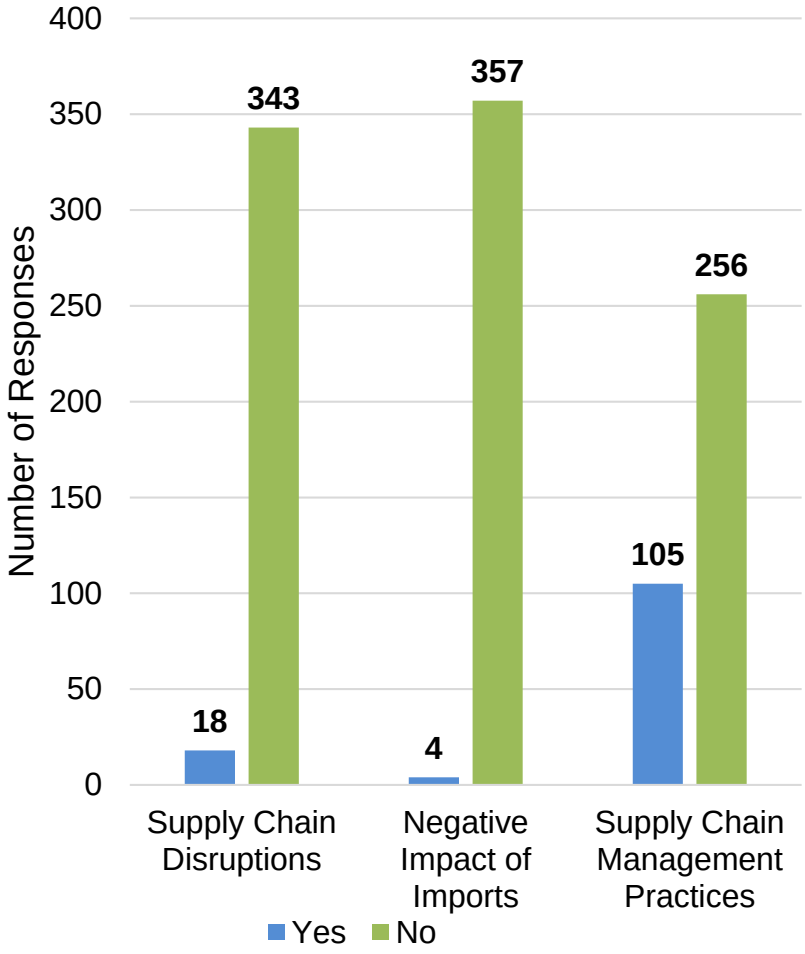
- MRP (Materials Requirements Planning): obtaining the correct quantity of materials and precise timeline to support production
- Multiple Sourcing: using various suppliers
- ERP (Enterprise Resource Planning): connecting producers with makers of raw materials
- Bar Coding: using a bar code as an identification tool to track products
- CRM (Customer Relationship Management): managing and tracking relationships with customers
- MRPII (Manufacturing Resource Planning): orchestrating the correct quantity of materials throughout the entire value stream

Q7

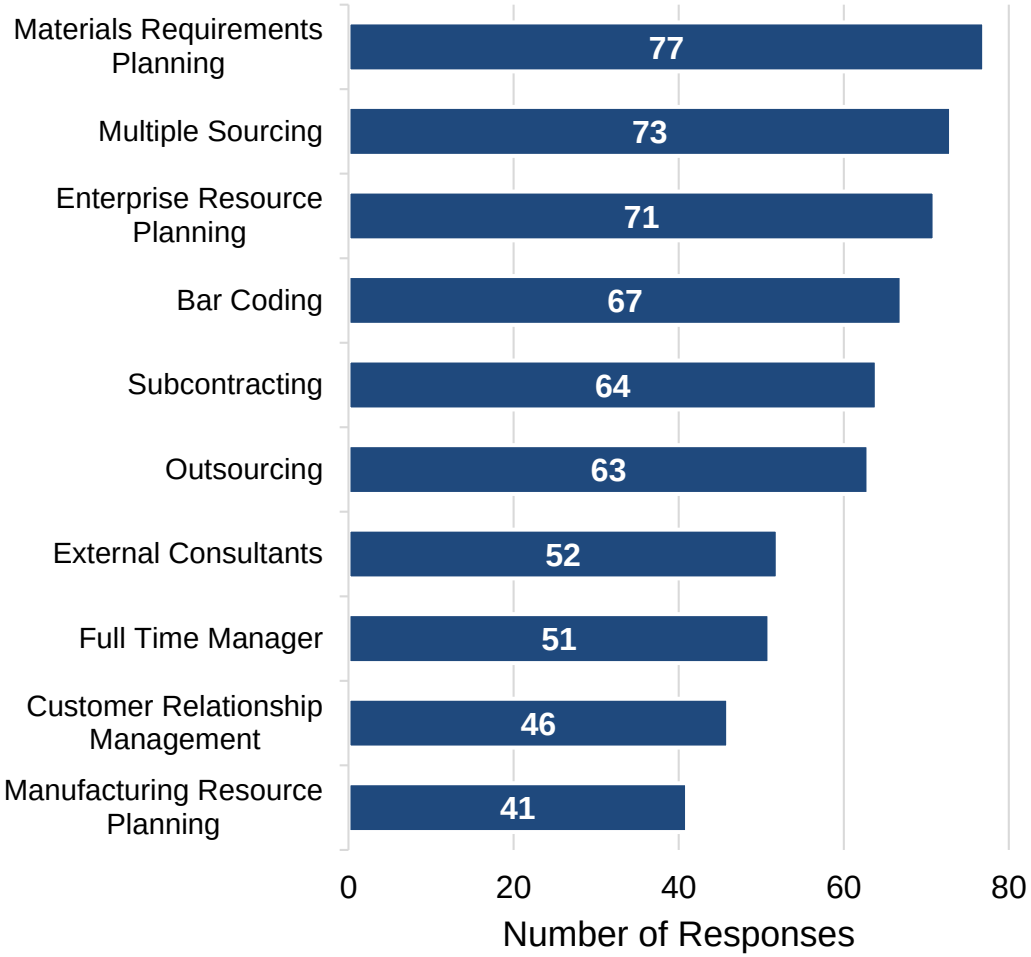
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Propulsion-Related Supply Chain

Disruptions/Impacts Experienced



Number Companies Using Top 10 Supply Chain Practices



Q7, A-C

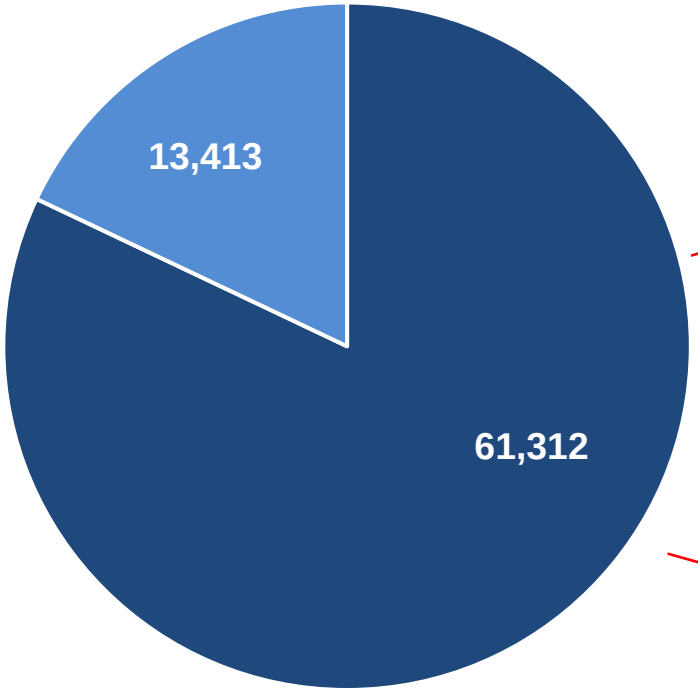
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

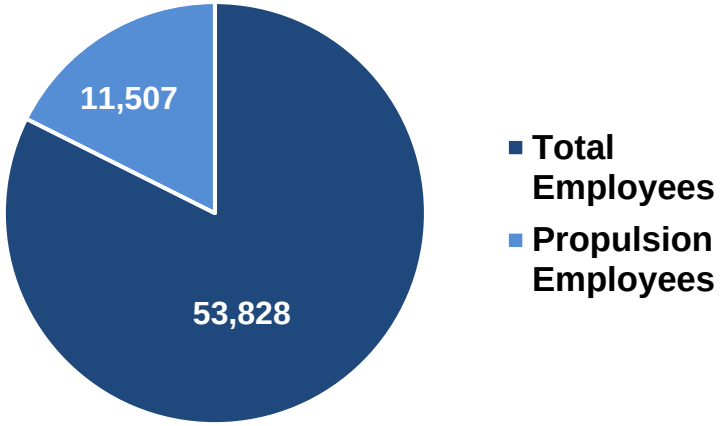
Employment - Space Primes

Total U.S. Employment vs Propulsion-Related Employment

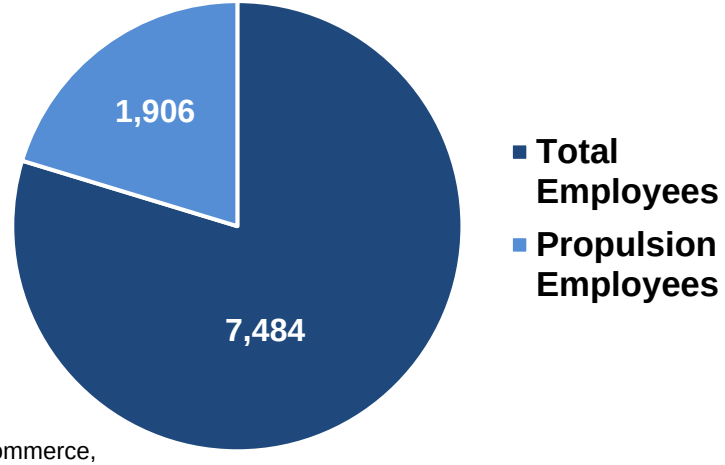
Total Space Primes - 11



Legacy Space Primes - 5



New Space Primes - 6



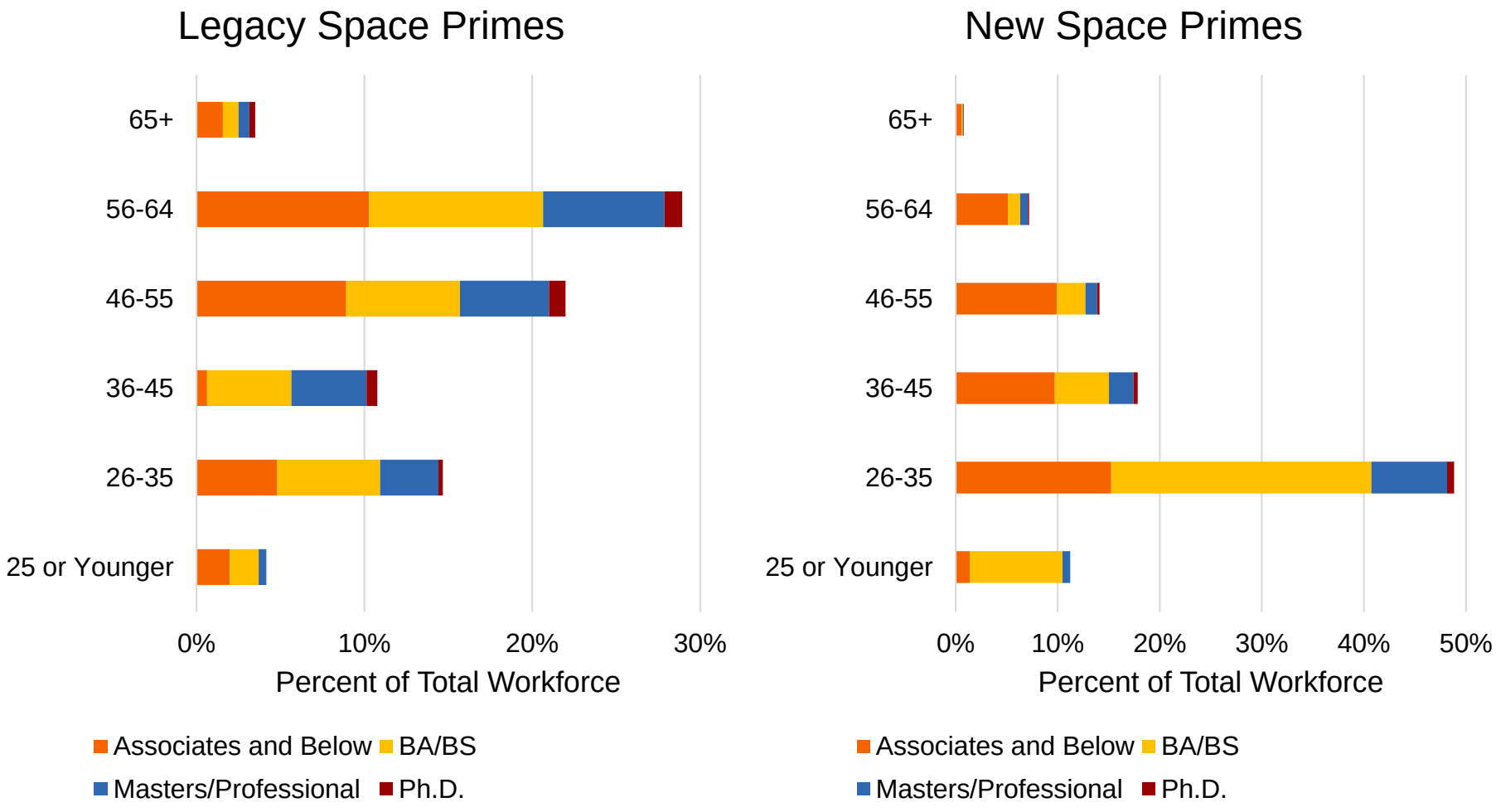
Q8, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

11 Respondents

Employment at Legacy and New Space Primes

Percentage of Propulsion Employees by Age and Education



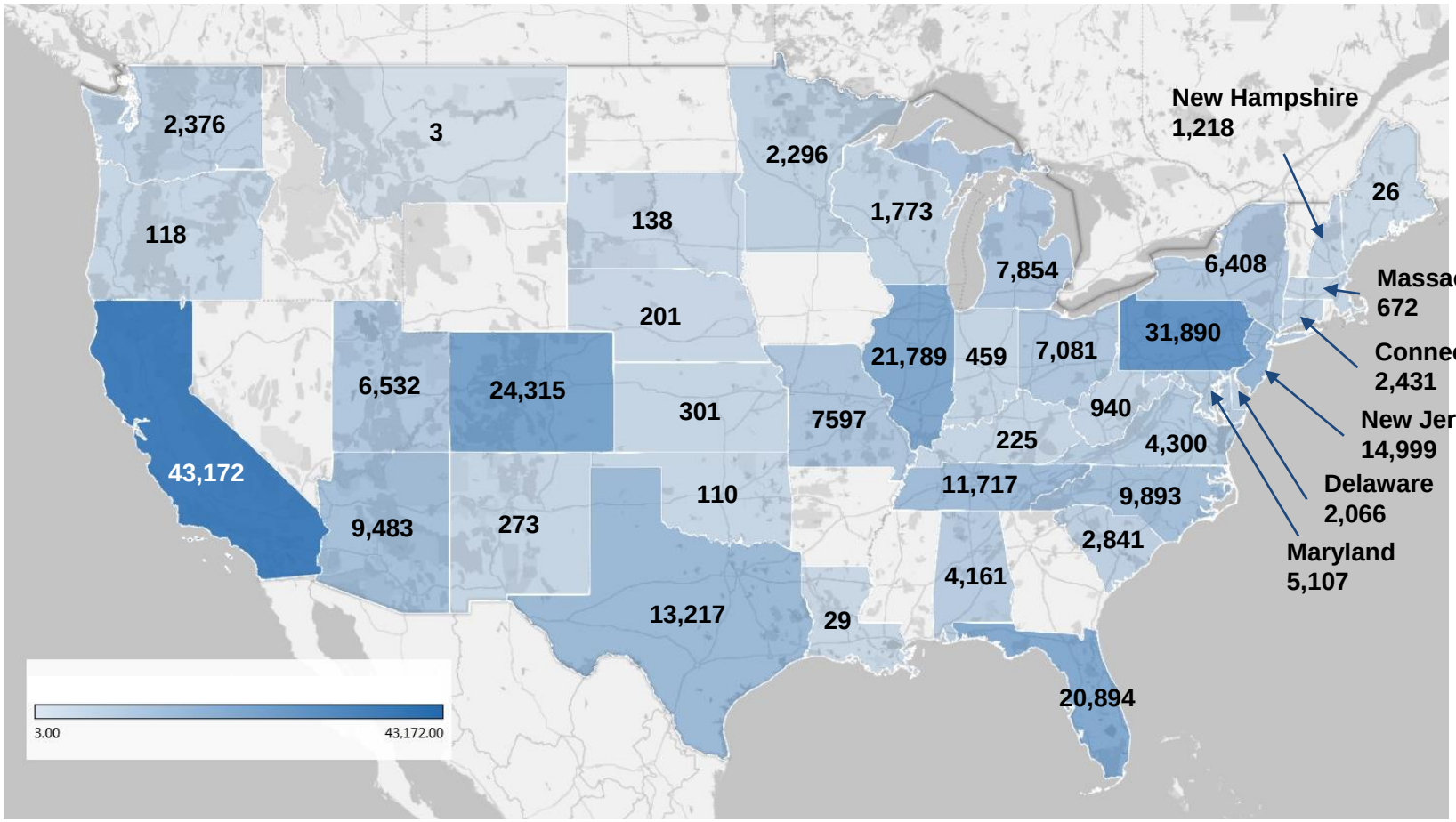
Q8, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

11 Respondents

Employment - 2016

Total Number of Employees (All Respondents) by State: 268,545



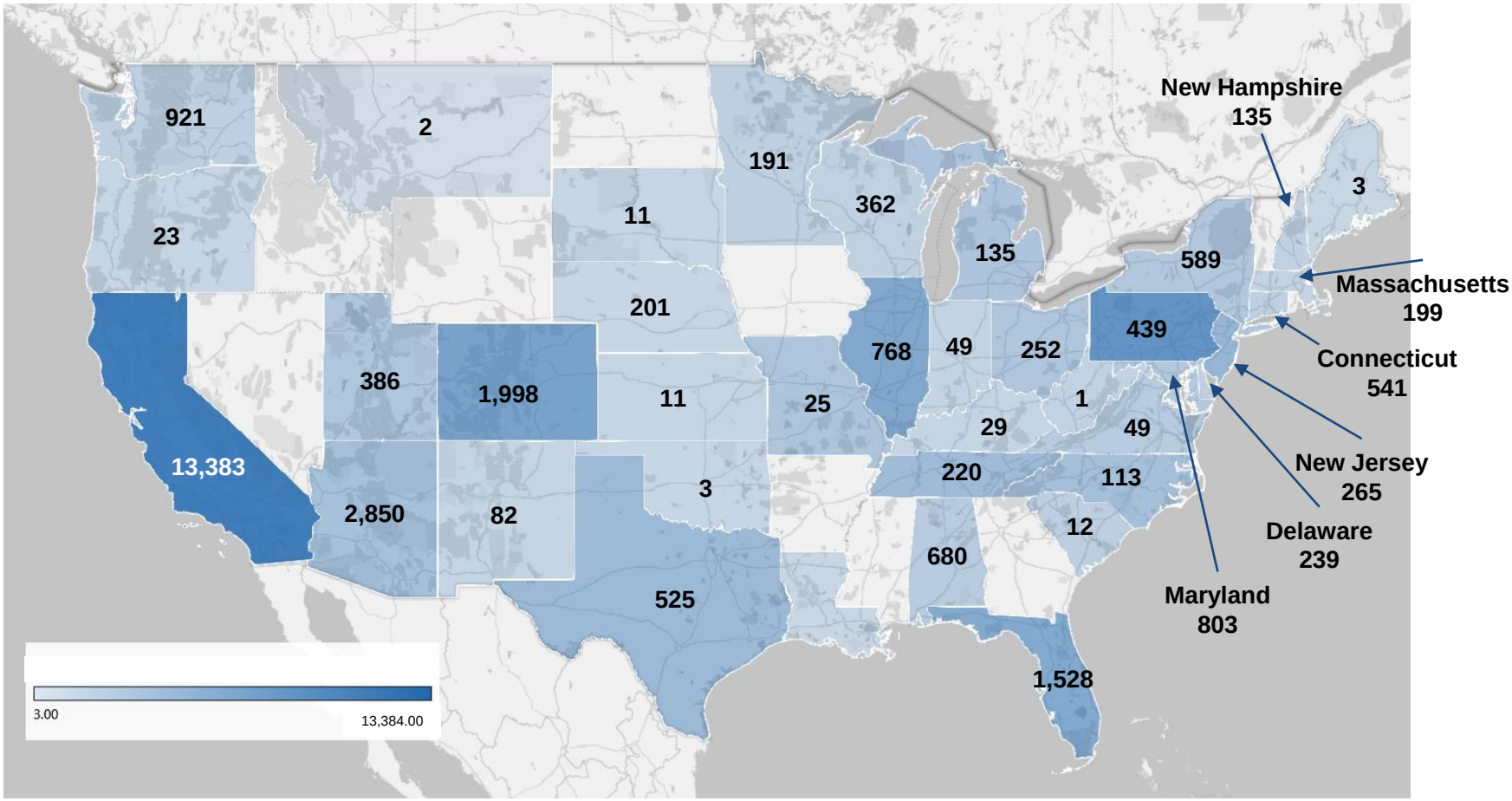
Q8, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Employment - 2016

Total Number of Propulsion-Related Employees (All Respondents) by State: 29,238



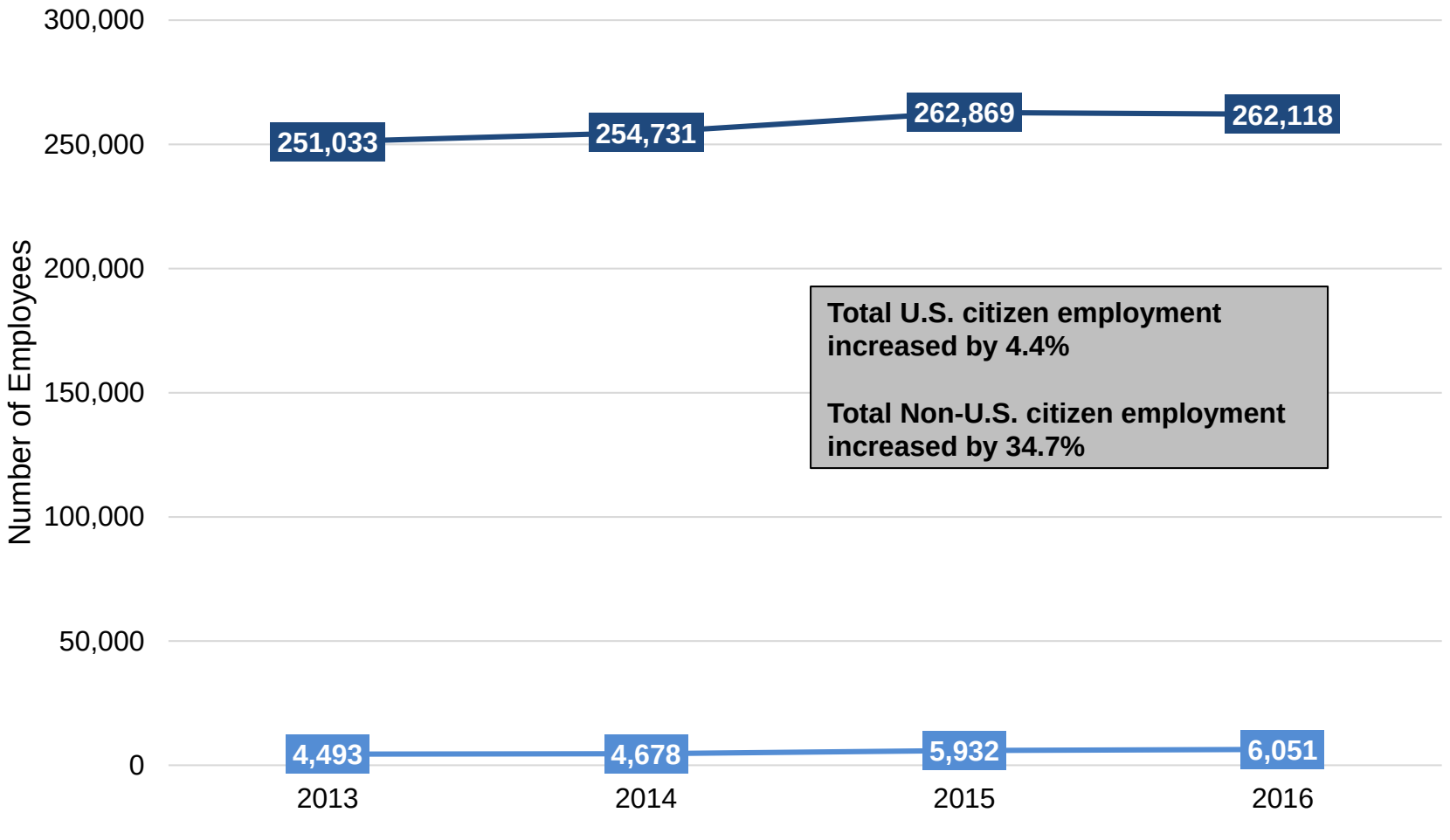
Q8, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Employment – 2013-2016

Total U.S. Citizen vs Total Non-U.S. Citizen Employees



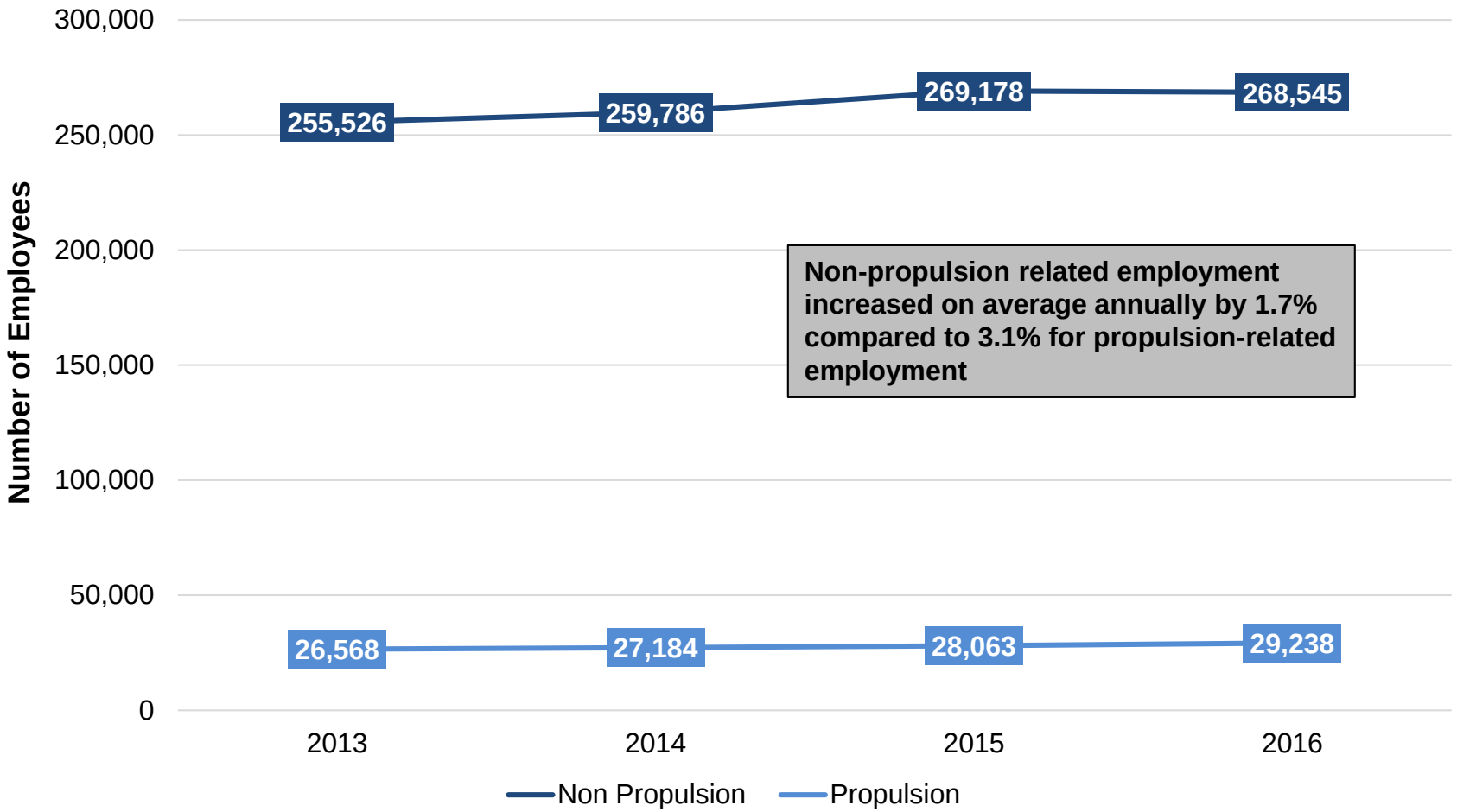
Q8, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Employment – 2013-2016

Total Propulsion-Related vs Non Propulsion-Related Employees



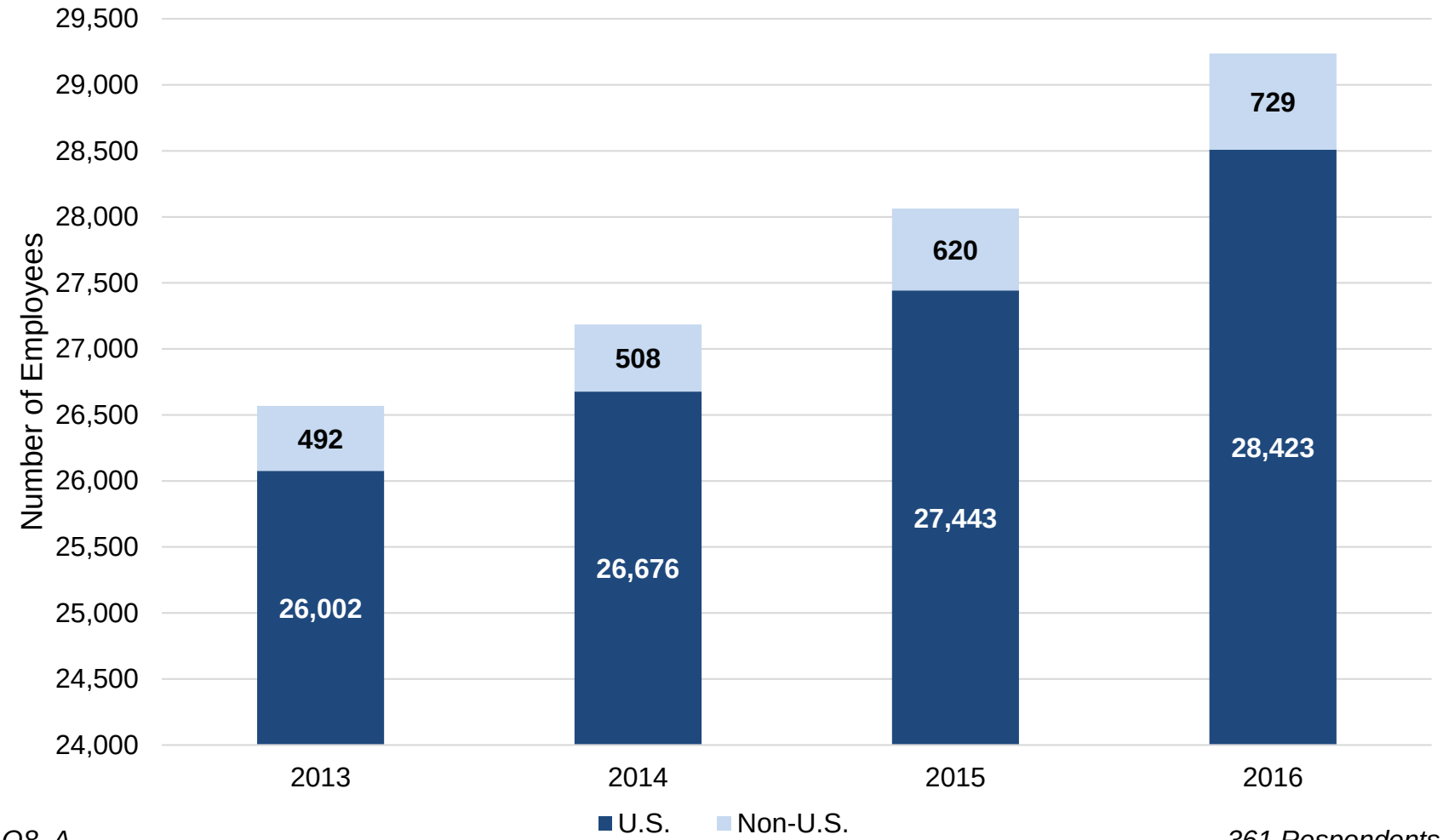
Q8, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Employment – 2013-2016

U.S. Citizen Propulsion vs Non-U.S. Citizen Propulsion Employees



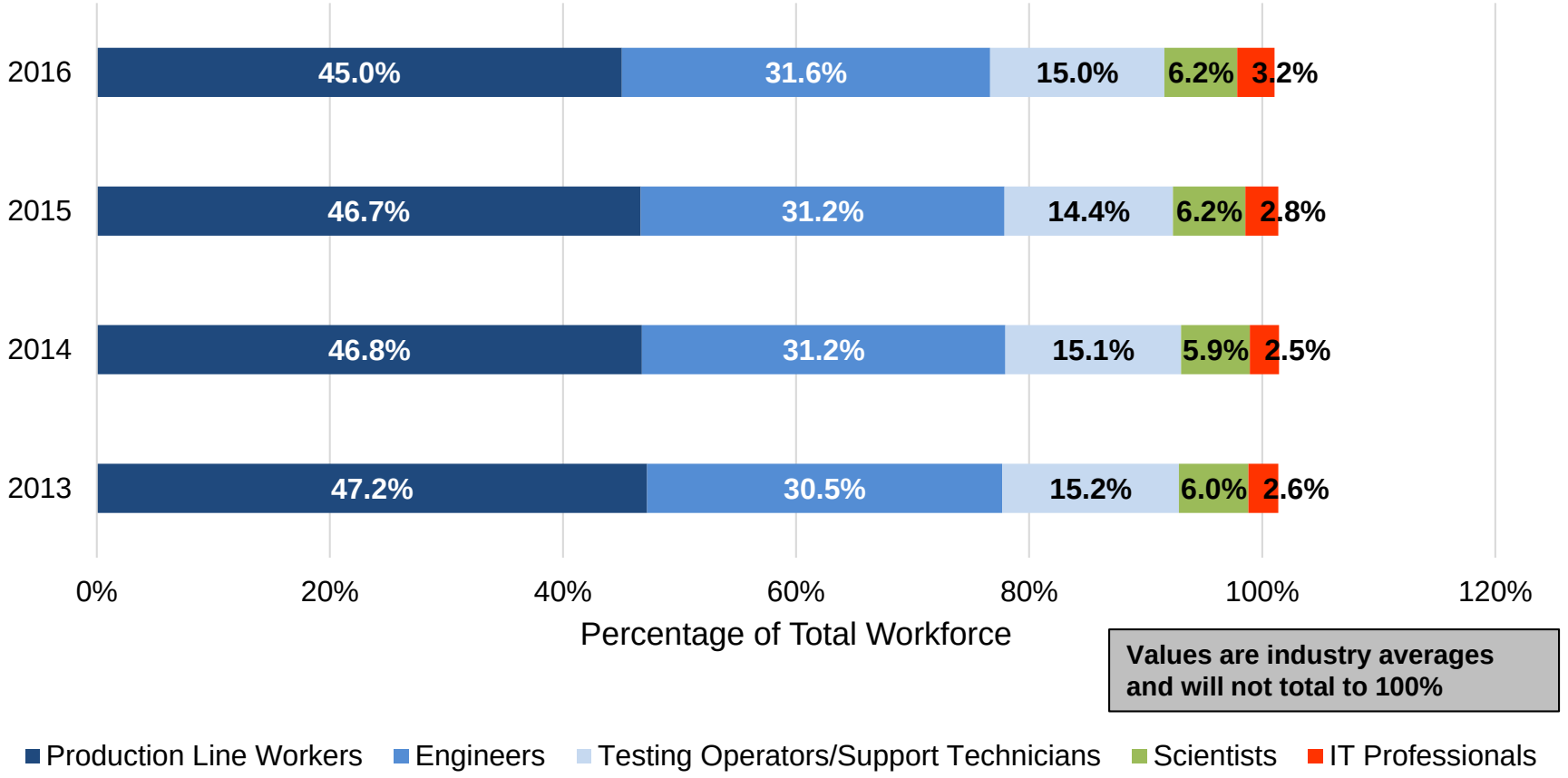
Q8, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Employment – 2013-2016

Average Percentage of FTEs by Occupational Category



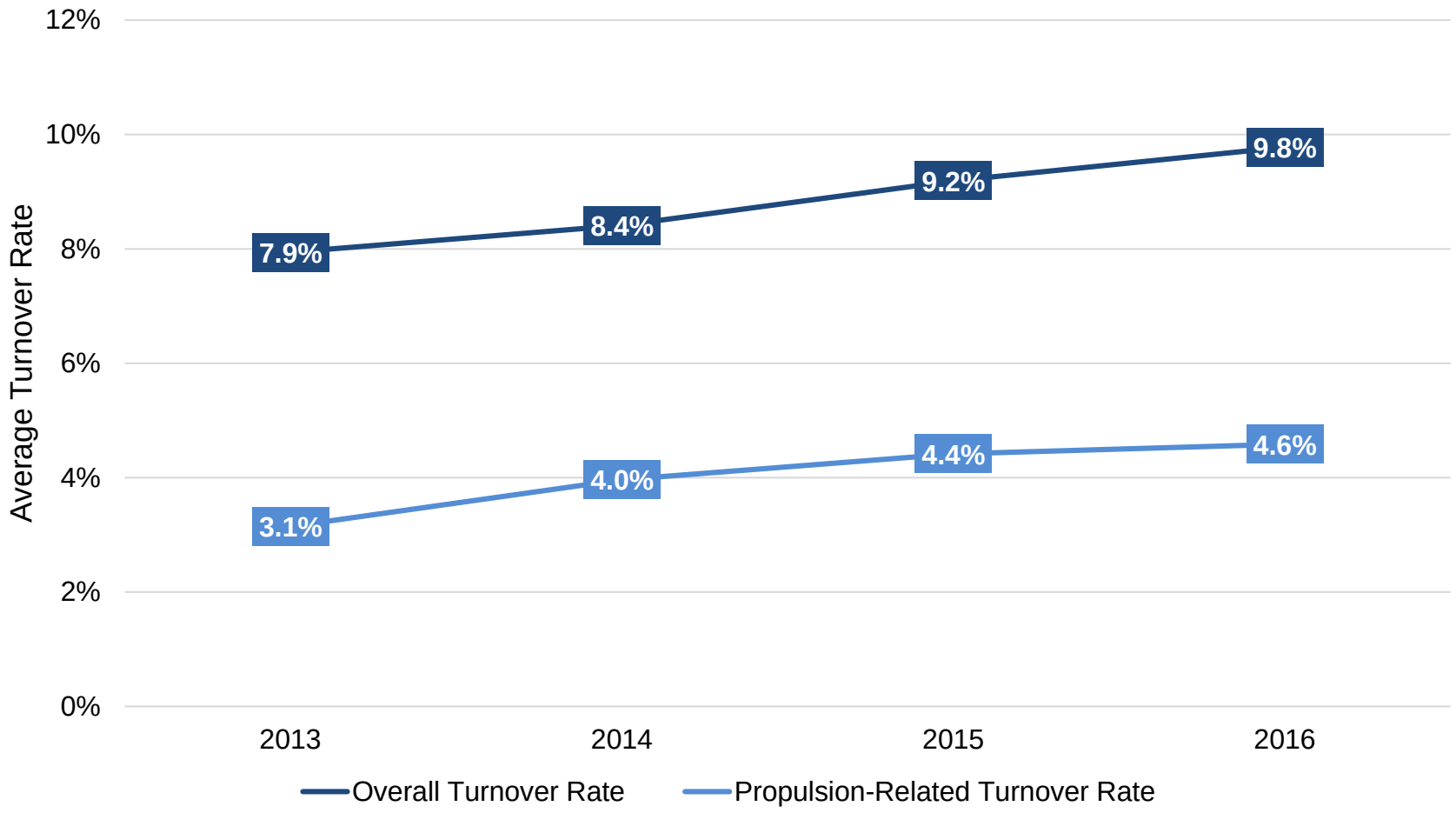
Q8, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Employment – 2013-2016

Average Turnover Rate by Operations



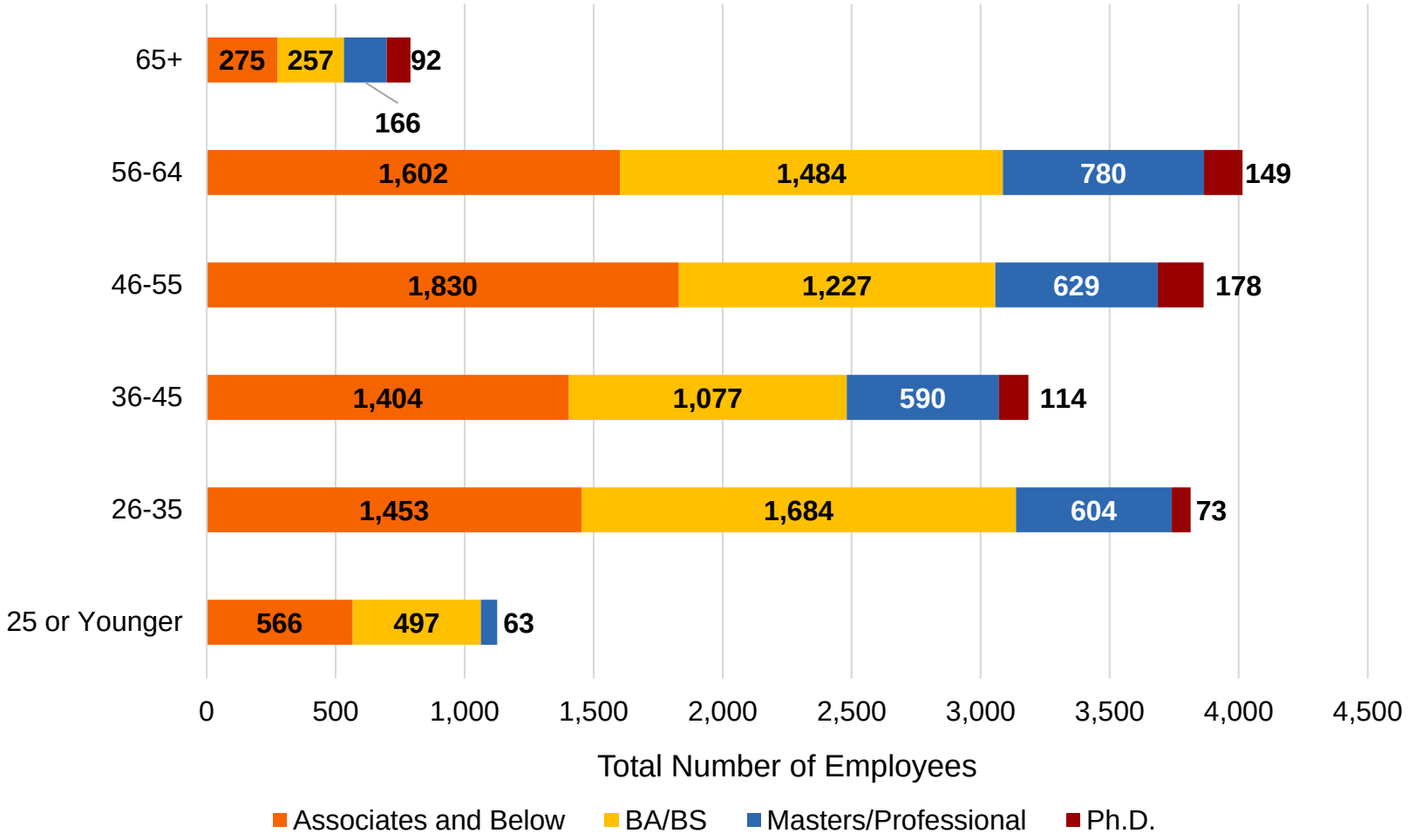
Q8, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Employment – 2016

Total STEM Degree Propulsion-Related FTEs by Age



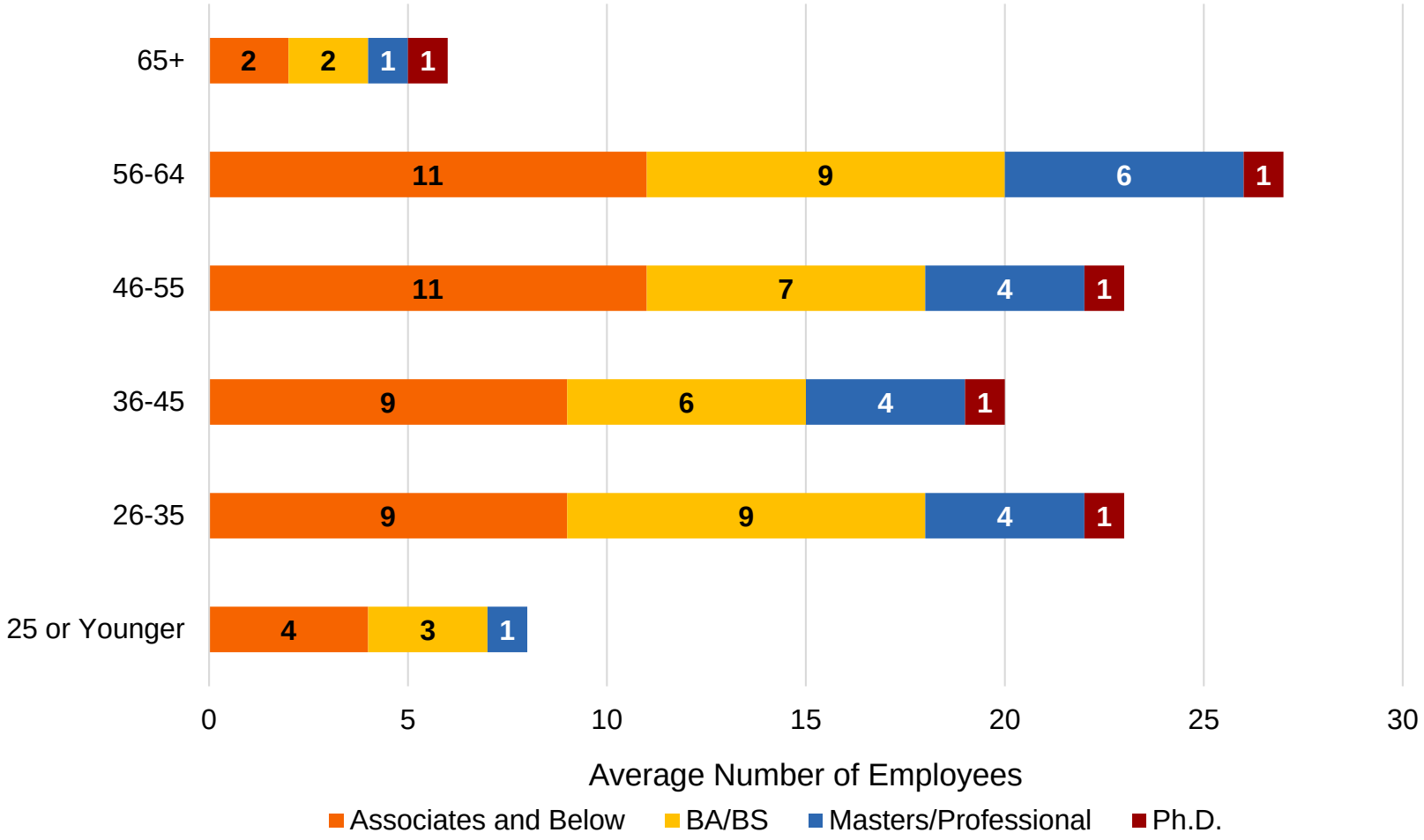
Q8, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Employment – 2016

Average STEM Degree Propulsion-Related FTEs by Age



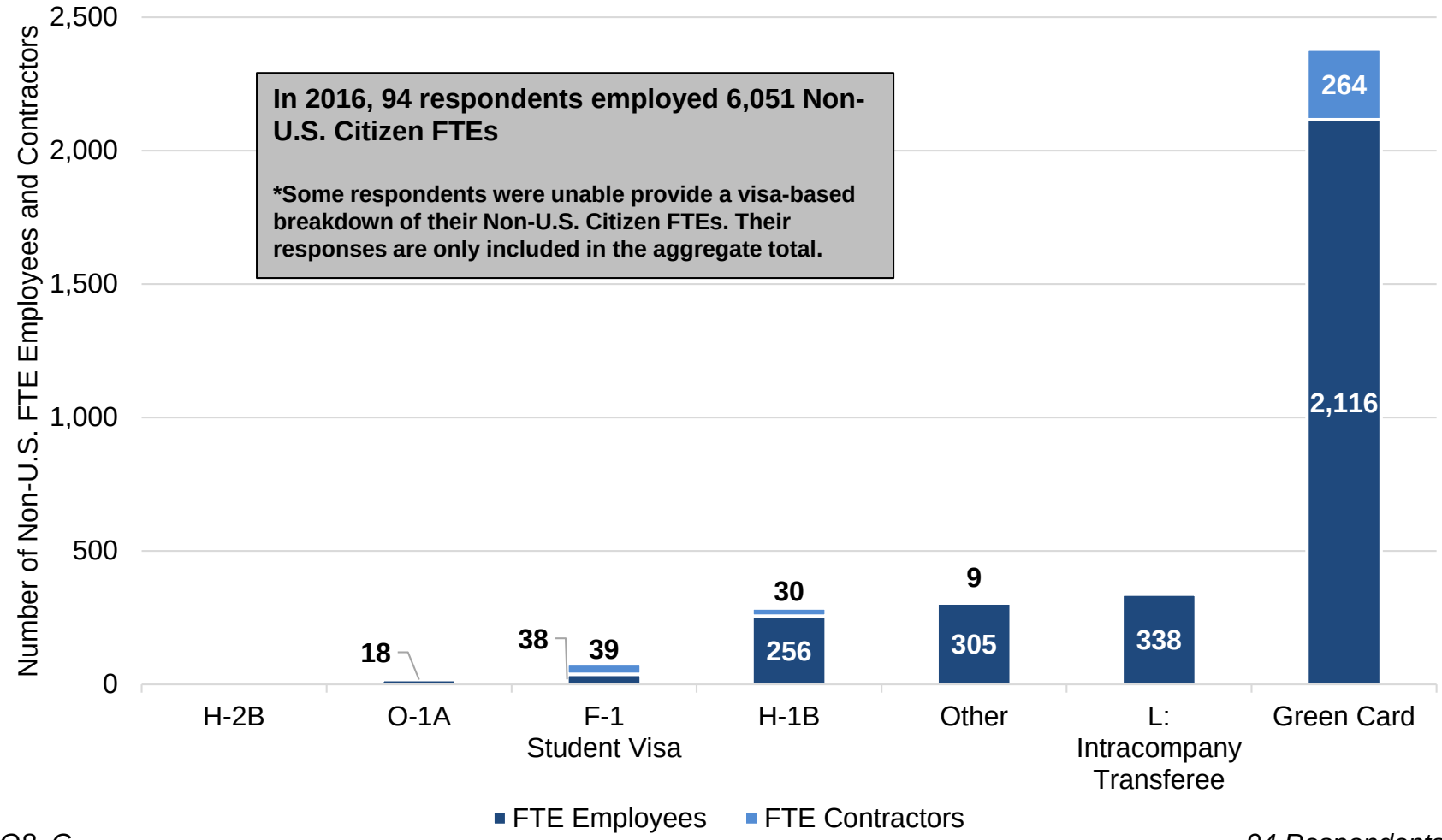
Q8, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Employment – 2016

Total Non-U.S. FTE Employees and Contractors by Visa Type



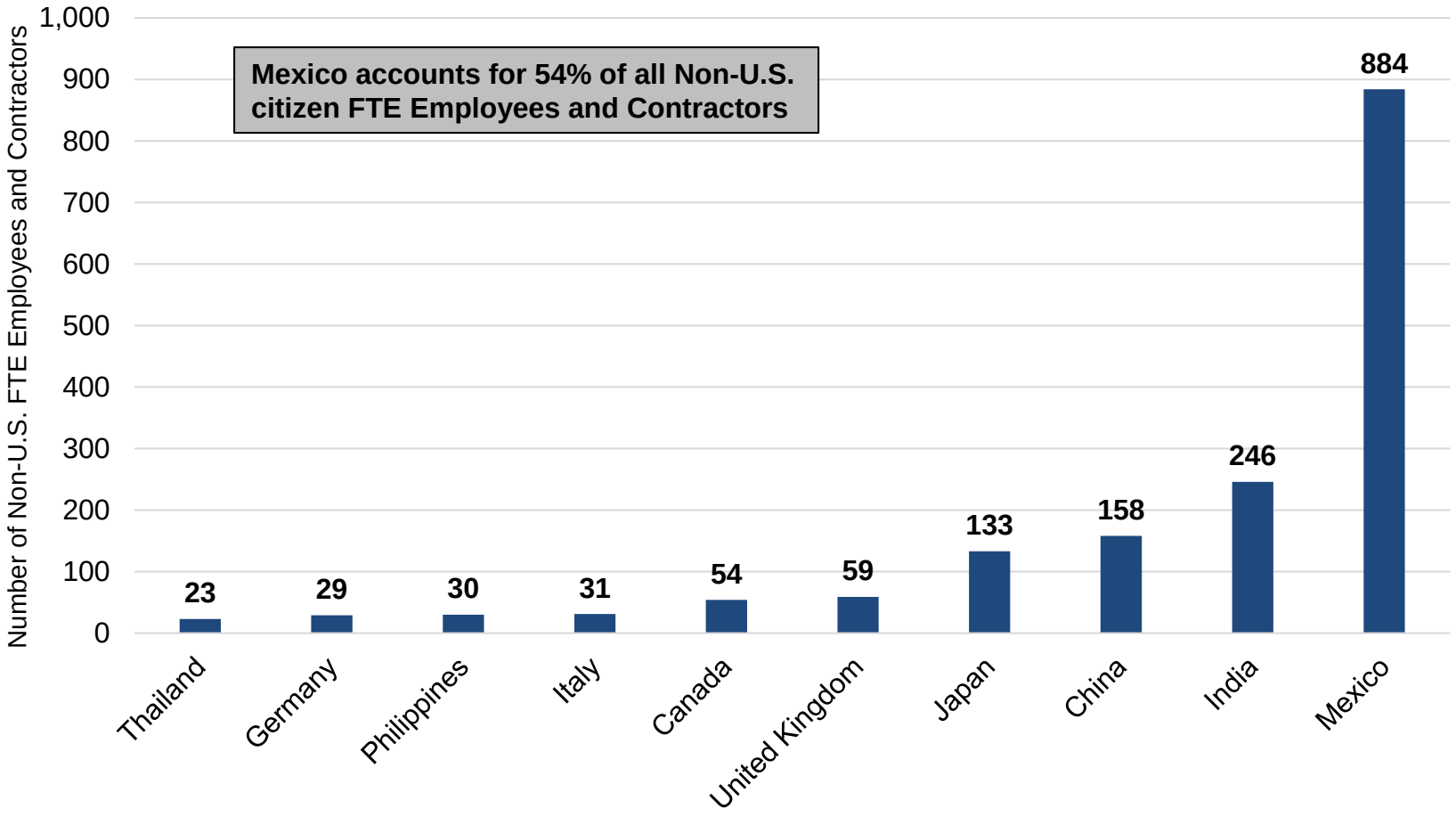
Q8, C

94 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Employment – 2016

Non-U.S. FTE Employees and FTE Contractors by Top 10 Countries



Q8, C

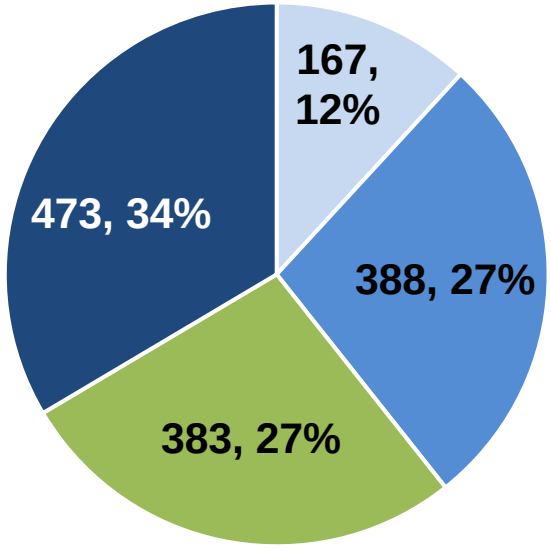
94 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

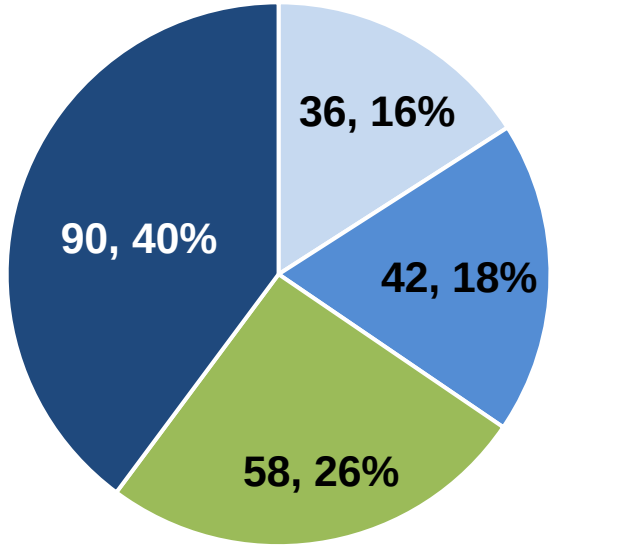
Customers

By Type of Customers Supported

Domestic Customers - 1,411



Foreign Customers - 226



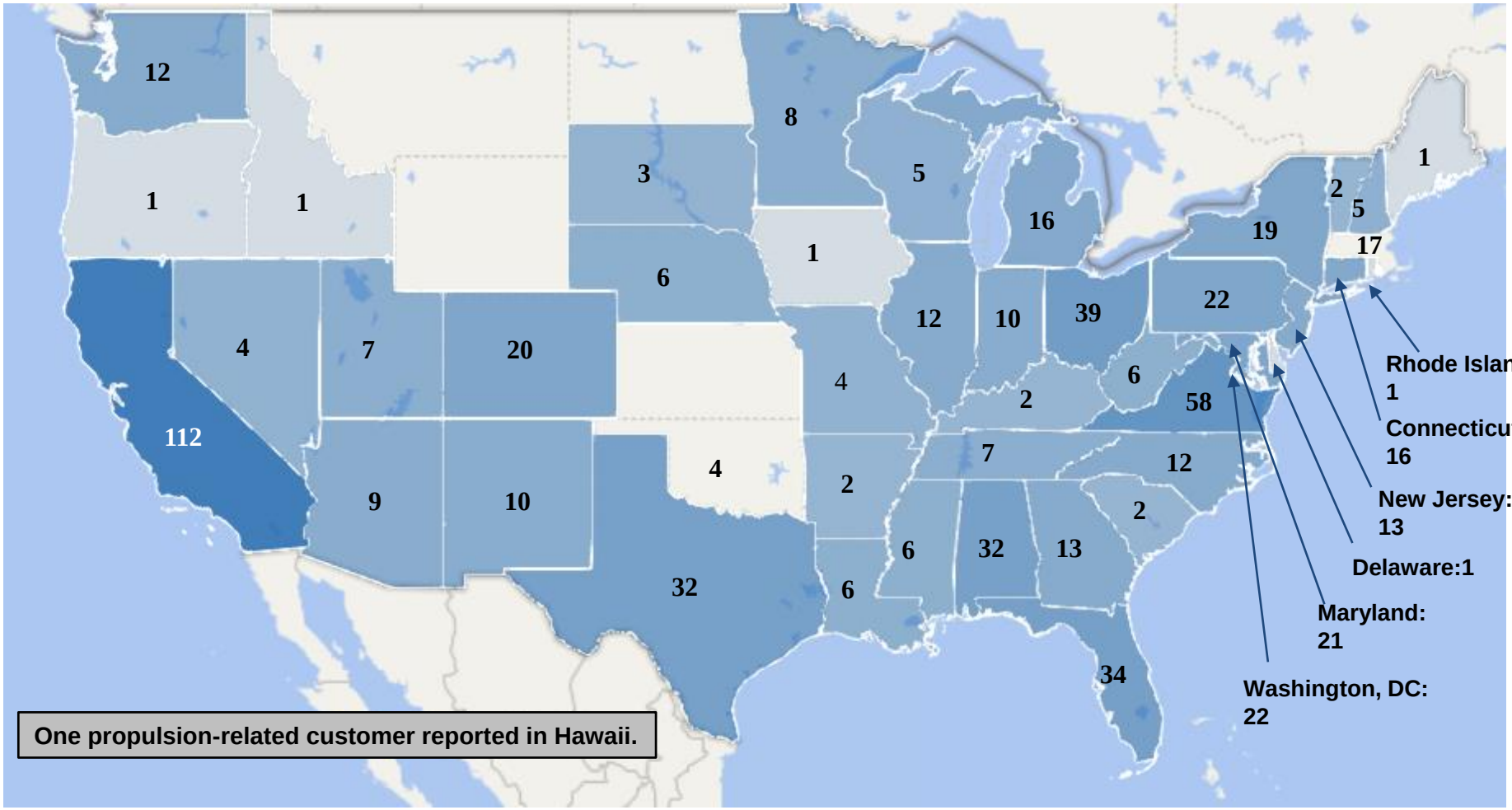
Q10, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 respondents

Customers

Total Propulsion-Related Unique Customers by State: 637



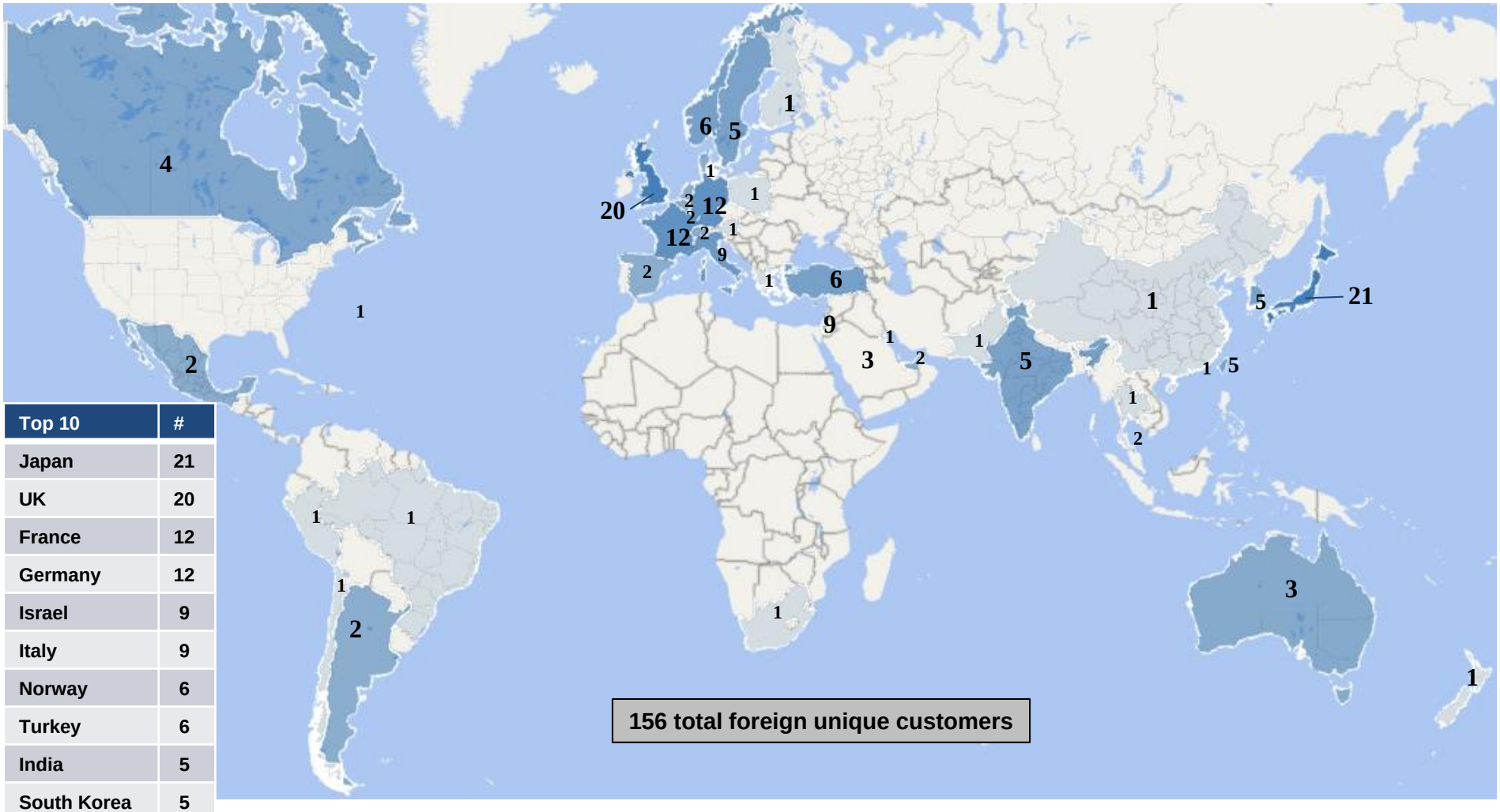
Q10, B

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Customers

Total Foreign Unique Customers by Country: 156



Top 10	#
Japan	21
UK	20
France	12
Germany	12
Israel	9
Italy	9
Norway	6
Turkey	6
India	5
South Korea	5

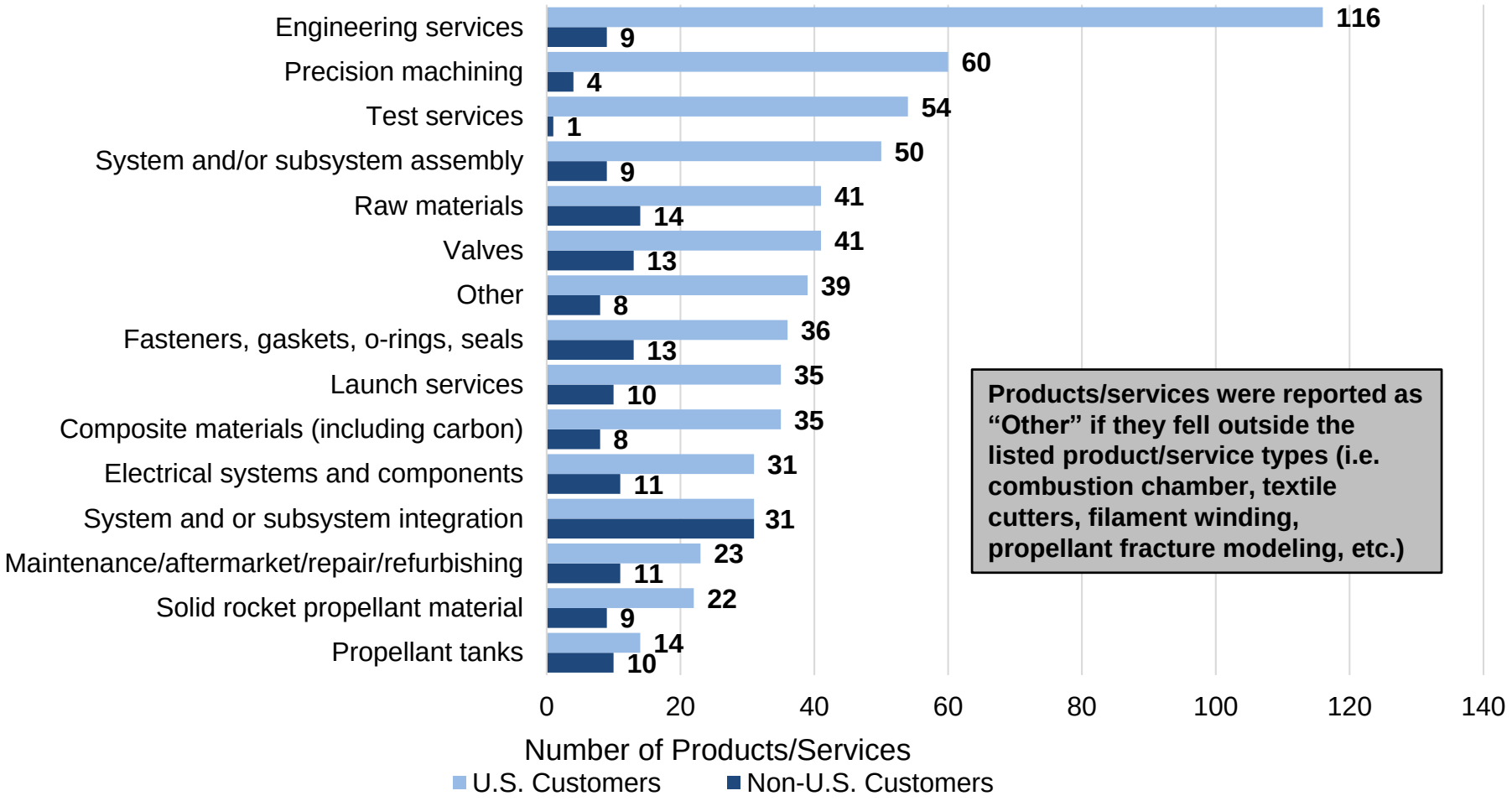
Q10, D

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Customers

Top 15 Product/Services Provided to U.S. and Non-U.S. Customers



Q10, A

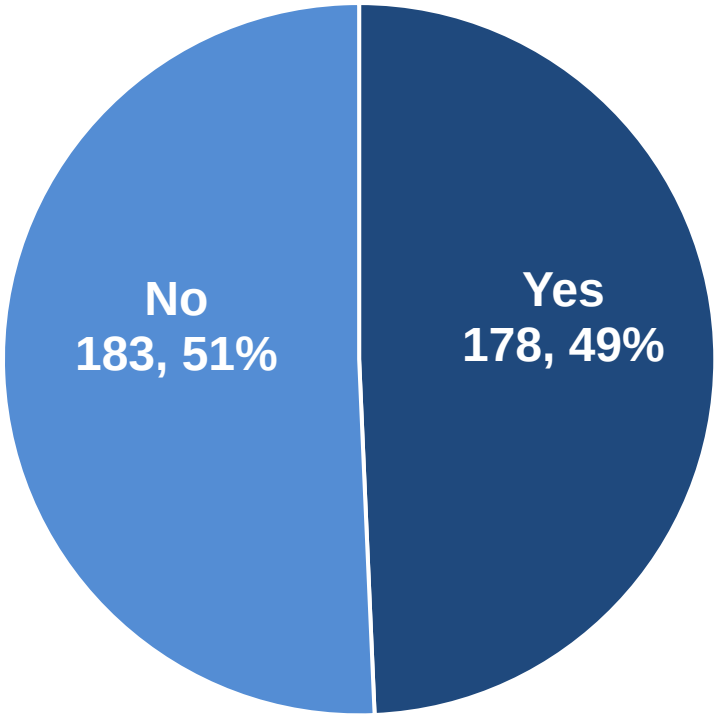
361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D, Testing, and Evaluation

General Participation

Percentage of All Respondents



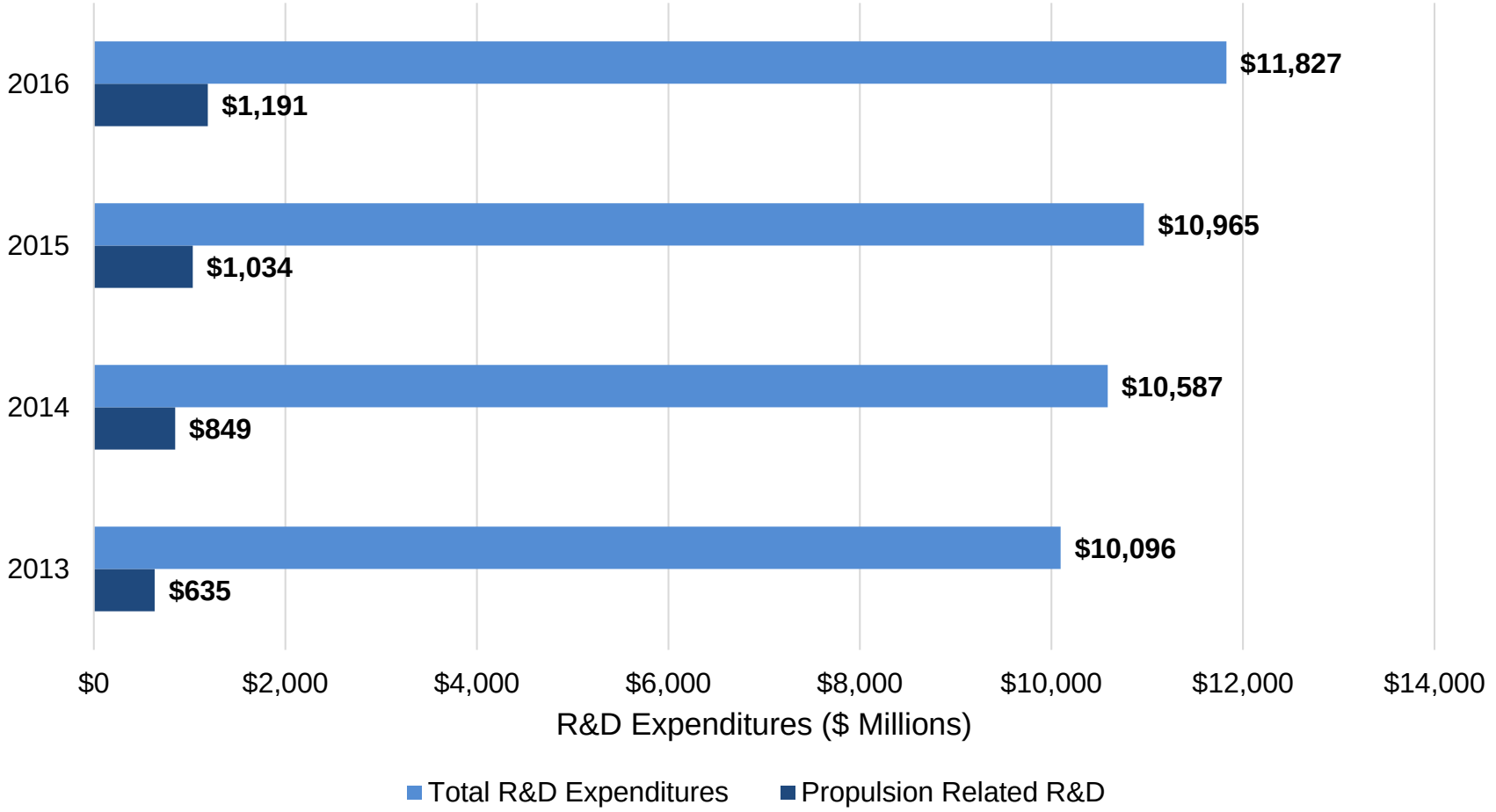
Q11a, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D Expenditures – 2013-2016

Total and Propulsion-Related R&D Expenditures by Value



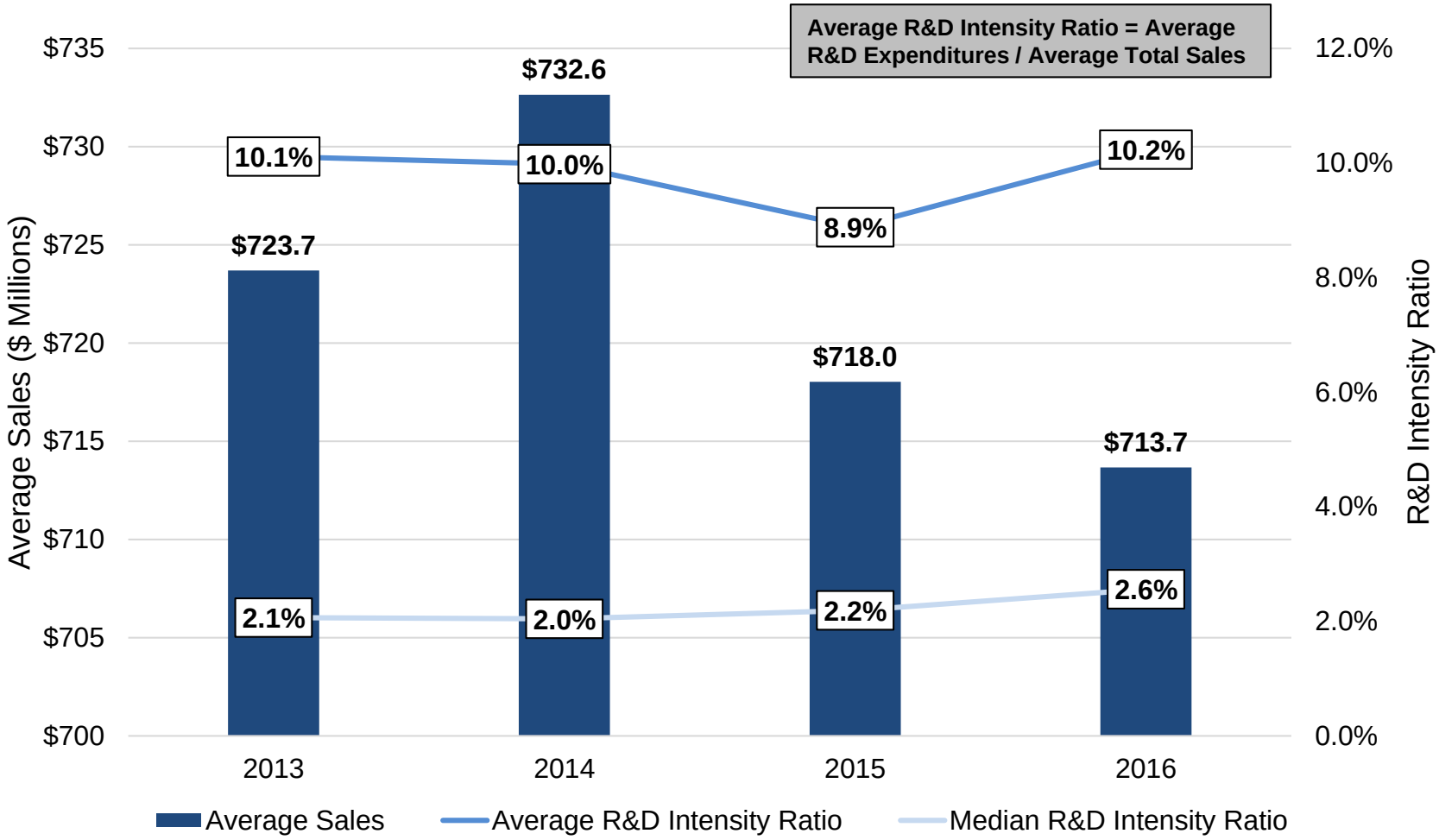
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D Expenditures – 2013-2016

R&D Intensity Ratio by Average Sales



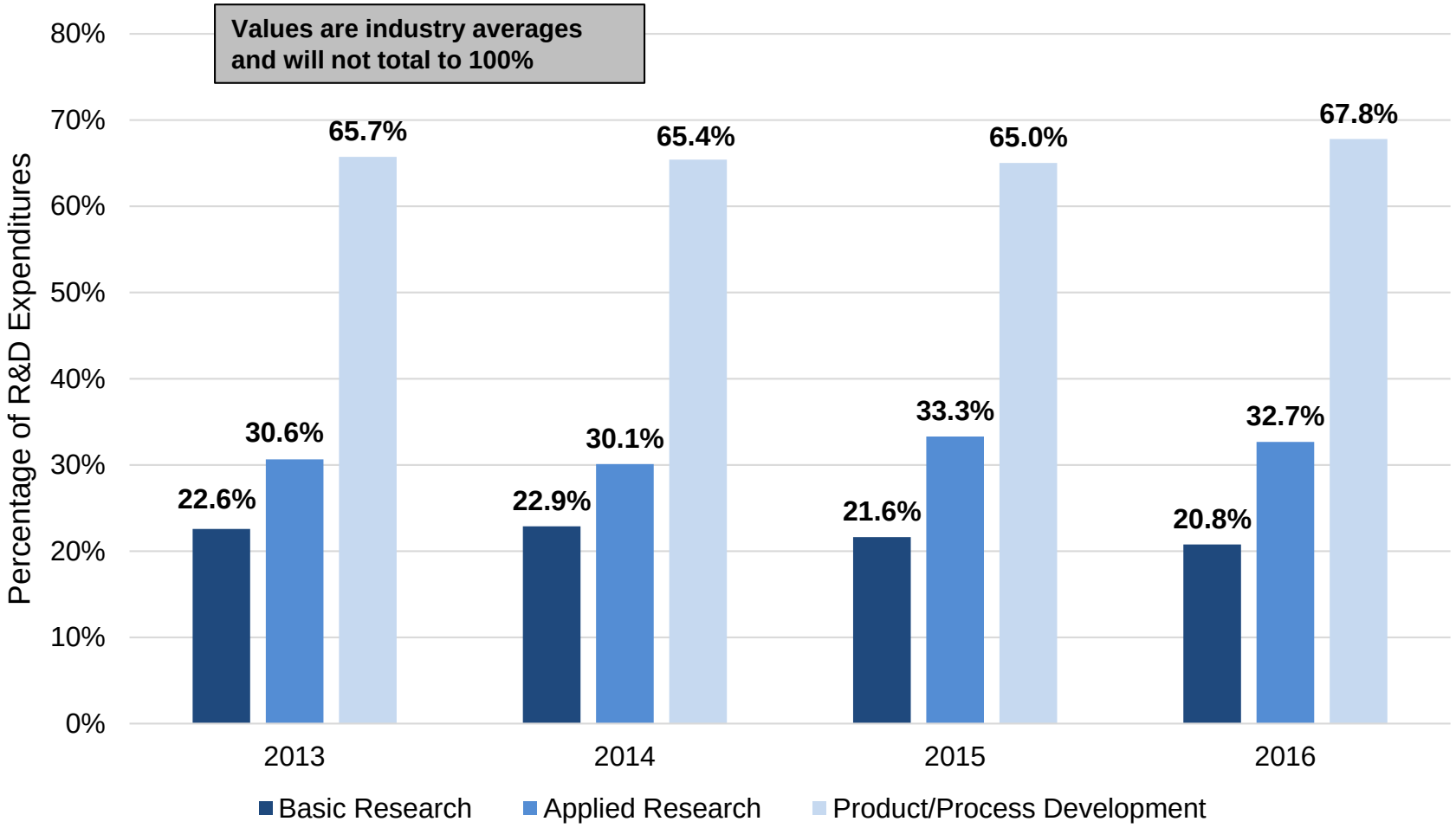
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D Expenditures – 2013-2016

Top Categories of R&D Expenditures by Percentage



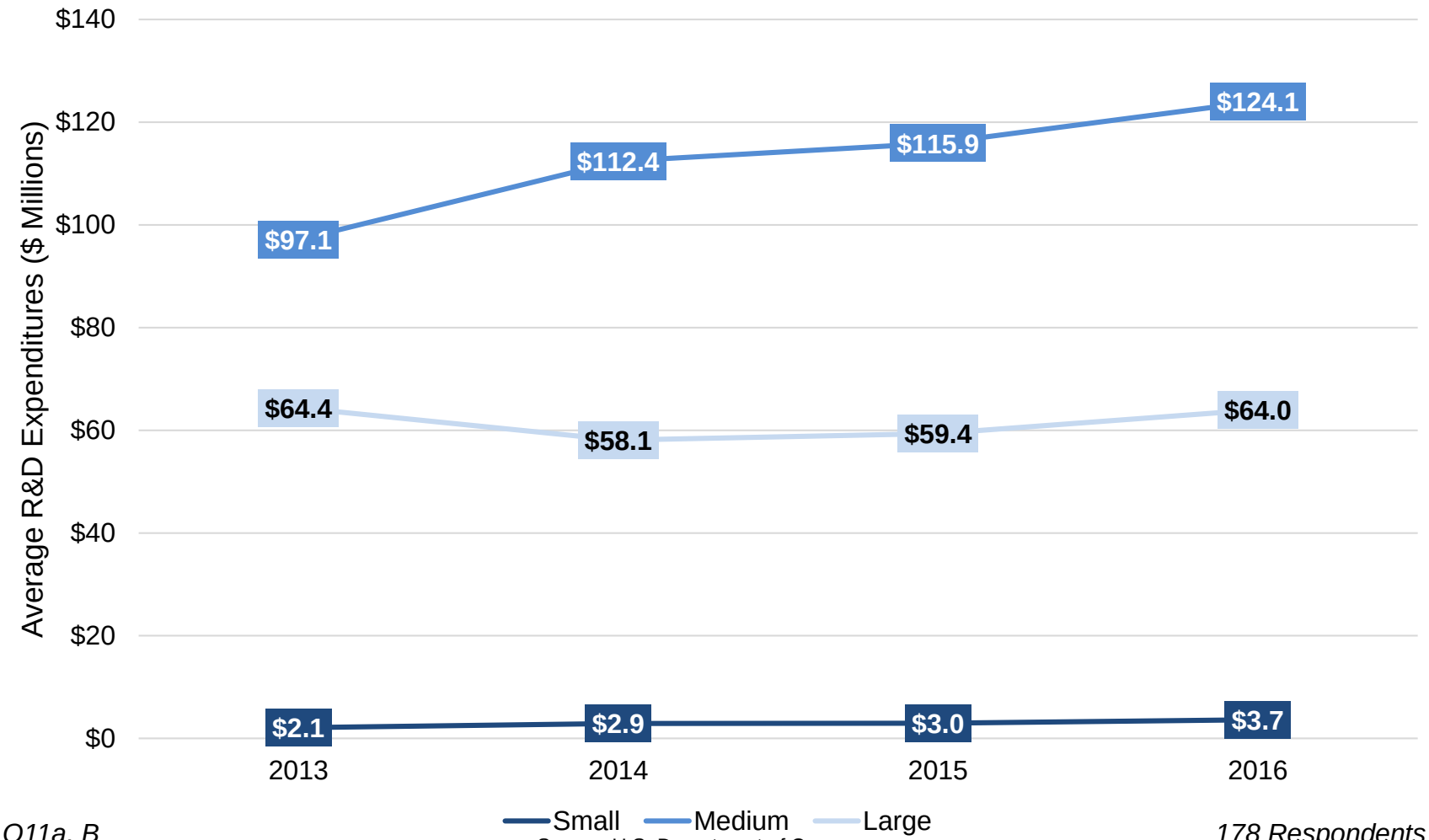
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D Expenditures – 2013-2016

Average R&D Expenditures by Company Size



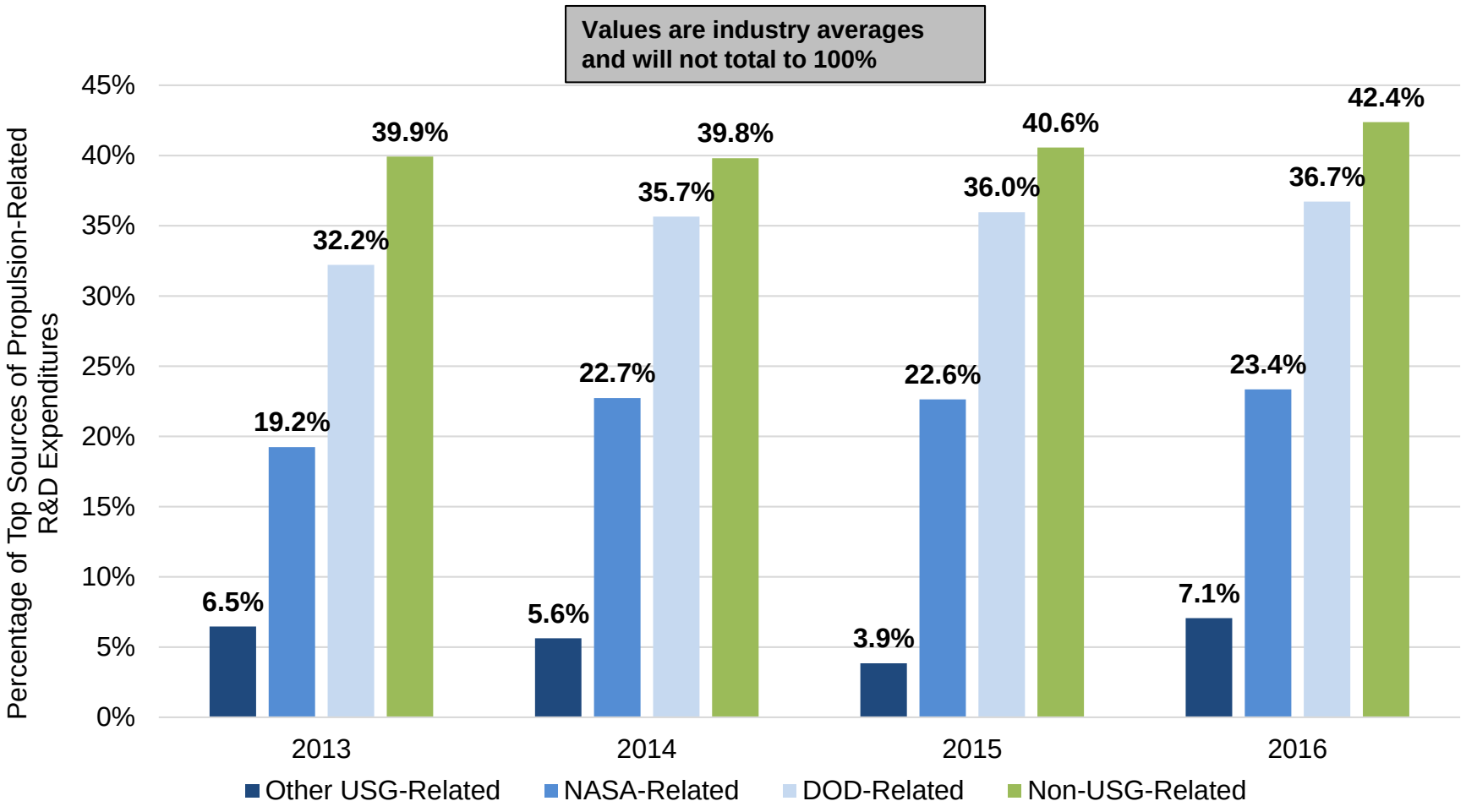
Q11a, B

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018

Propulsion-Related R&D Expenditures

Top Sources of Propulsion-Related R&D Expenditures by Percentage



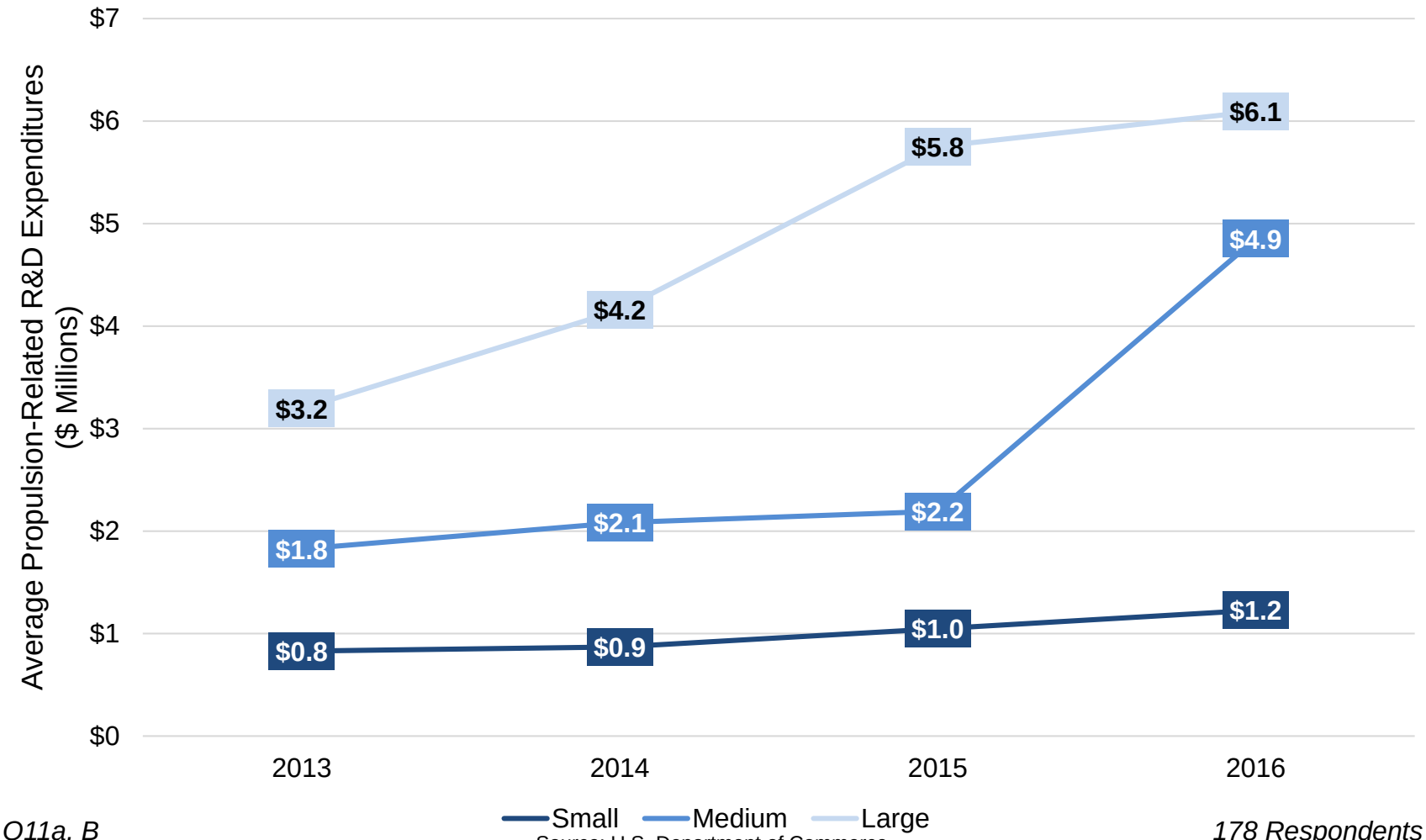
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Propulsion-Related R&D Expenditures – 2013-2016

Average Propulsion-Related R&D Expenditures by Company Size



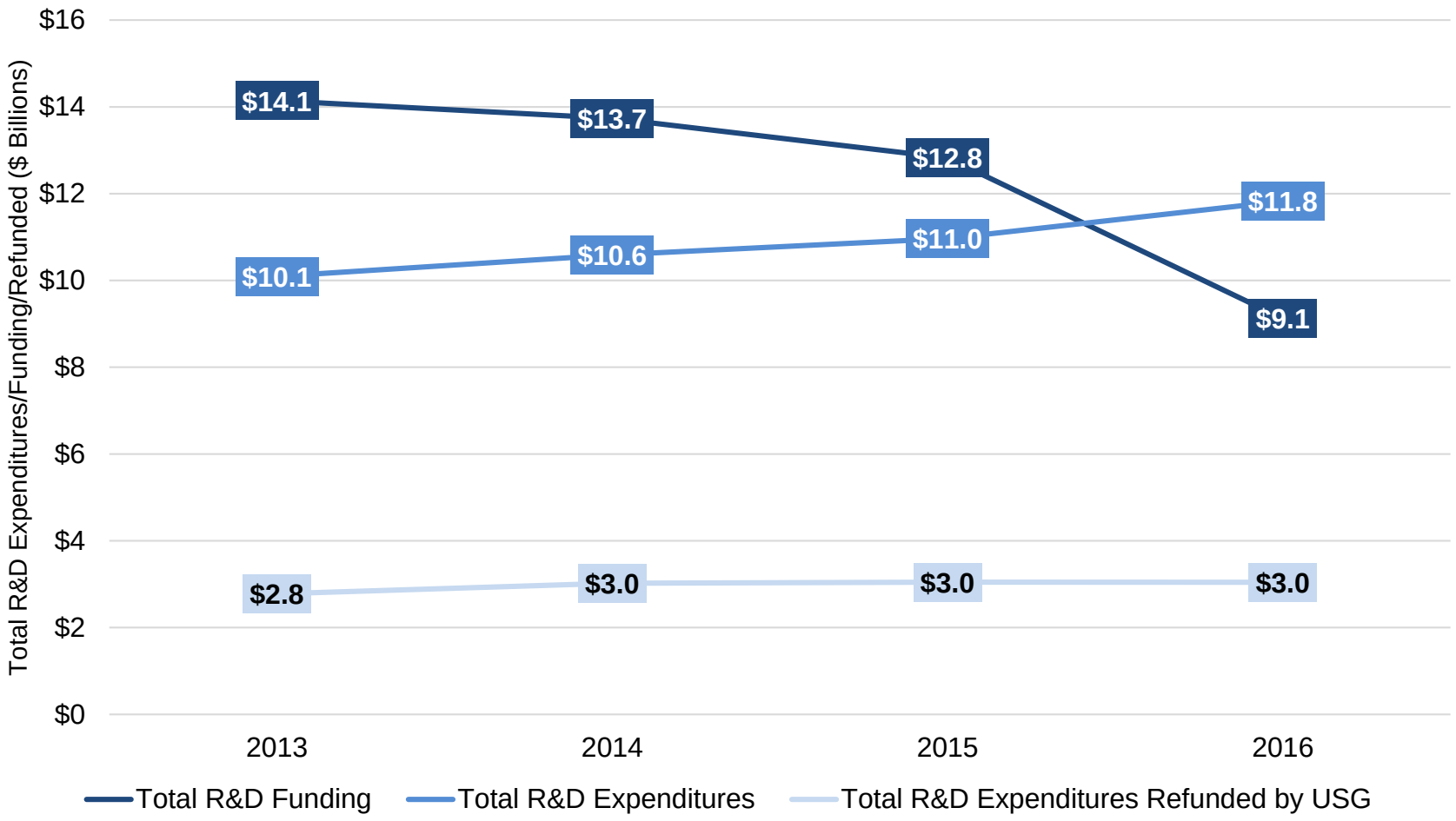
Q11a, B

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018

R&D Funding

Total R&D Funding, Expenditures, and Refunds - 2013-2016



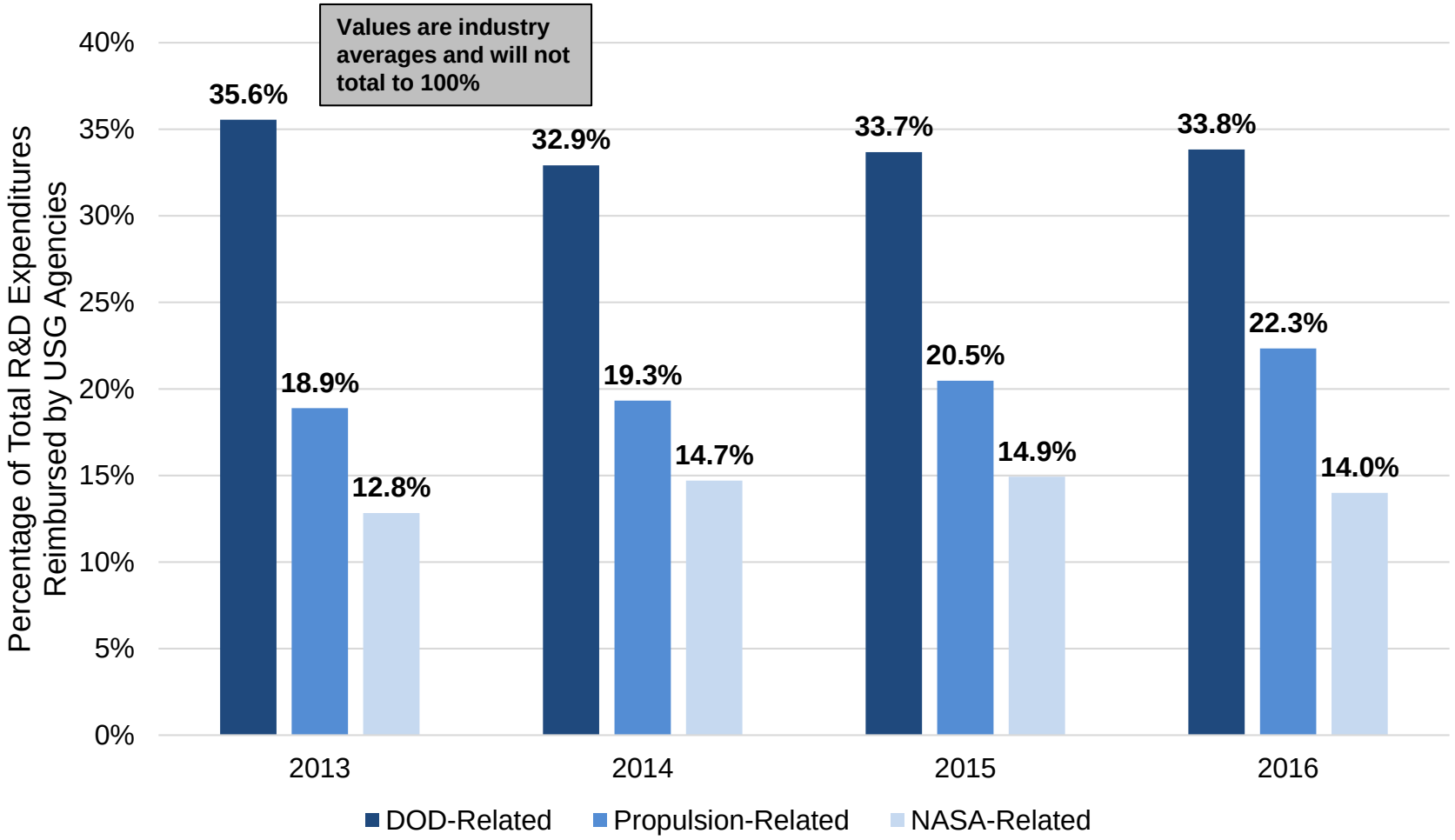
Q11a, B

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D Expenditures Reimbursed – 2013-2016

Total R&D Expenditures Reimbursed by USG Agencies



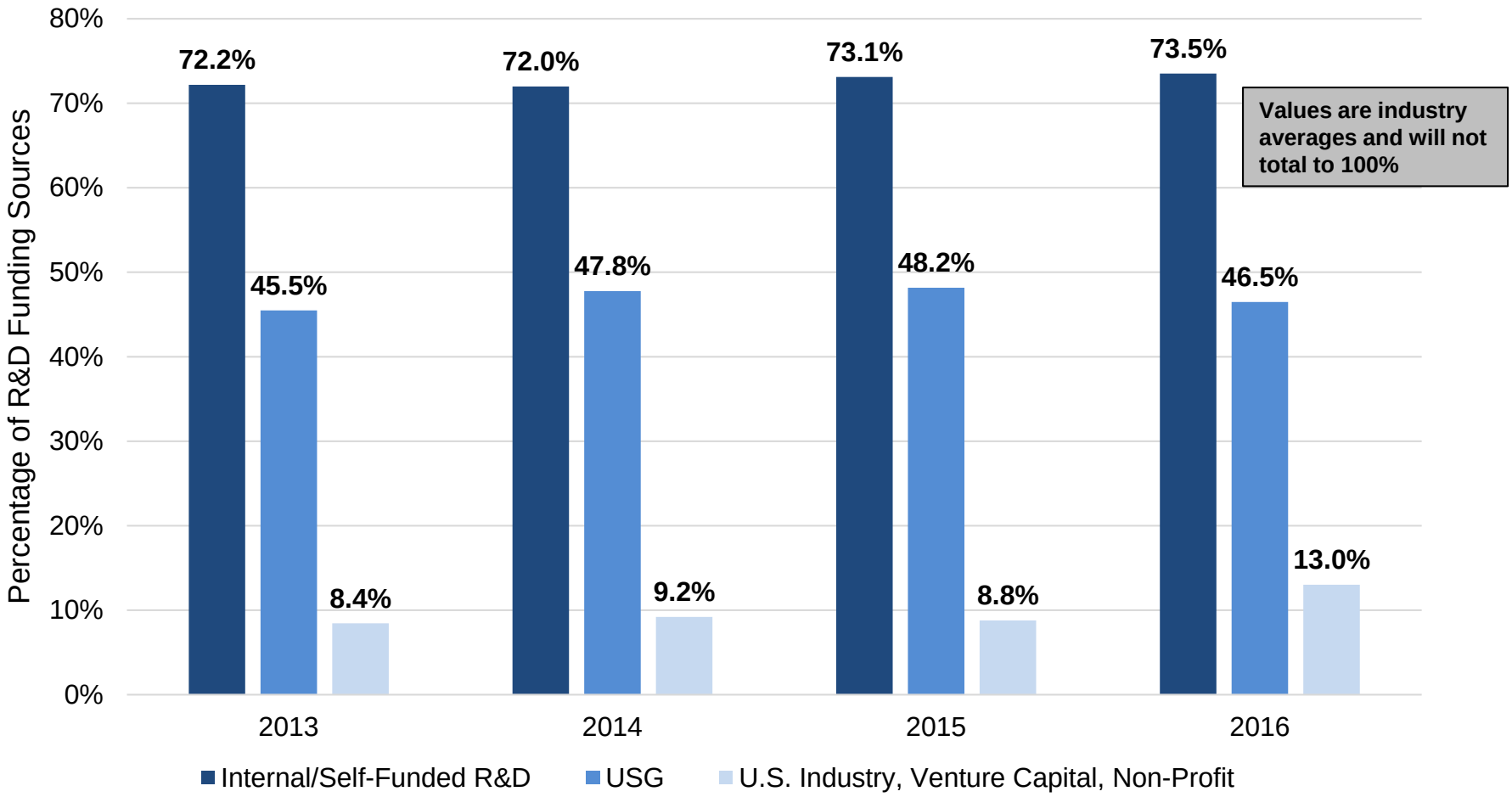
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D Funding – 2013-2016

Top 3 Sources of R&D Funding by Percentage



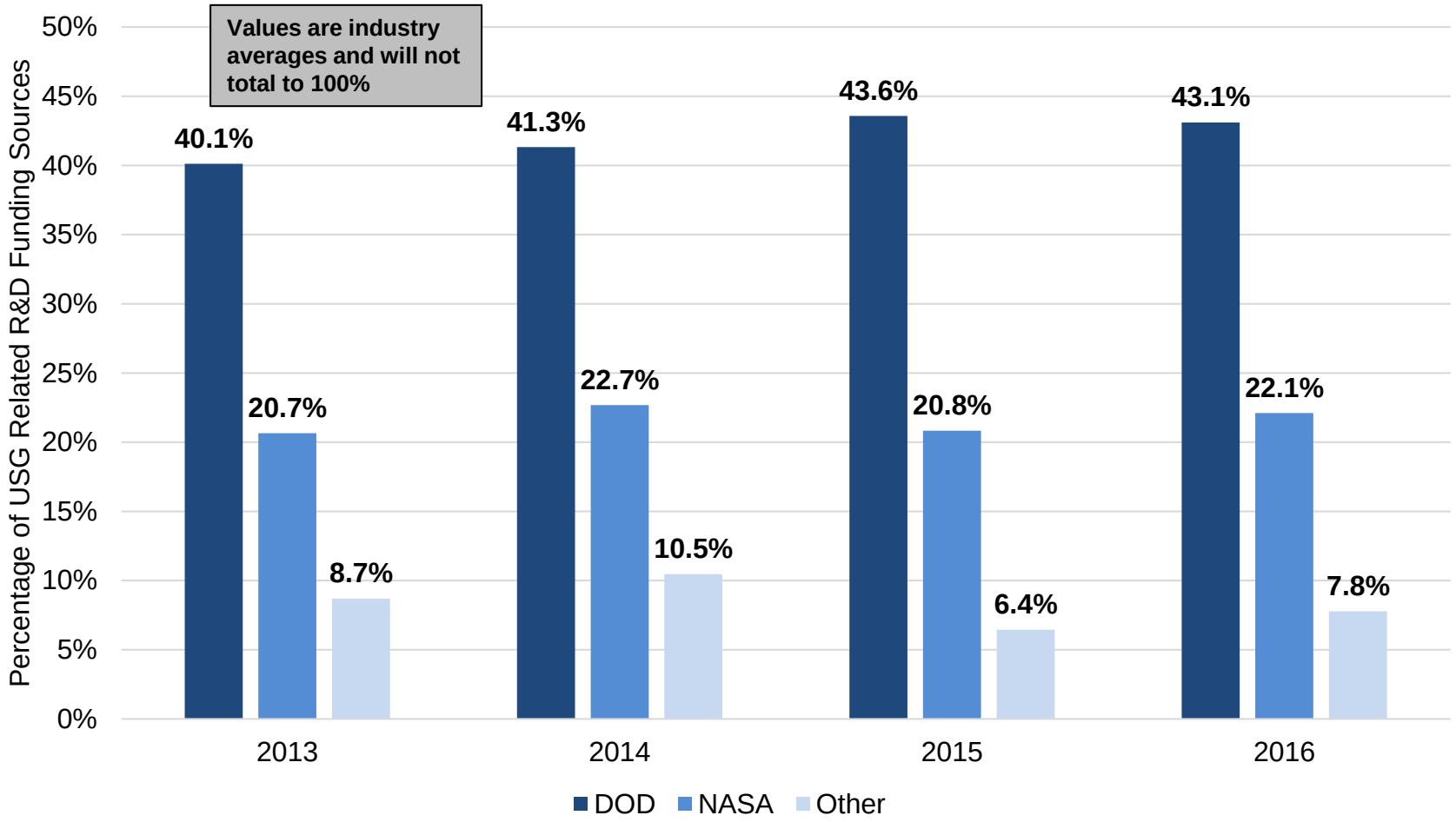
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

USG-Related R&D Funding – 2013-2016

Top Sources of USG-Related R&D Funding by Percentage



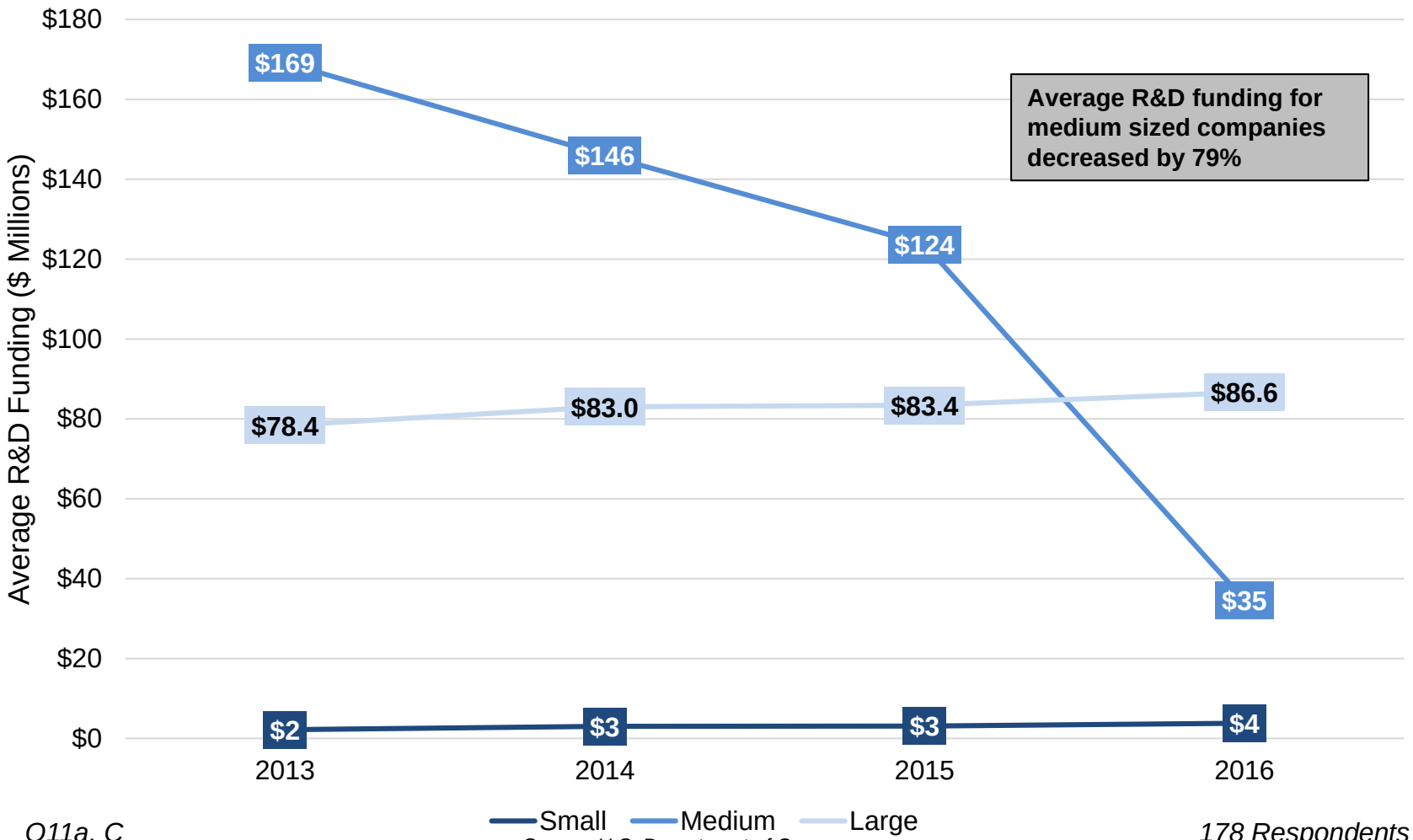
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D Funding – 2013-2016

Average Value of R&D Funding by Company Size



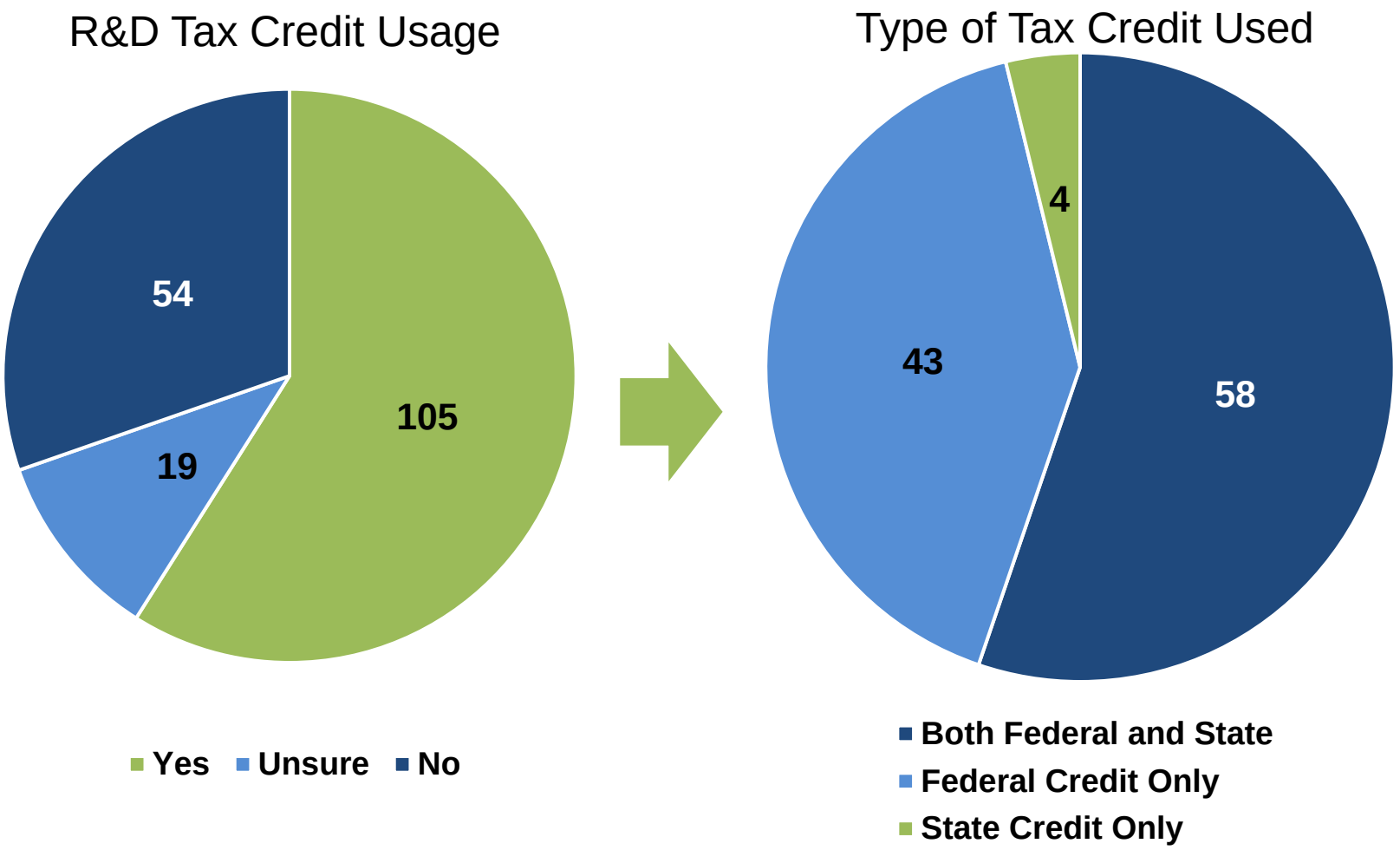
Q11a, C

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Research, Development, Testing, and Evaluation

R&D Tax Credit Use and Type



Q11a, D

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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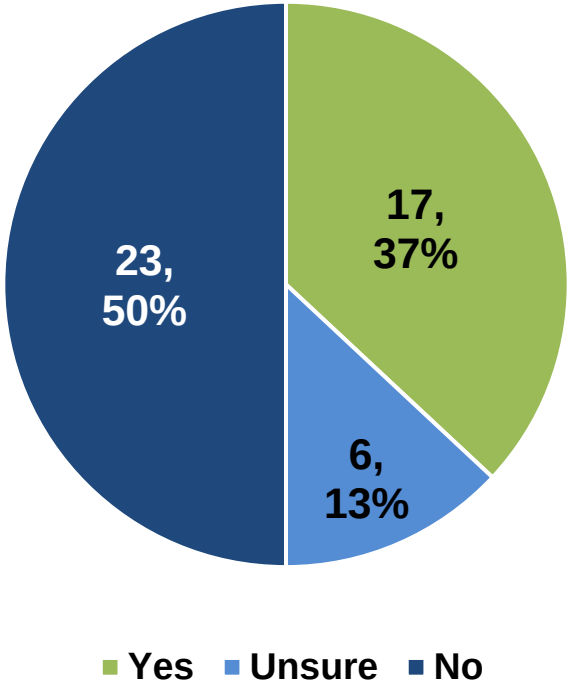
178 Respondents

Research, Development, Testing, and Evaluation

R&D Tax Credit Use by Company Size

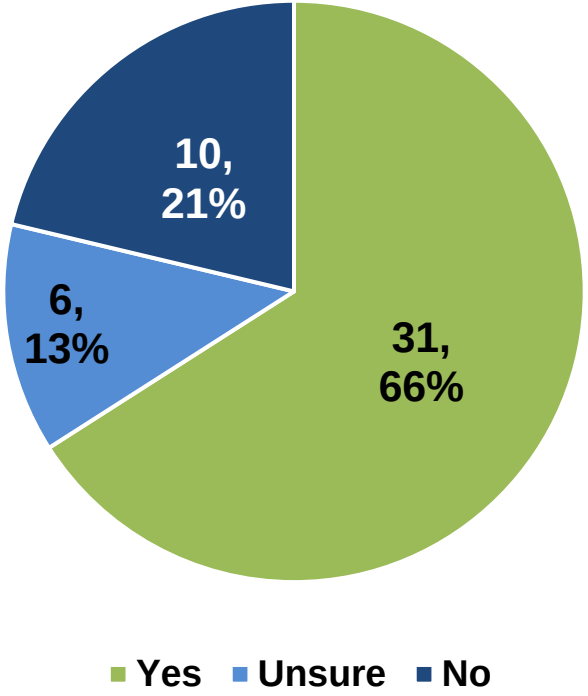
R&D Tax Credit Usage (Small Companies)

46 Respondents



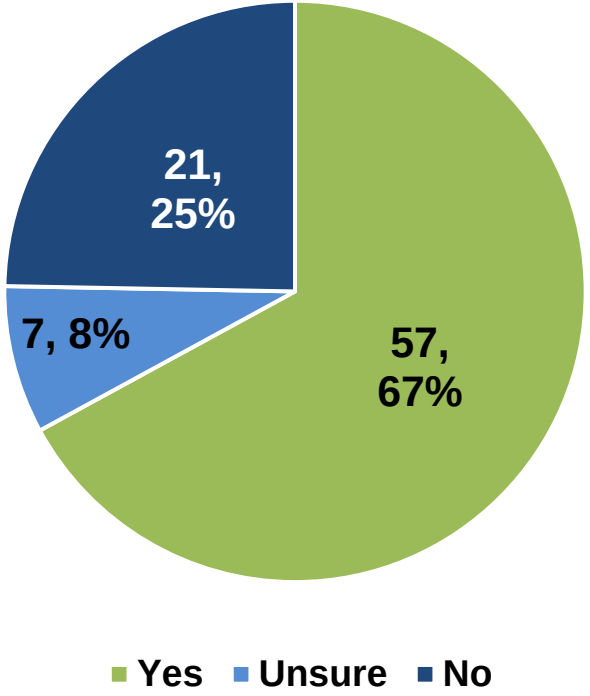
R&D Tax Credit Usage (Medium Companies)

47 Respondents



R&D Tax Credit Usage (Large Companies)

85 Respondents



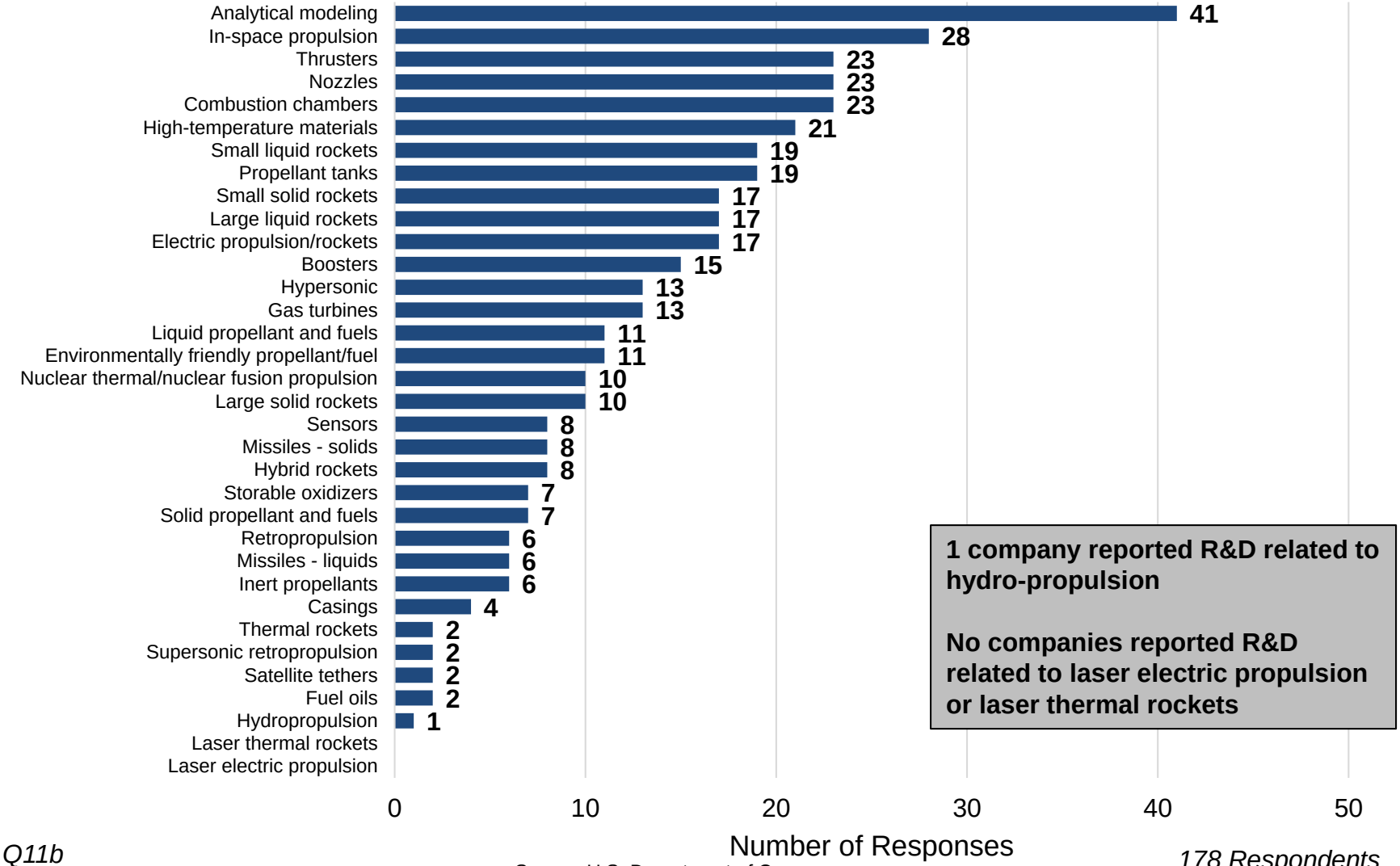
Q11a, D

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Research, Development, Testing, and Evaluation

R&D Application by Propulsion-Related Areas: 400 Total



1 company reported R&D related to hydro-propulsion

No companies reported R&D related to laser electric propulsion or laser thermal rockets

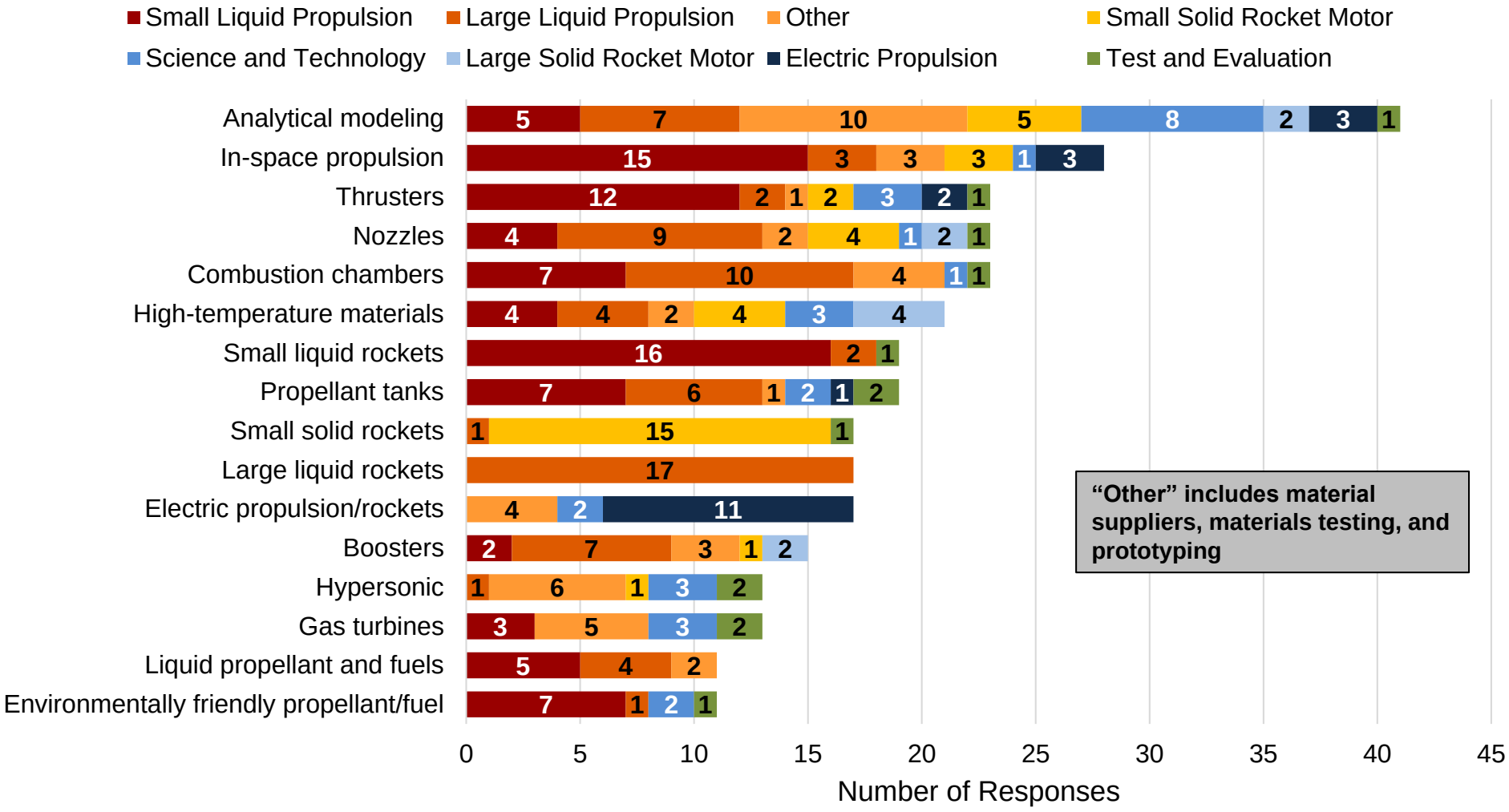
Q11b

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

R&D, Testing, and Evaluation

R&D Application Areas by Industrial Base Business Participation (Part 1 of 2)



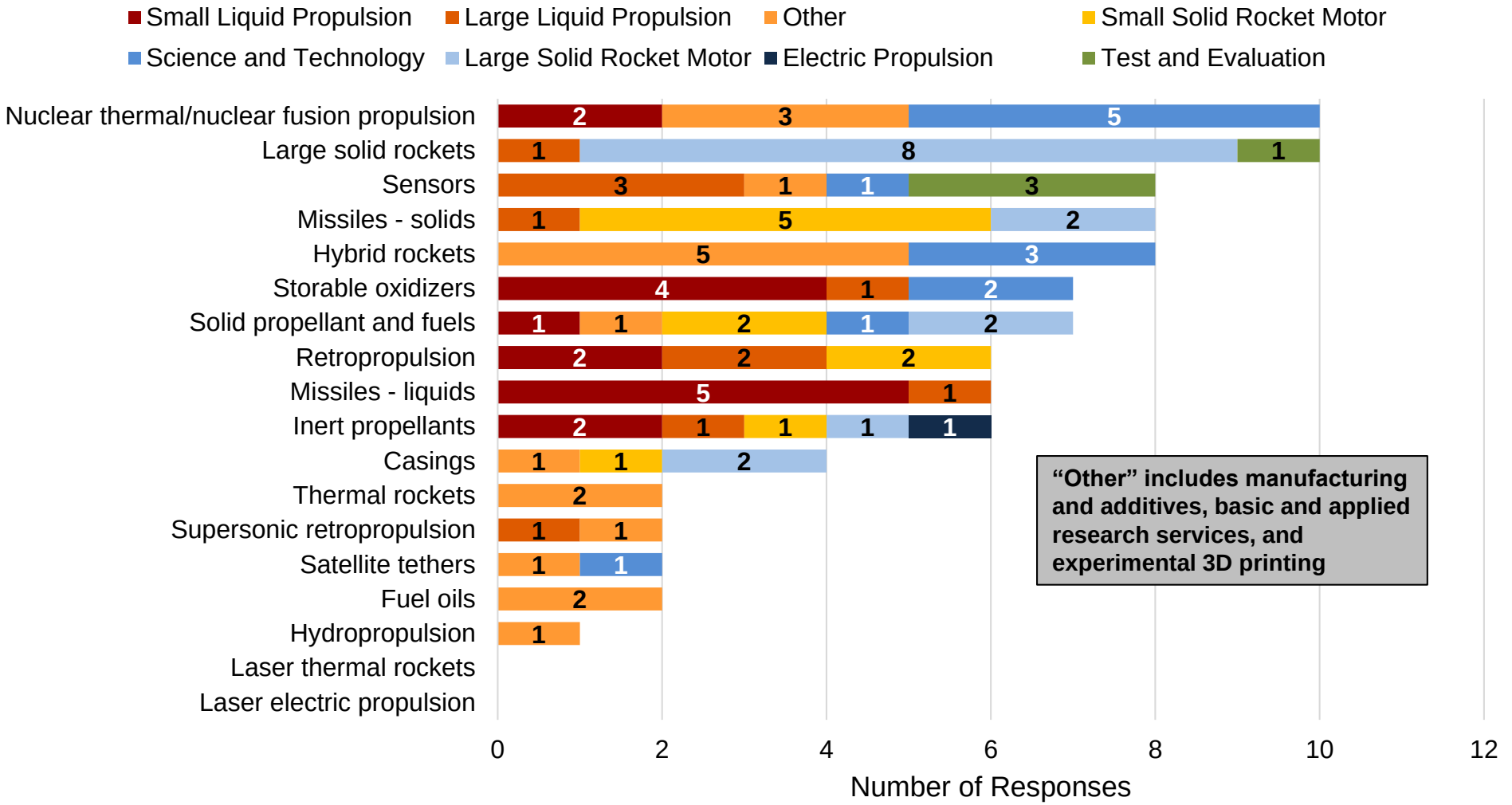
Q11b

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

178 Respondents

R&D, Testing, and Evaluation

R&D Application Areas by Industrial Base Business Participation (Part 2 of 2)



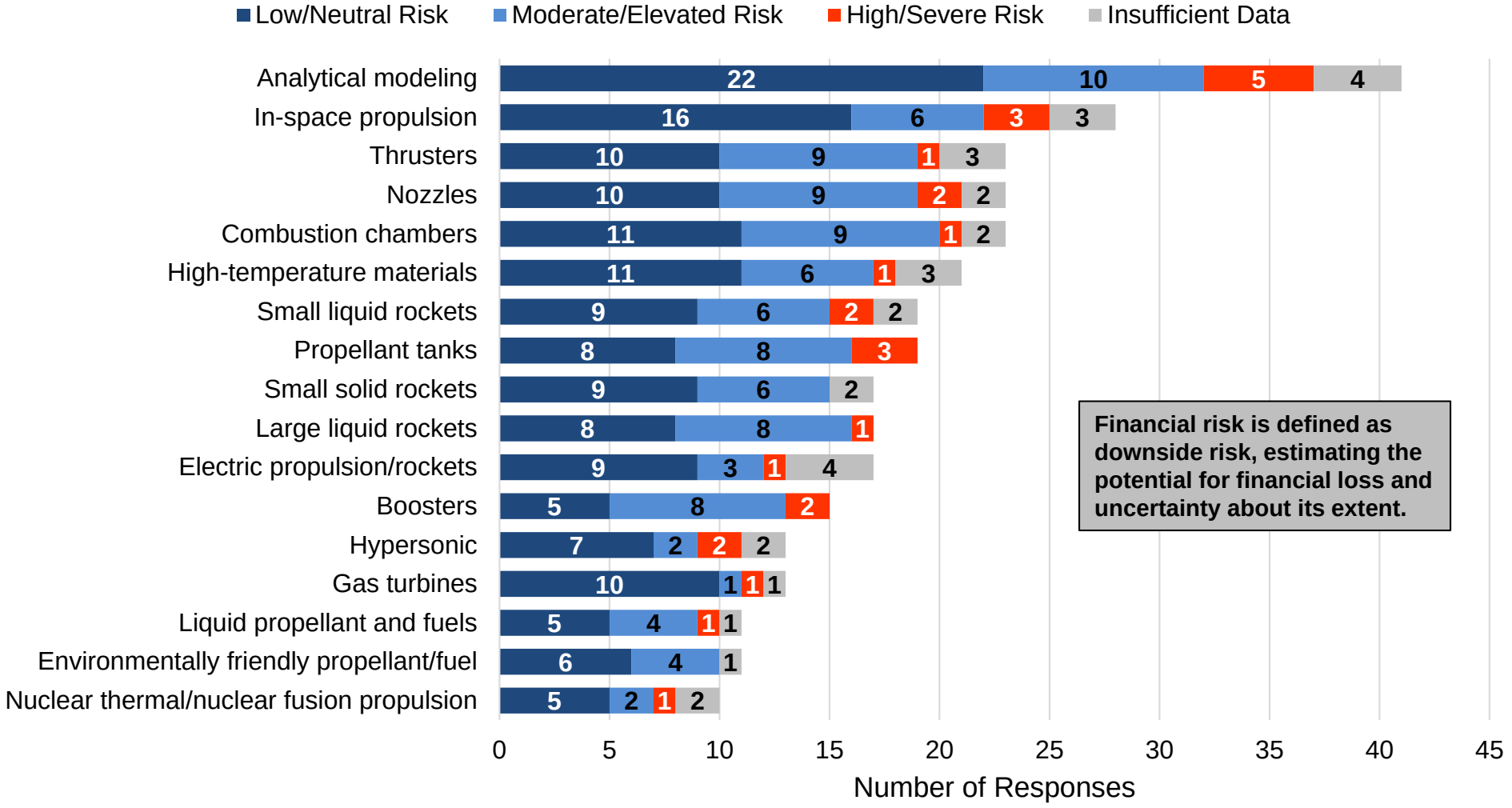
Q11b

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

178 Respondents

R&D, Testing, and Evaluation

Financial Risk by R&D Application Area (Part 1 of 2)



Q11b

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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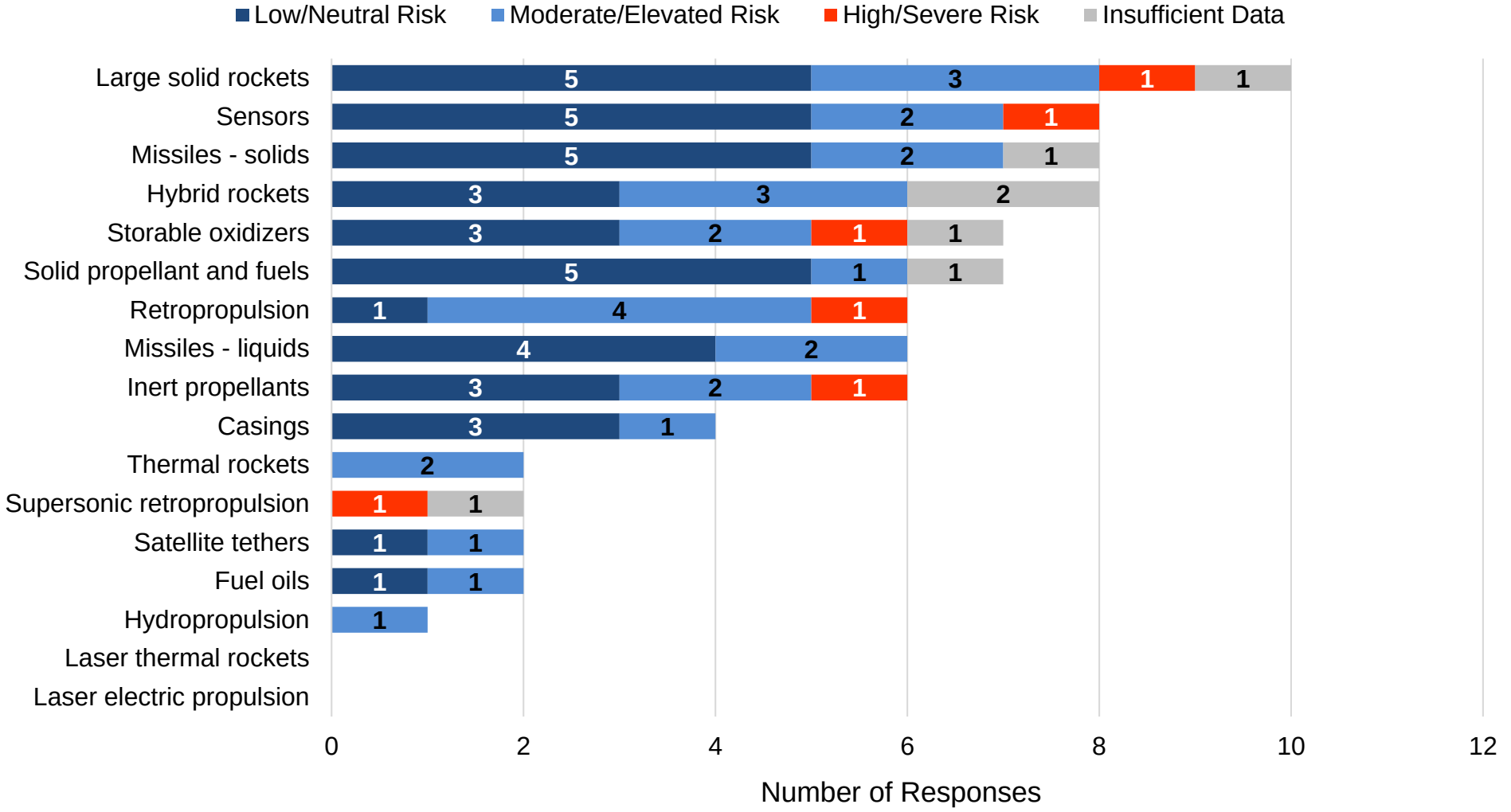
178 Respondents

R&D, Testing, and Evaluation

Financial Risk by R&D Application Area (Part 2 of 2)



Q11b

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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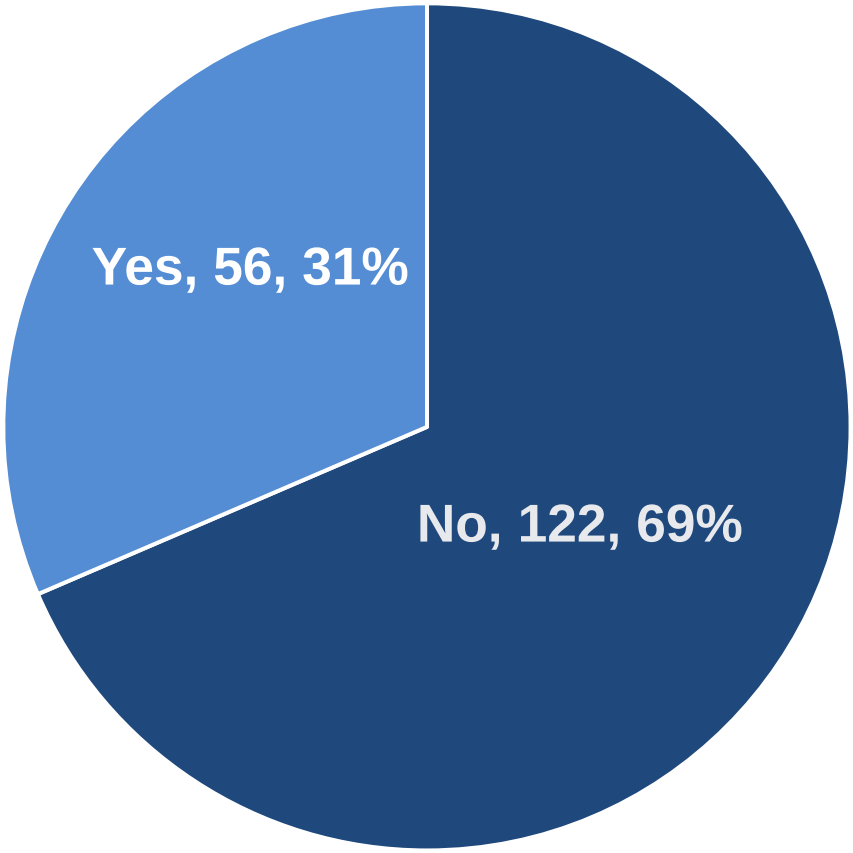
178 Respondents

Research, Development, Testing, and Evaluation

Received Federal Research and Development Funding (Direct and Indirect Funding)



Q11c, A

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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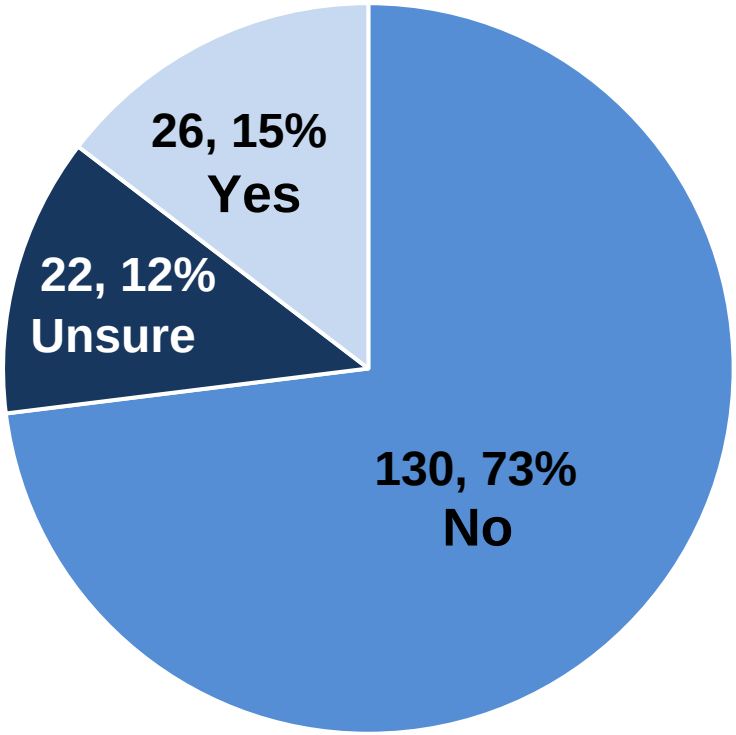
Research, Development, Testing, and Evaluation

USG Propulsion-Related Spending Practices Adversely Impact Organization's R&D Activities



USG Propulsion-Related Adverse Practices
Contract Type
Decreased Spending
Fluctuation/ Erratic Spending
Inadequate Guidance/ Outreach
Inadequate Budget
Program Cancellations
Domestic Sourcing/ Buy America/ Set Asides
Reliance on Prime Contractors
Revision of Requirements
No/ Limited R&D Reimbursement

Q11c, A

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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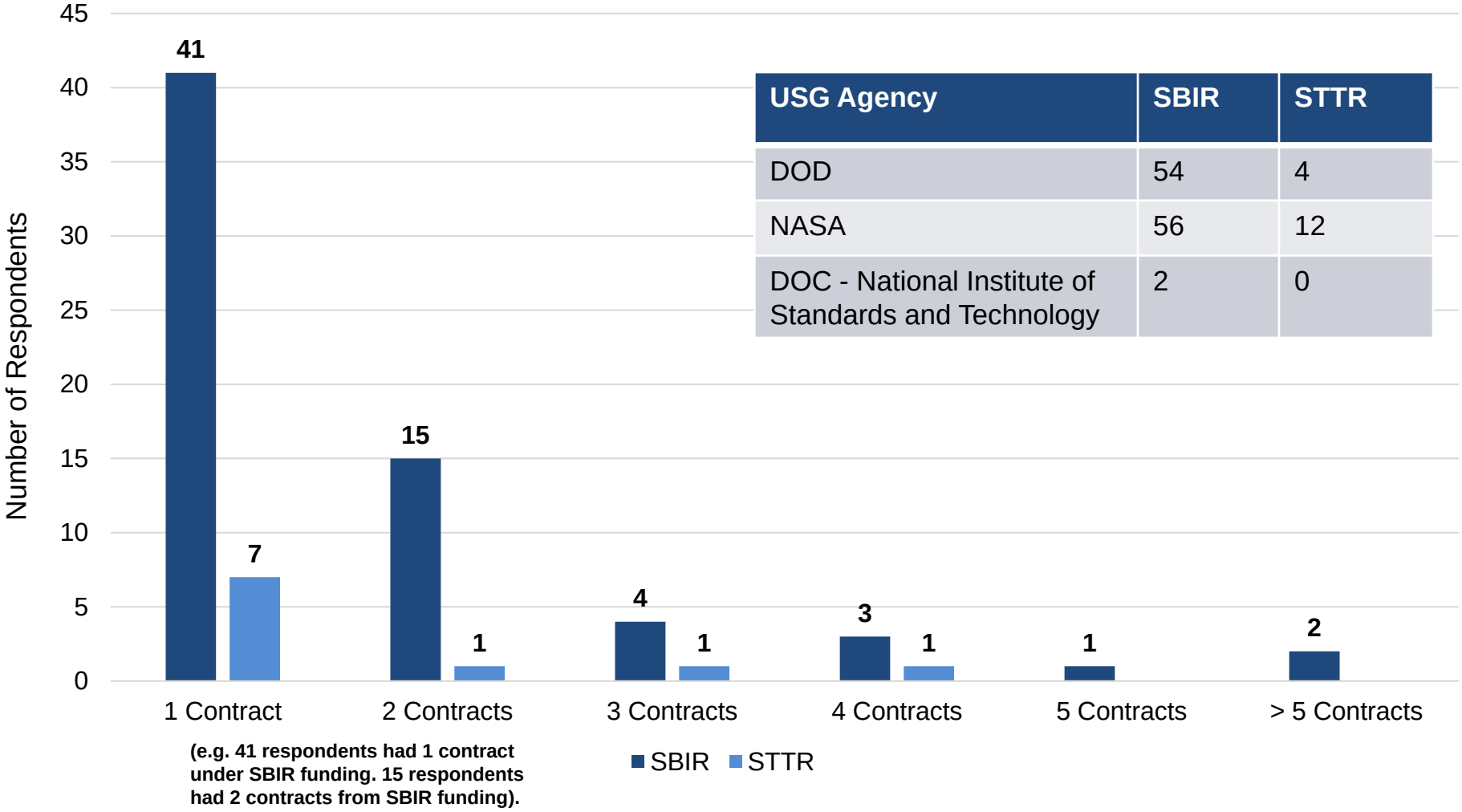
Research, Development, Testing, and Evaluation

USG-Funded Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Contracts: 128



USG Agency	SBIR	STTR
DOD	54	4
NASA	56	12
DOC - National Institute of Standards and Technology	2	0

(e.g. 41 respondents had 1 contract under SBIR funding. 15 respondents had 2 contracts from SBIR funding).

Q11c, C

Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018

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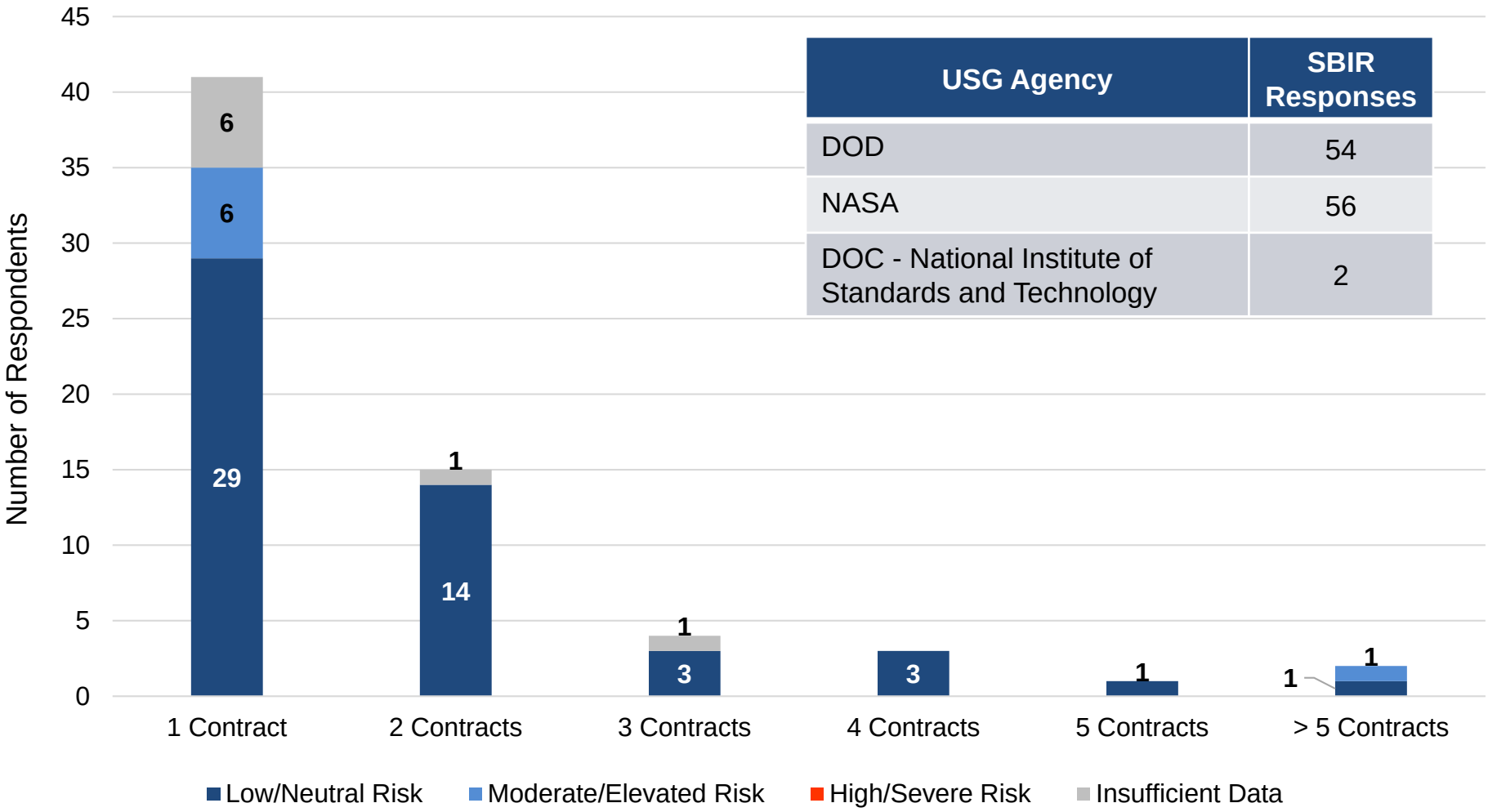
69 Respondents

Research, Development, Testing, and Evaluation

SBIR Contract Financial Risk



USG Agency	SBIR Responses
DOD	54
NASA	56
DOC - National Institute of Standards and Technology	2

Q11c, C

Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018

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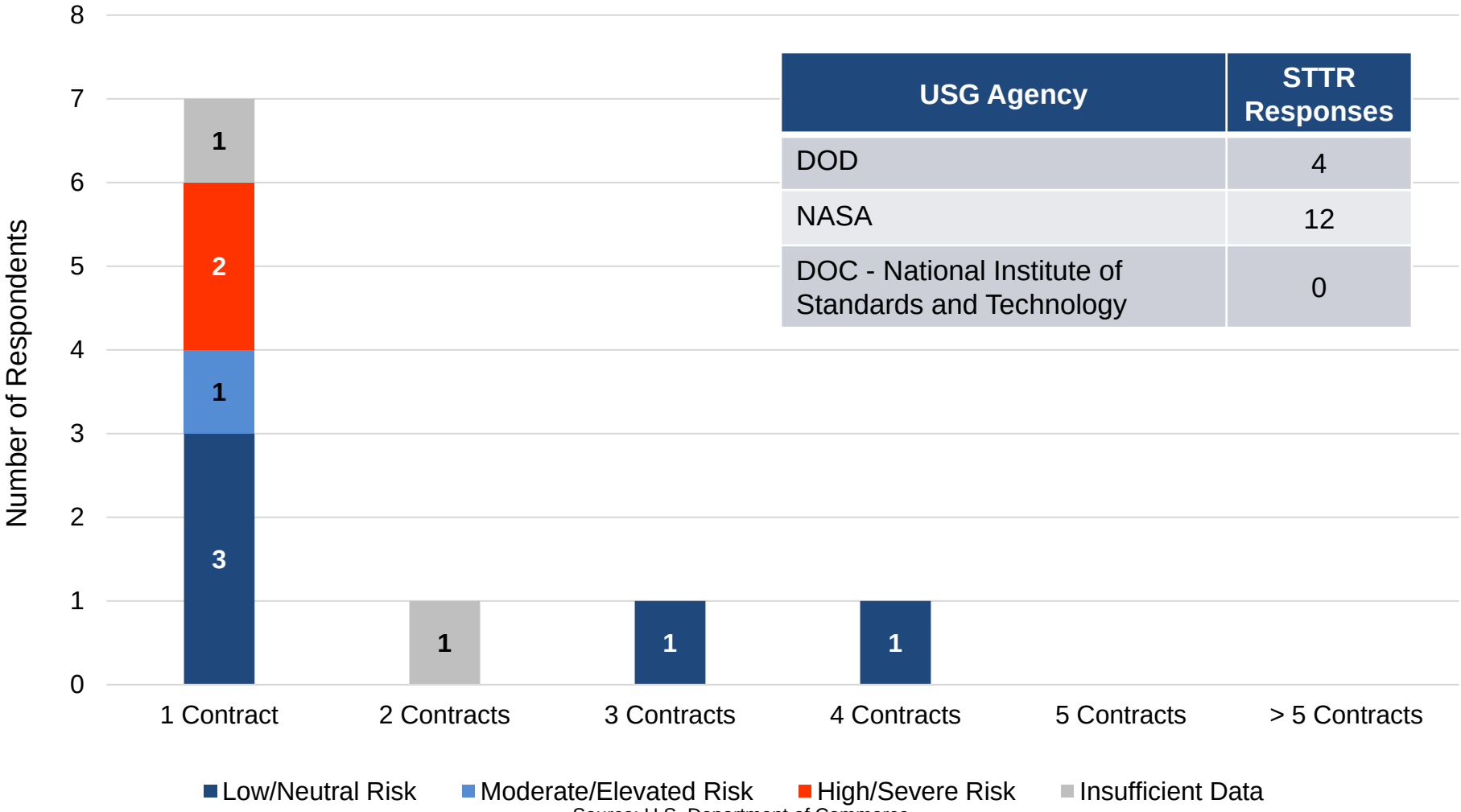
61 Respondents

Research, Development, Testing, and Evaluation

STTR Contract Financial Risk



USG Agency	STTR Responses
DOD	4
NASA	12
DOC - National Institute of Standards and Technology	0

Q11c, C

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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8 Respondents

Research, Development, Testing, and Evaluation

Program Technology Transfer

- Program Technology Transfer - defined as the movement of knowledge or technology developed by a federal laboratory for private organizations in the commercial marketplace
- Examples: patent dissemination, licensing of intellectual property, and R&D collaborative relationships such as Cooperative Research and Development Agreements (CRADAs)
- 6 organizations each identified they participated in one propulsion-related technology transfer activity between 2013 and 2016
- The federal agencies/departments involved included: U.S. Navy, U.S. Army, U.S. Air Force, NASA, and U.S. Department of Energy

Q11c, D

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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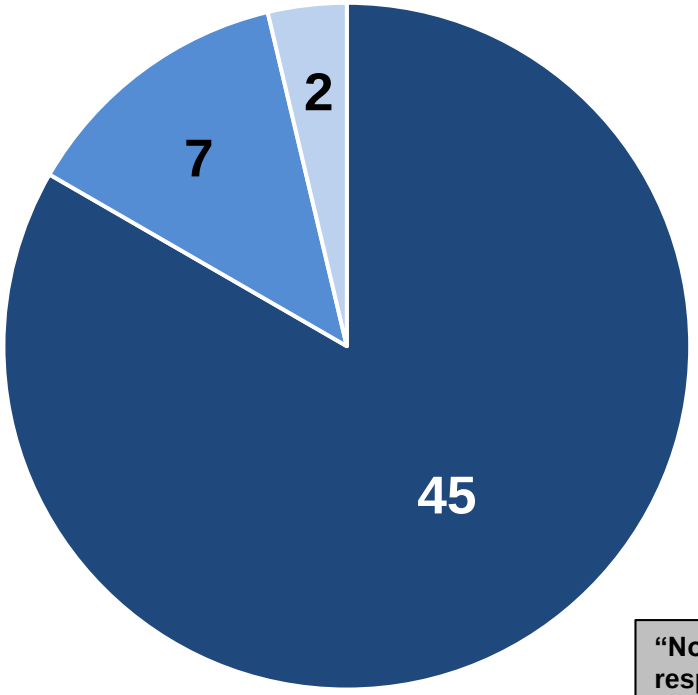
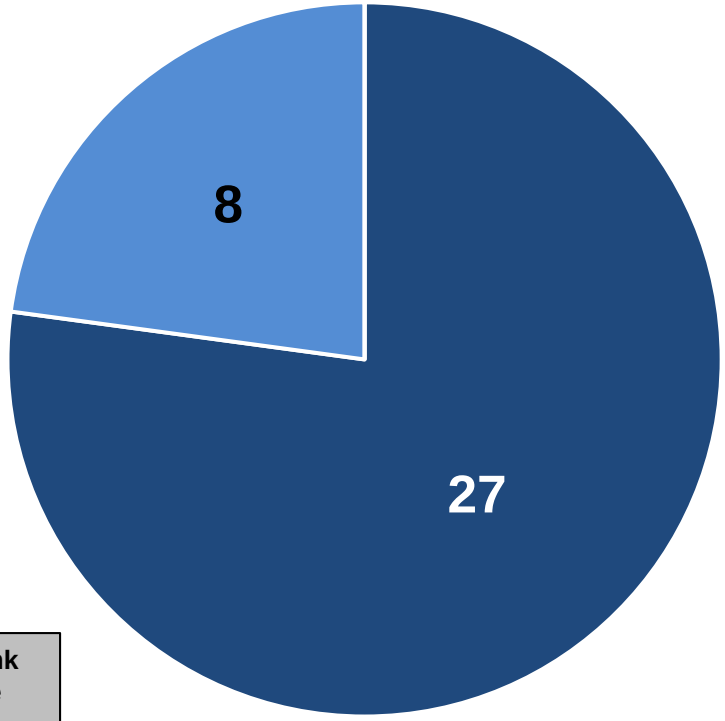
Research, Development, Testing, and Evaluation

Number of Organizations with Testing Needs

Propulsion-Related



Engine and/or Motor-Related



"No" and Blank responses are not included

- Both Past & Future Use
- Anticipated Future Use (2017-2020)
- Past Use (2013-2016)

- Both Past & Future Use
- Anticipated Future Use (2017-2020)
- Past Use (2013-2016) (0 Total)

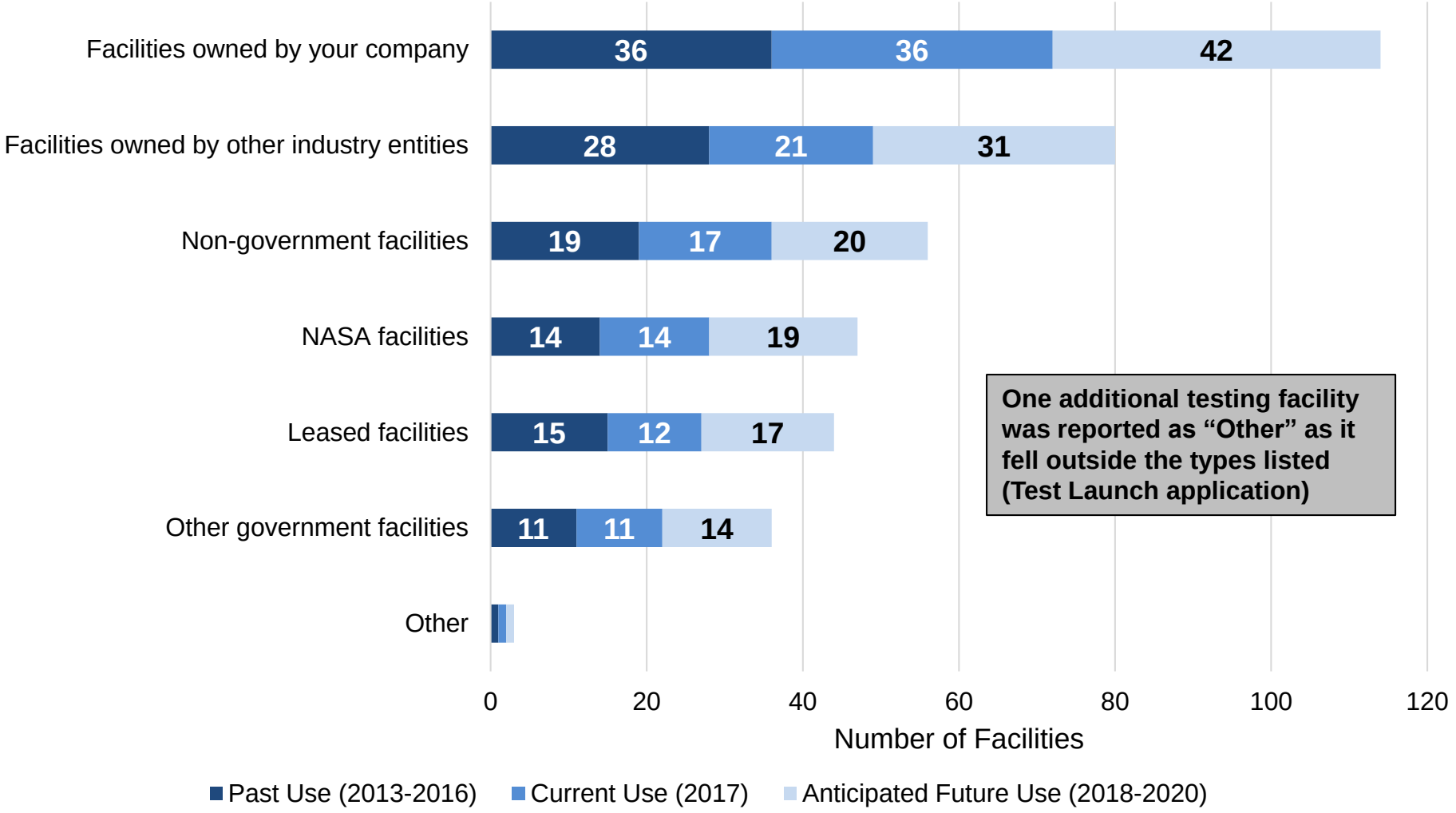
Q11d, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

178 Respondents

Research, Development, Testing, and Evaluation

Location of Testing Facilities Used By Testing Needs



Q11d, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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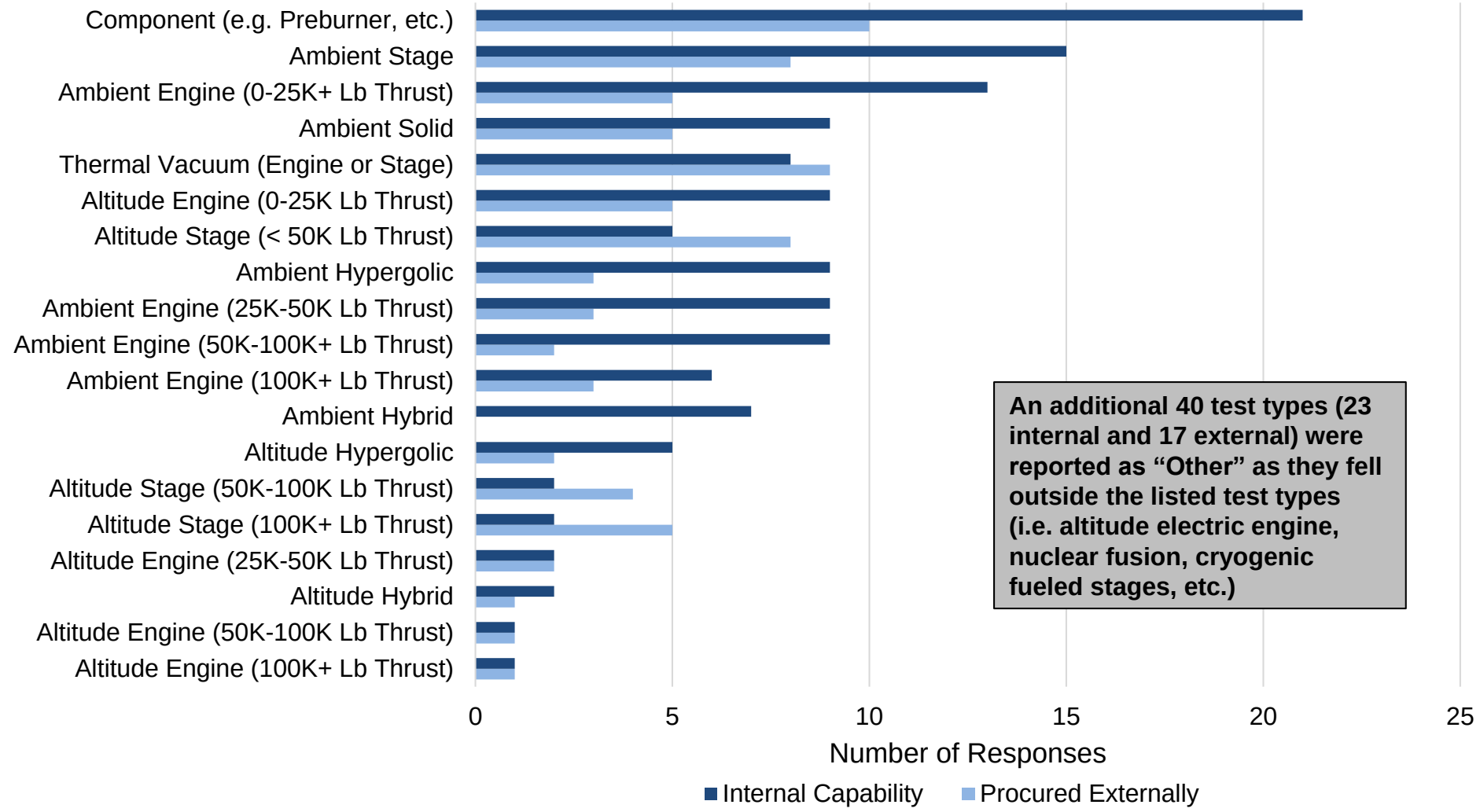
178 Respondents

Research, Development, Testing, and Evaluation

Organization's Ability to Perform Test Type (Internal/ External)



An additional 40 test types (23 internal and 17 external) were reported as "Other" as they fell outside the listed test types (i.e. altitude electric engine, nuclear fusion, cryogenic fueled stages, etc.)

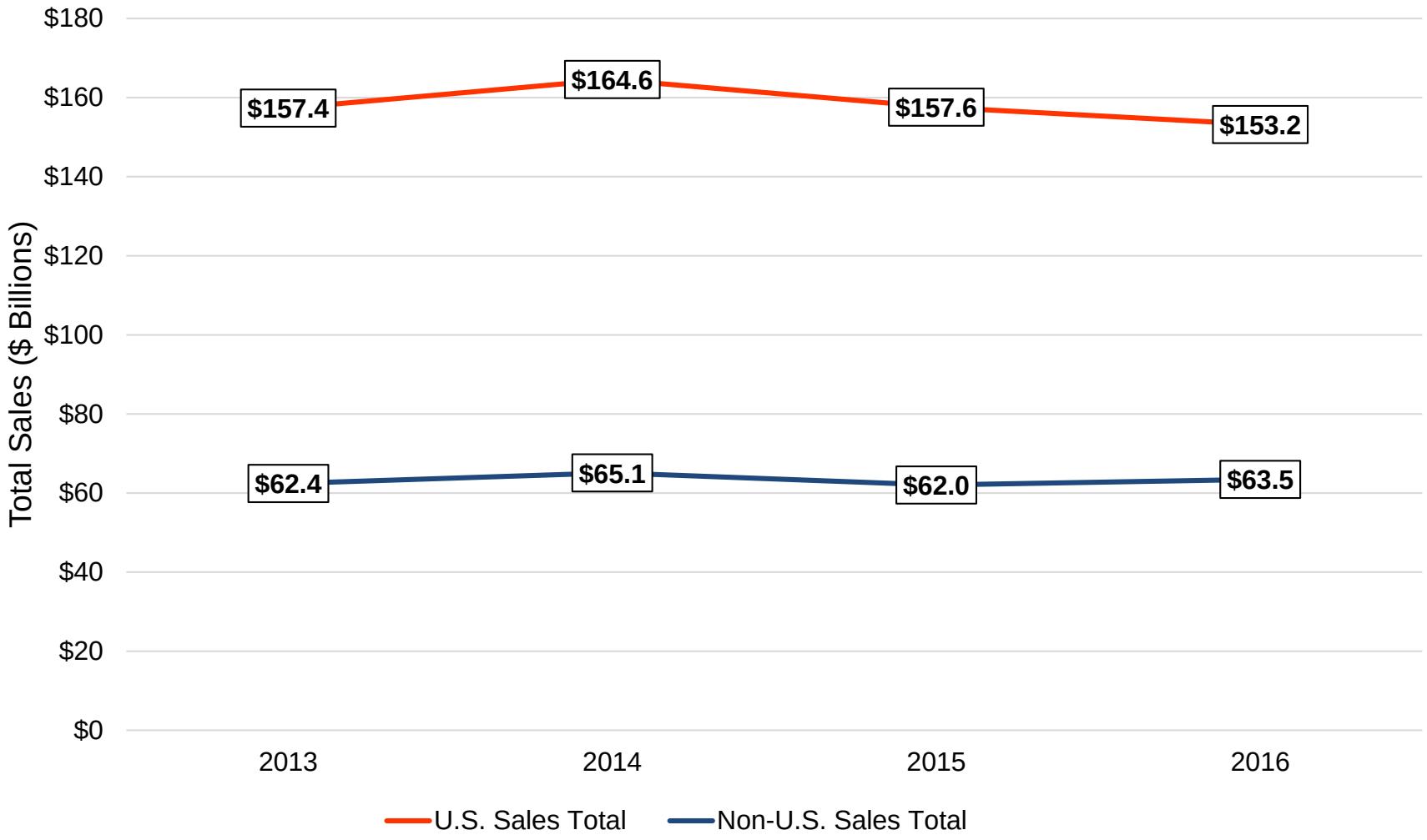
Q11d, B

178 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Sales

Total U.S. and Non-U.S. Sales – 2013-2016



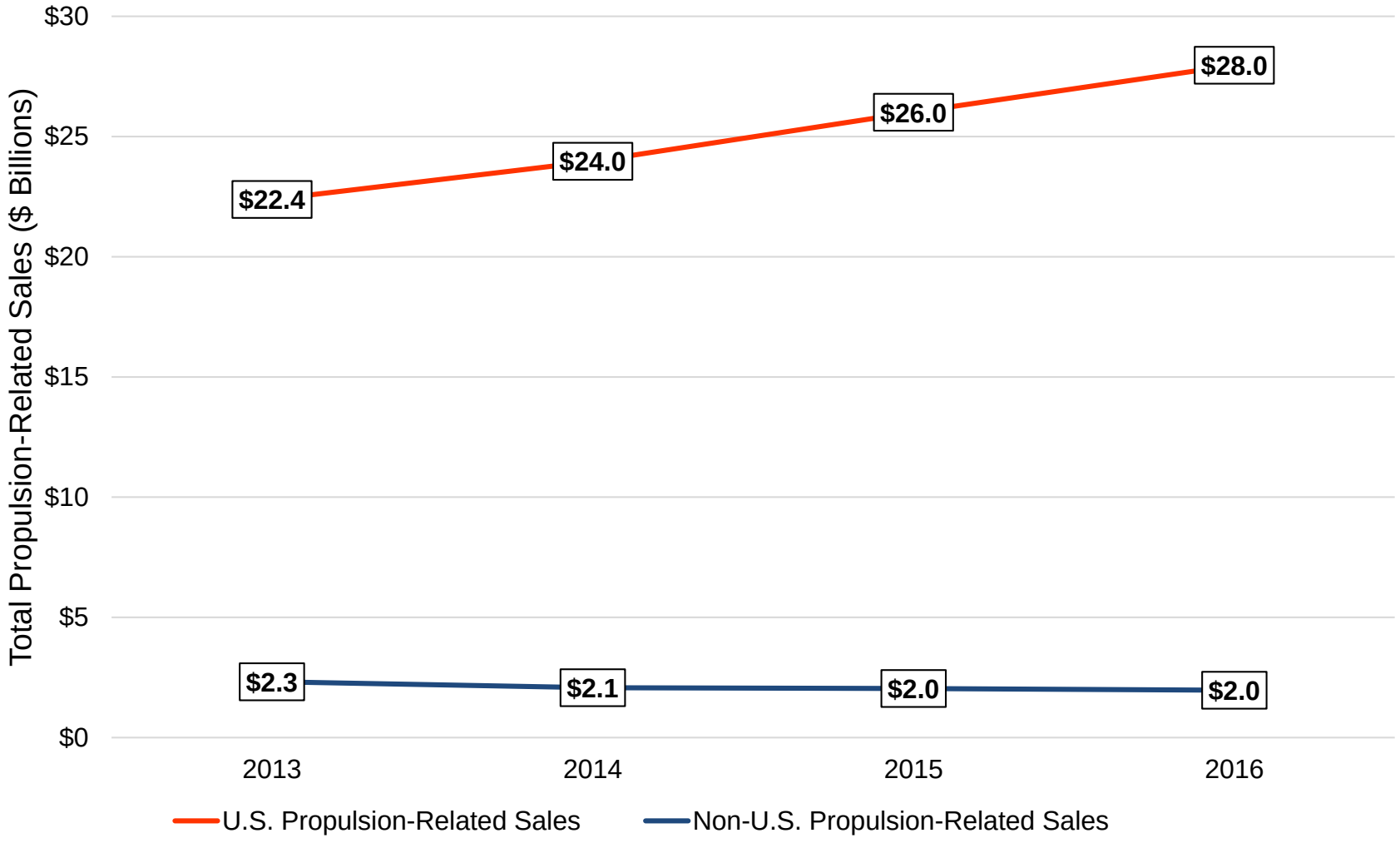
Q9, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Sales

Total U.S. and Non-U.S. Propulsion-Related Sales – 2013-2016



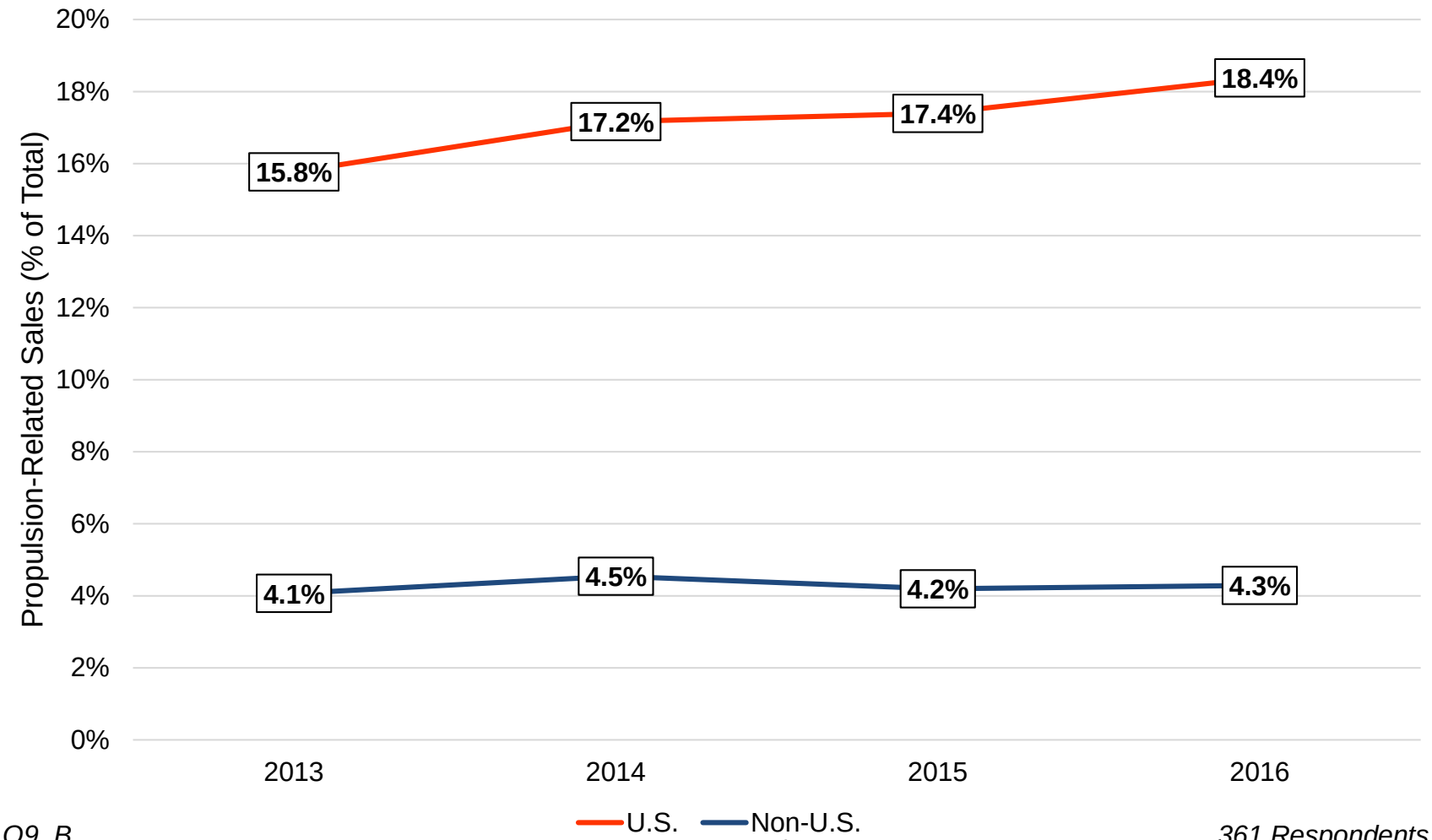
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Q9, A

361 Respondents

Sales

U.S. and Non-U.S. Propulsion-Related Sales as a Percent of Total Sales 2013 – 2016



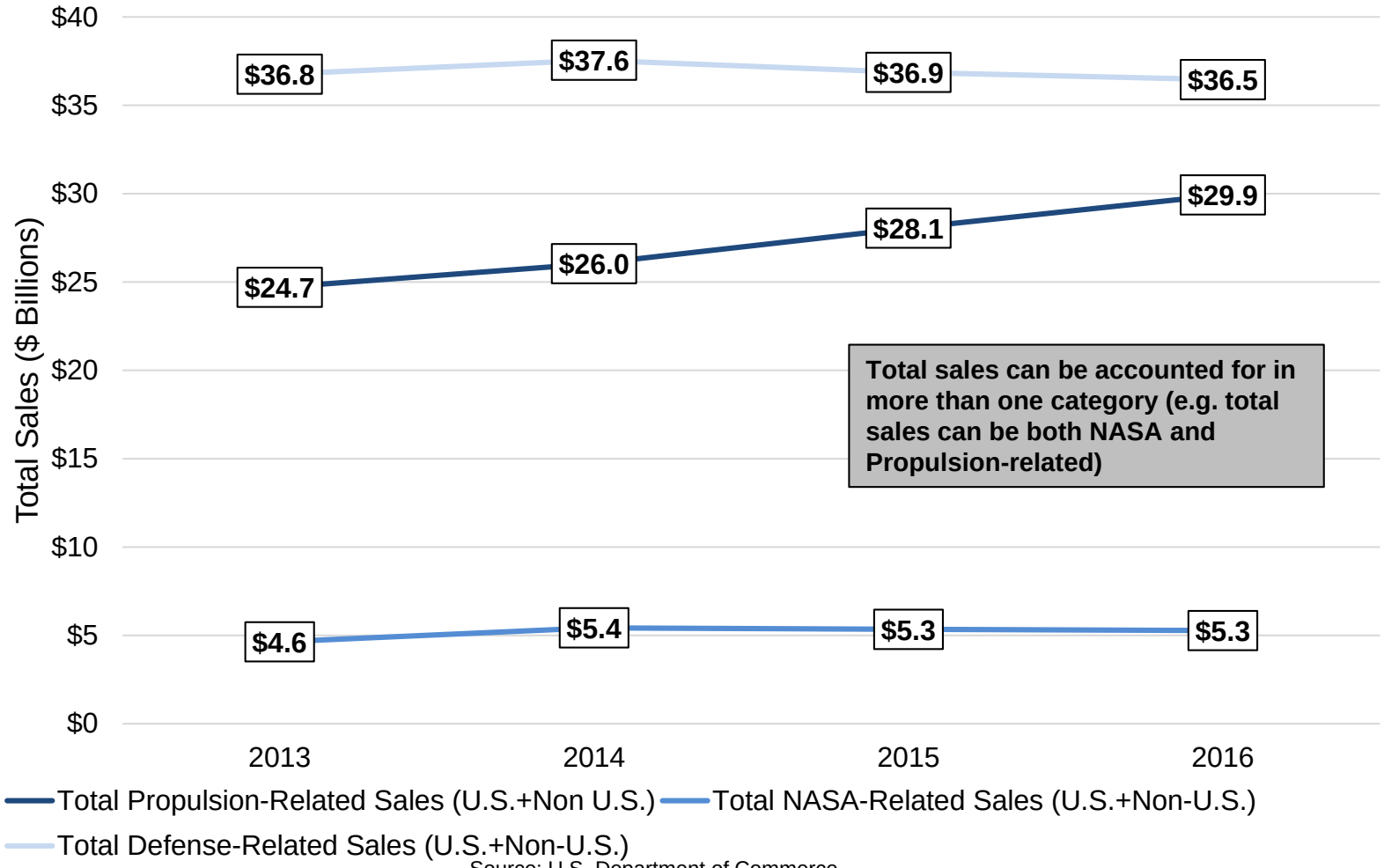
Q9, B

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018

Sales

Combined Total U.S. and Non-U.S. Propulsion, NASA, and Defense Related Sales – 2013-2016



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

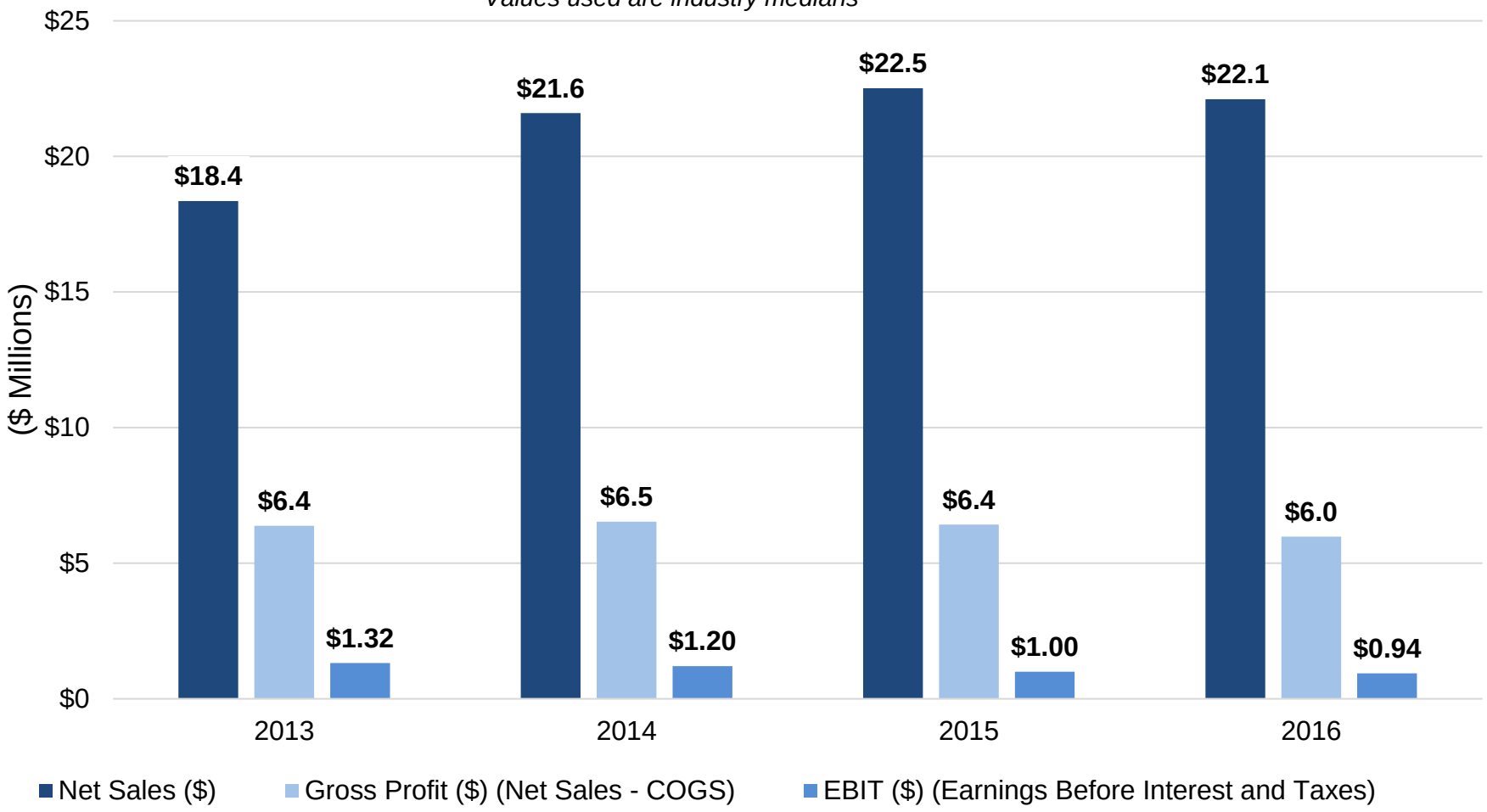
Q9, B-D

361 Respondents

Financial Growth 2013–2016

Median Net Sales, Gross Profit, EBIT

**Values used are industry medians*



Q12

*Data reflects all organizations activities

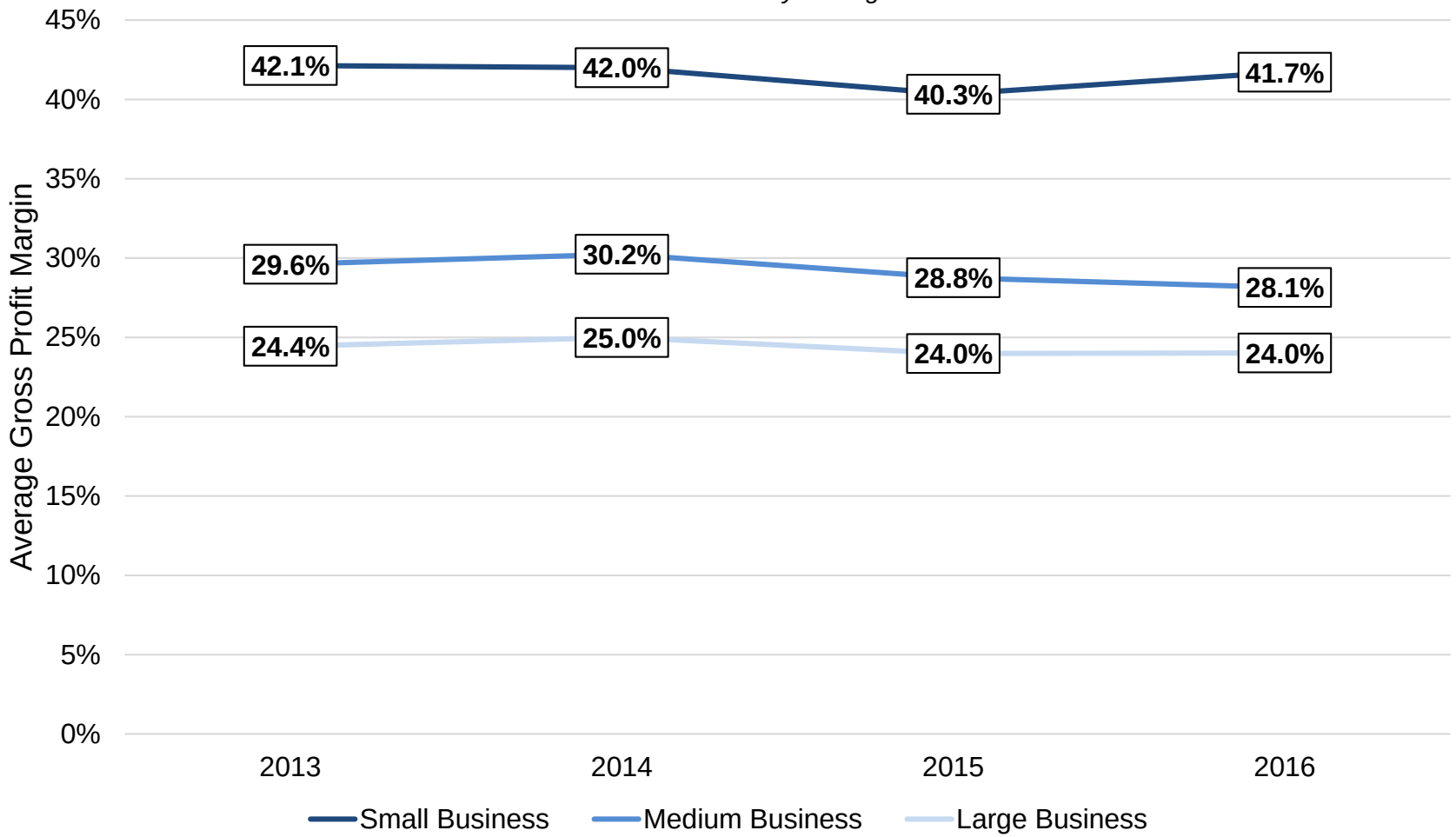
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Financial Growth 2013–2016

Average Gross Profit Margin % by Business Size

**Values used are industry averages*



Q12

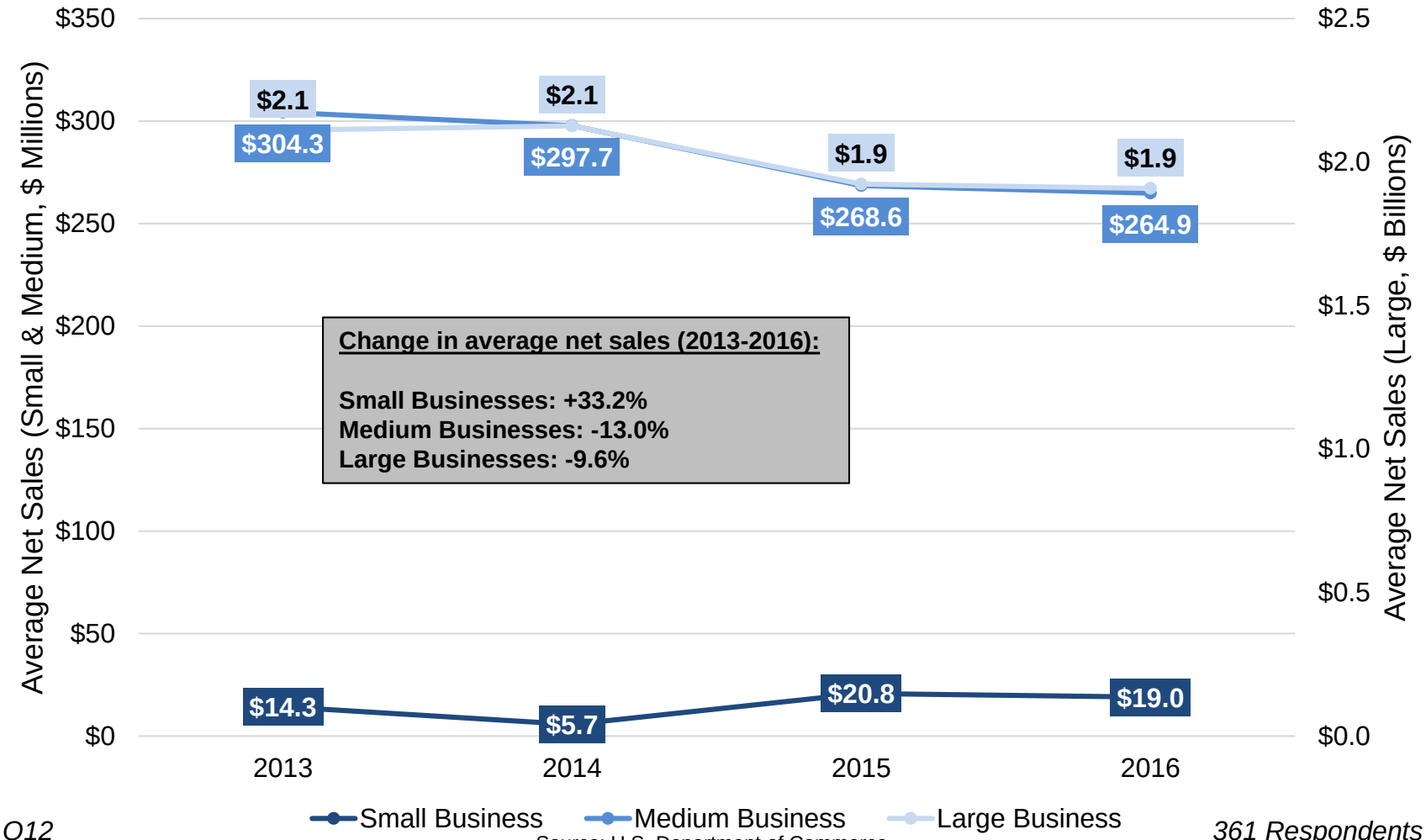
361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Financial Growth 2013–2016

Average Net Sales by Business Size

**Values used are industry averages*



Q12

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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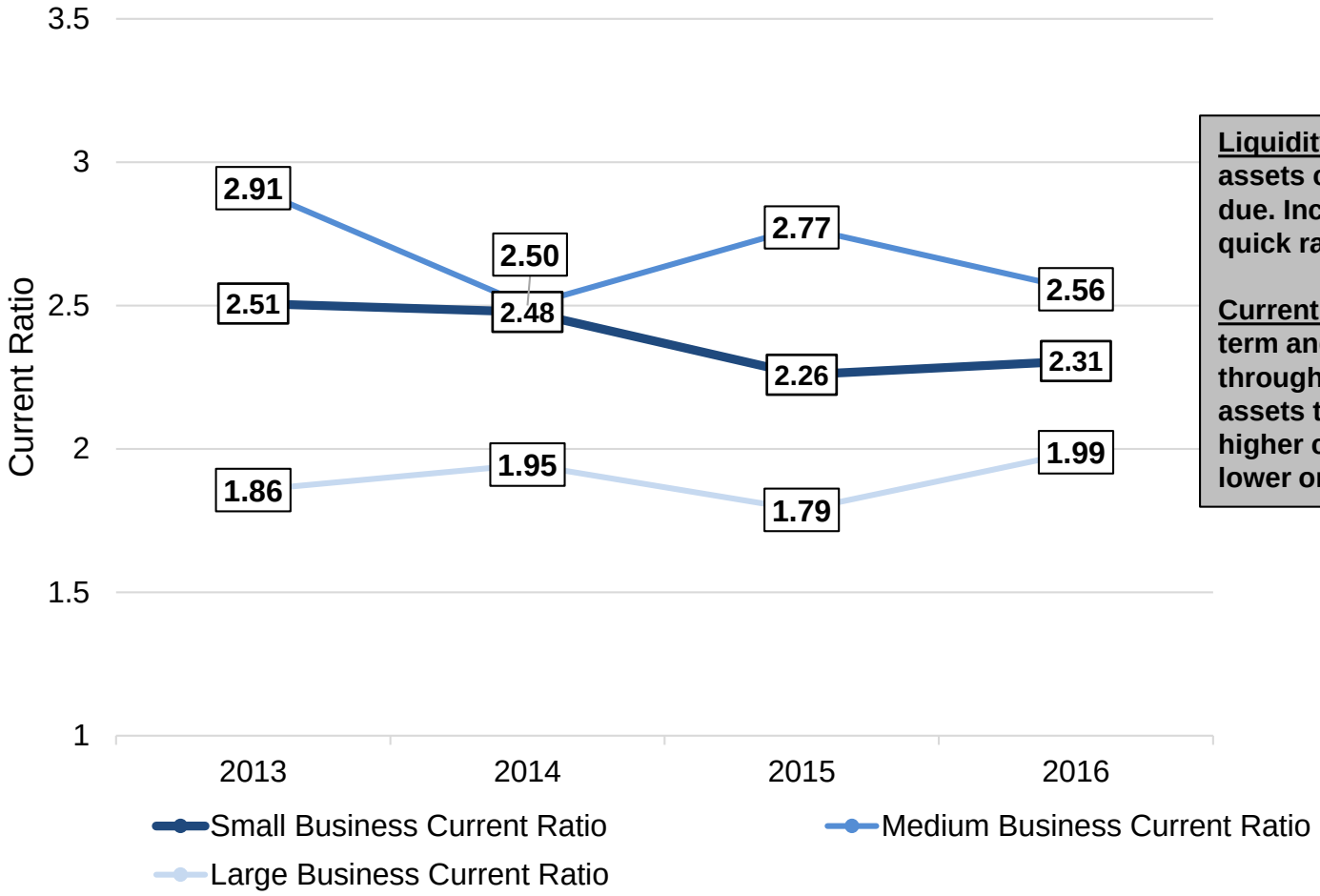
Financial Risk – 2013-2016

Current Ratios

*Values used are industry medians



Liquidity ratio - measures if current assets can meet liabilities when due. Includes: current ratio and quick ratio

Current ratio - ability to pay short-term and long-term liabilities through the proportion of current assets to current liabilities. A higher current ratio is better than a lower one

*Data reflects all organizations activities, 25 organizations had insufficient data and were excluded

Q12

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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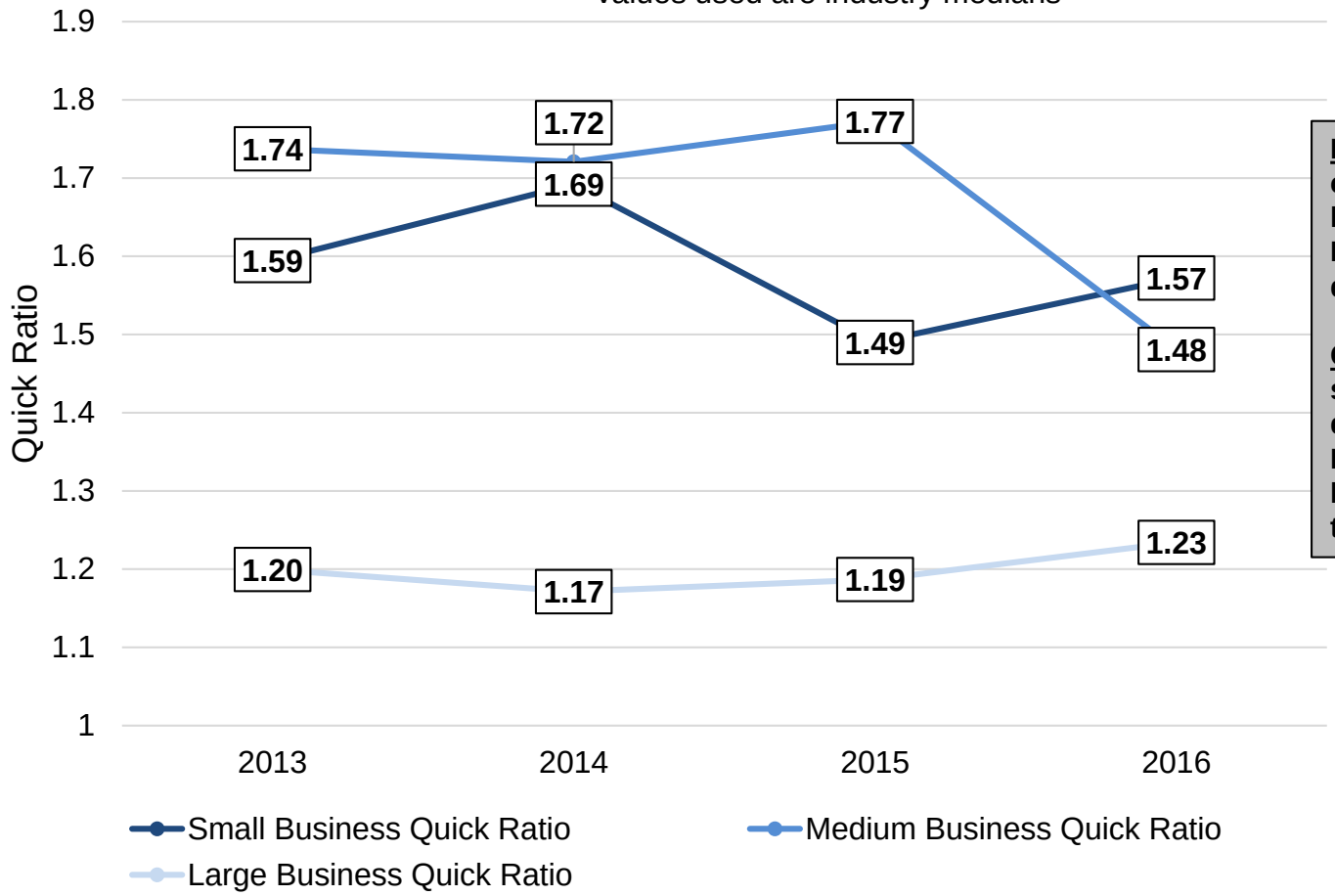
Financial Risk – 2013-2016

Quick Ratios

*Values used are industry medians



Liquidity ratio - measures if current assets can meet liabilities when due. Includes: current ratio and quick ratio

Quick ratio - ability to meet short-term liabilities with quick/near cash assets. Excludes inventories. A higher quick ratio is better than a lower one

*Data reflects all organizations activities, 25 organizations had insufficient data and were excluded

Q12

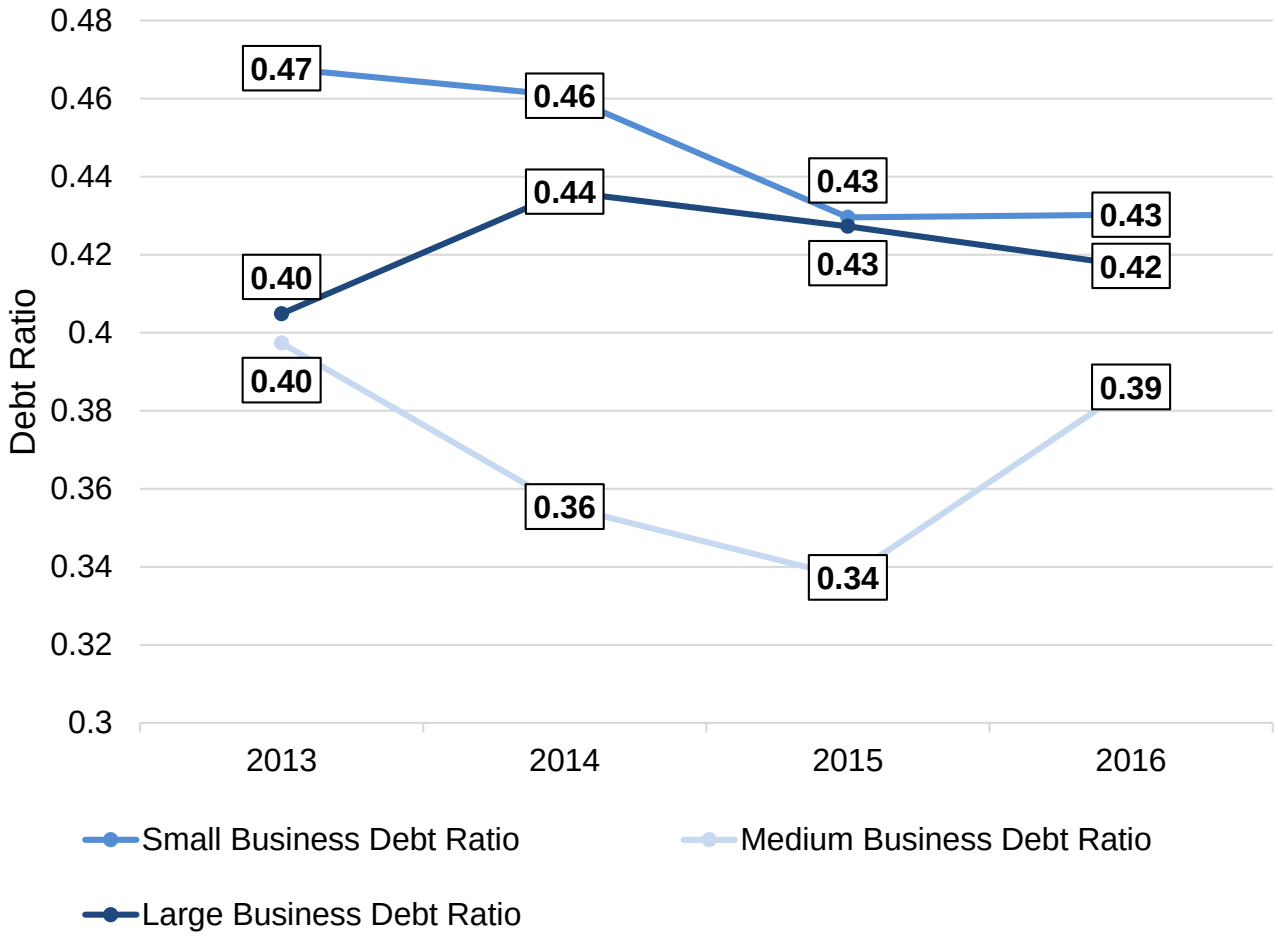
361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Financial Risk – 2013-2016

Debt Ratio by Business Size

*Values used are industry medians



Debt Ratio – capability to pay long-term debt by measuring the proportion of assets financed by debt. Ratio < 0.5 indicates most assets are financed by equity

*Data reflects all organizations activities, 25 organizations had insufficient data and were excluded

Q12

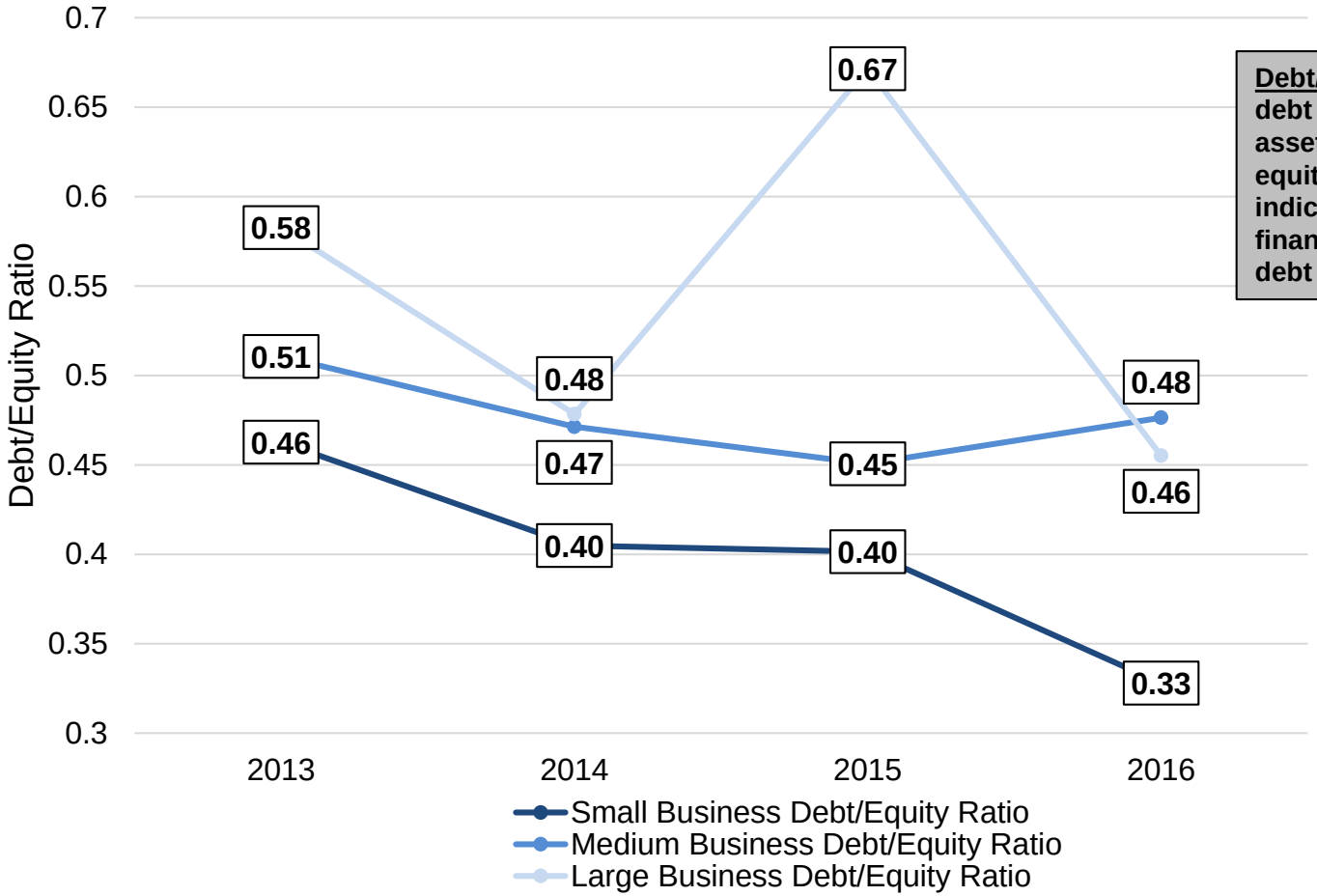
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Financial Risk – 2013-2016

Debt/Equity Ratio by Business Size

*Values used are industry medians



Debt/Equity Ratio – Extent debt is utilized to finance assets relative to value of equity. Ratio lower than 1 indicates more assets financed by equity rather than debt

*Data reflects all organizations activities, 25 organizations had insufficient data and were excluded

Q12

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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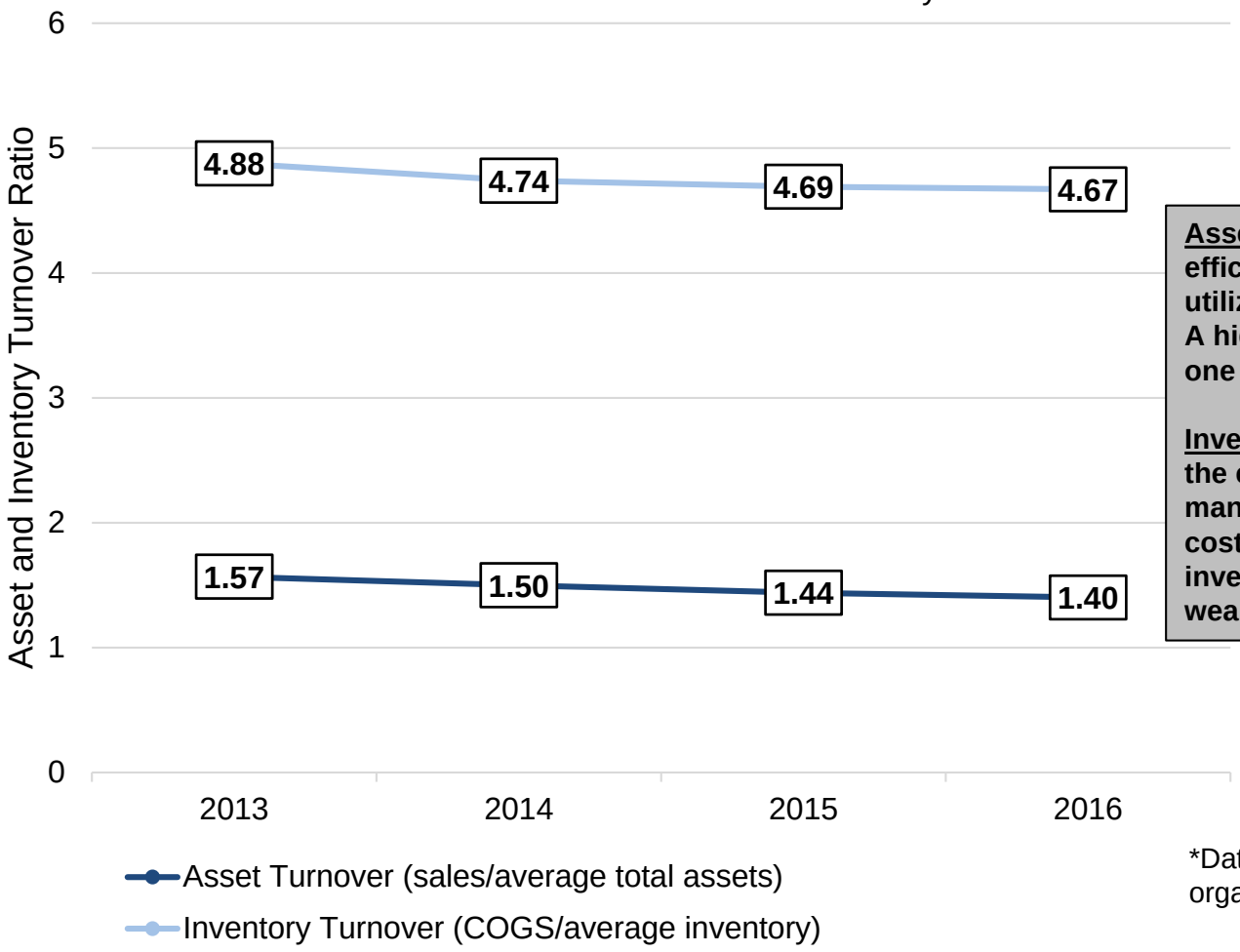
Financial Risk – 2013-2016

Asset and Industry Turnover Ratios

*Values used are industry medians



Asset Turnover Ratio - Indicates the efficiency in which an organization utilizes its assets to generate revenue. A higher ratio is better than a lower one

Inventory Turnover Ratio – Measures the effectiveness that inventory is managed through a comparison of cost of goods sold with average inventory. A lower ratio indicates weaker sales and excess inventory

*Data reflects all organizations activities

Q12

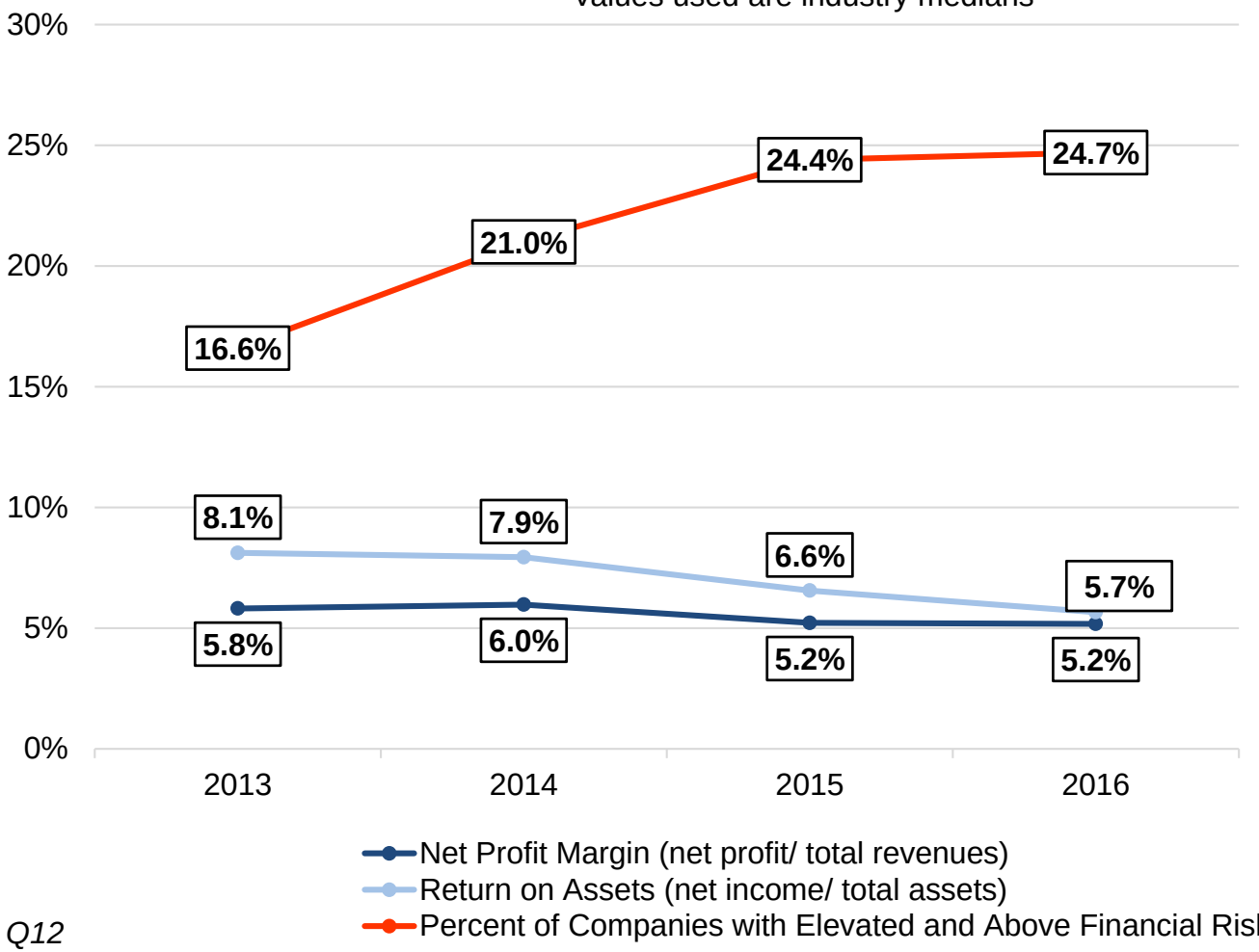
Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Financial Risk – 2013-2016

Profitability Measures

*Values used are industry medians



Net Profit Margin - **Indicates the extent of profit associated with each dollar sold**

Return on Assets (ROA) – Indicates the efficiency in which an organization can manage its assets to generate profits

*Data reflects all organizations activities

Q12

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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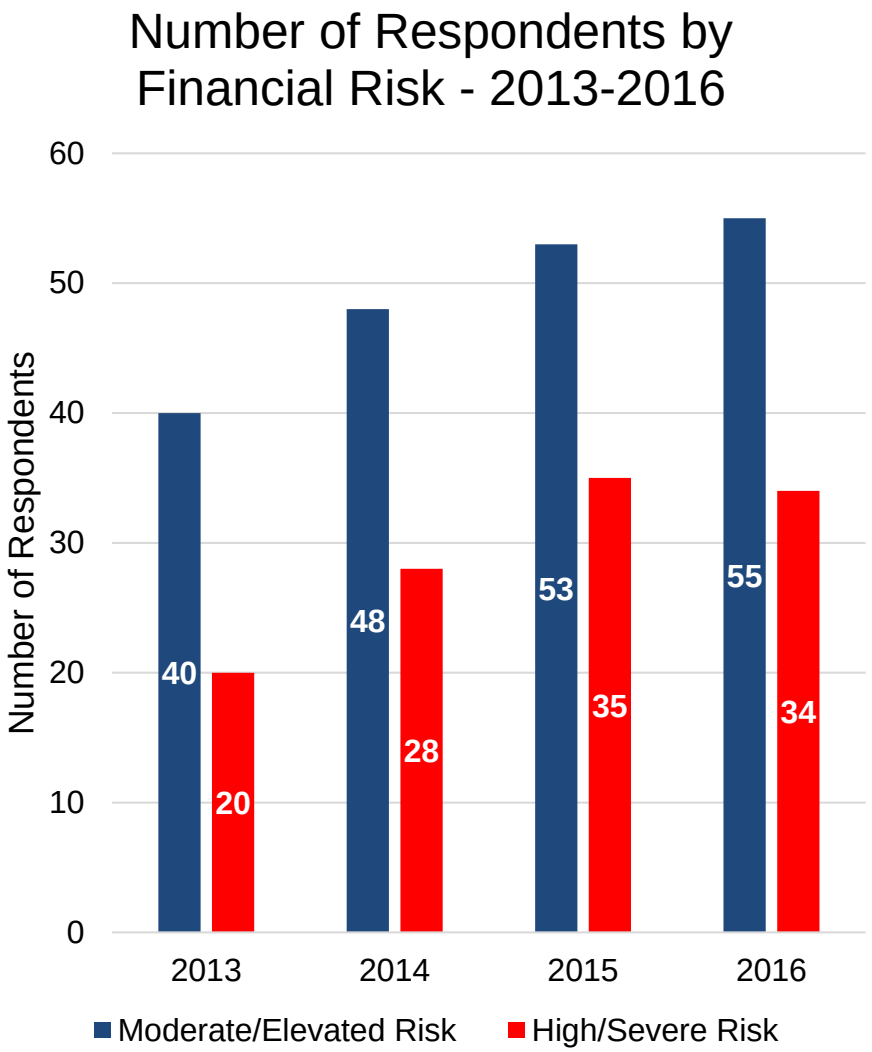
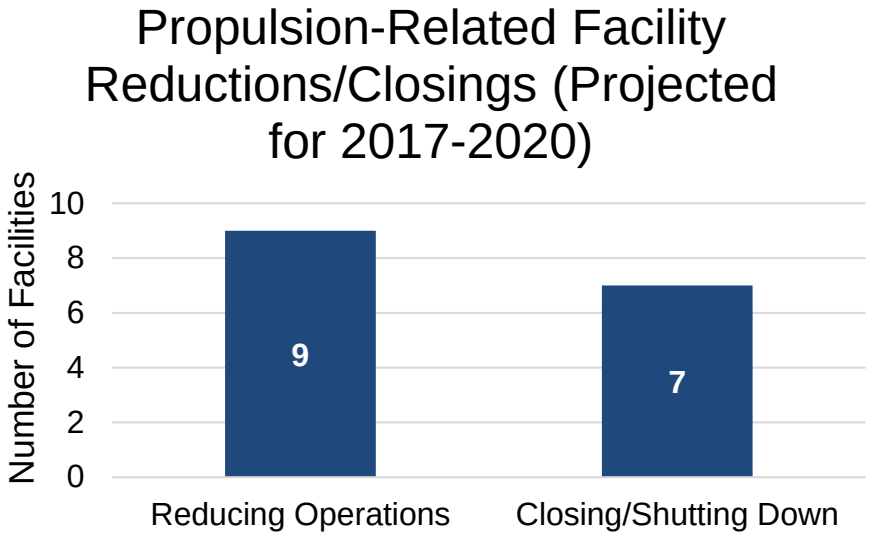
Financial Risk and Facility Reduction/Closing



Financial risk is defined as downside risk which estimates the potential for financial loss and uncertainty

From 2013 to 2016:
-Total companies identified as moderate/elevated risk and high/severe risk grew by 48.3%



3% of propulsion-related facilities (16 of 531) are projected to either reduce operations (9) or close (7) between 2017 and 2020

Q2, Q9

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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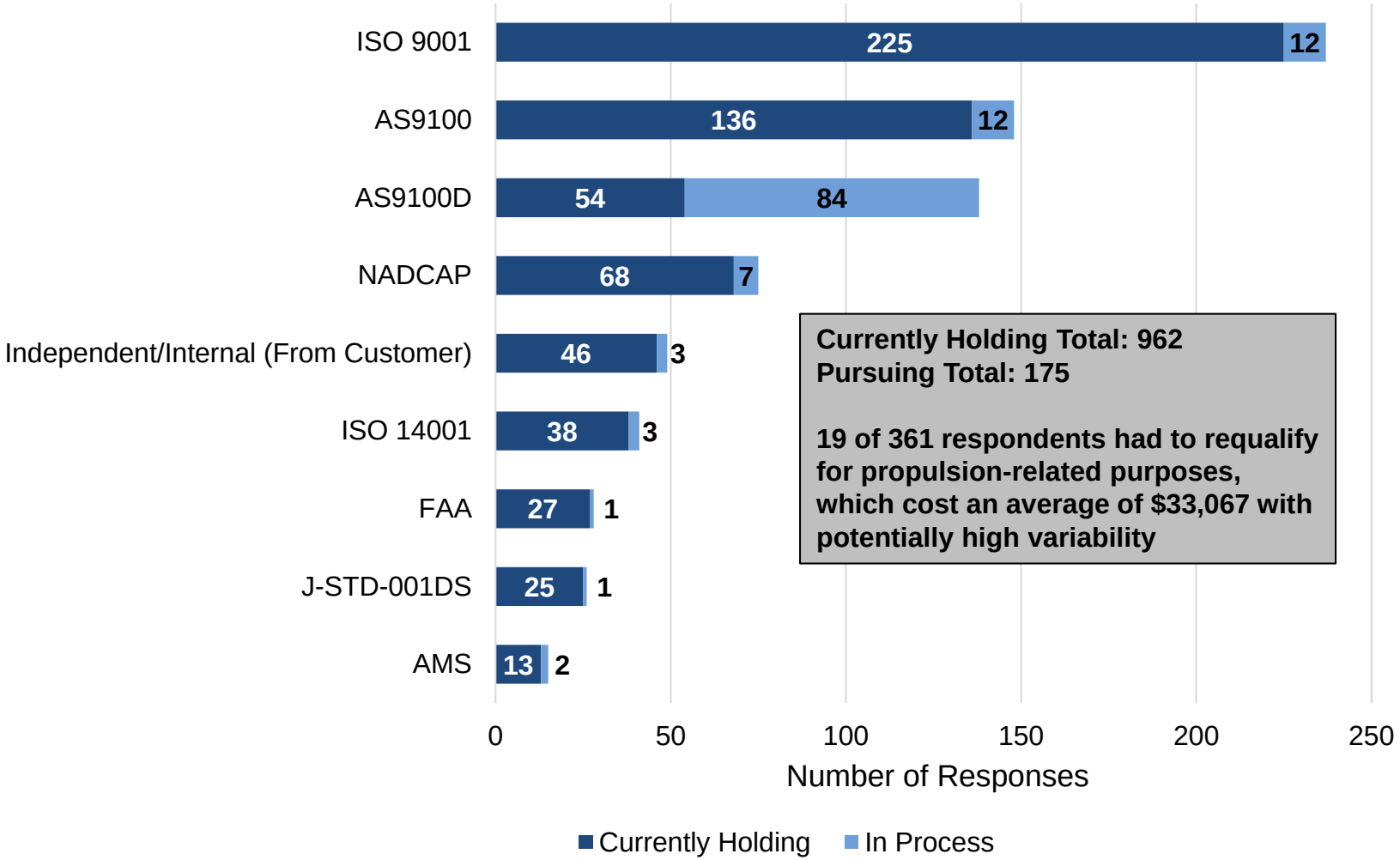
361 Respondents

Organization Standards/Certifications

Standards/Certifications Organizations are Currently Holding or Pursuing



Q13, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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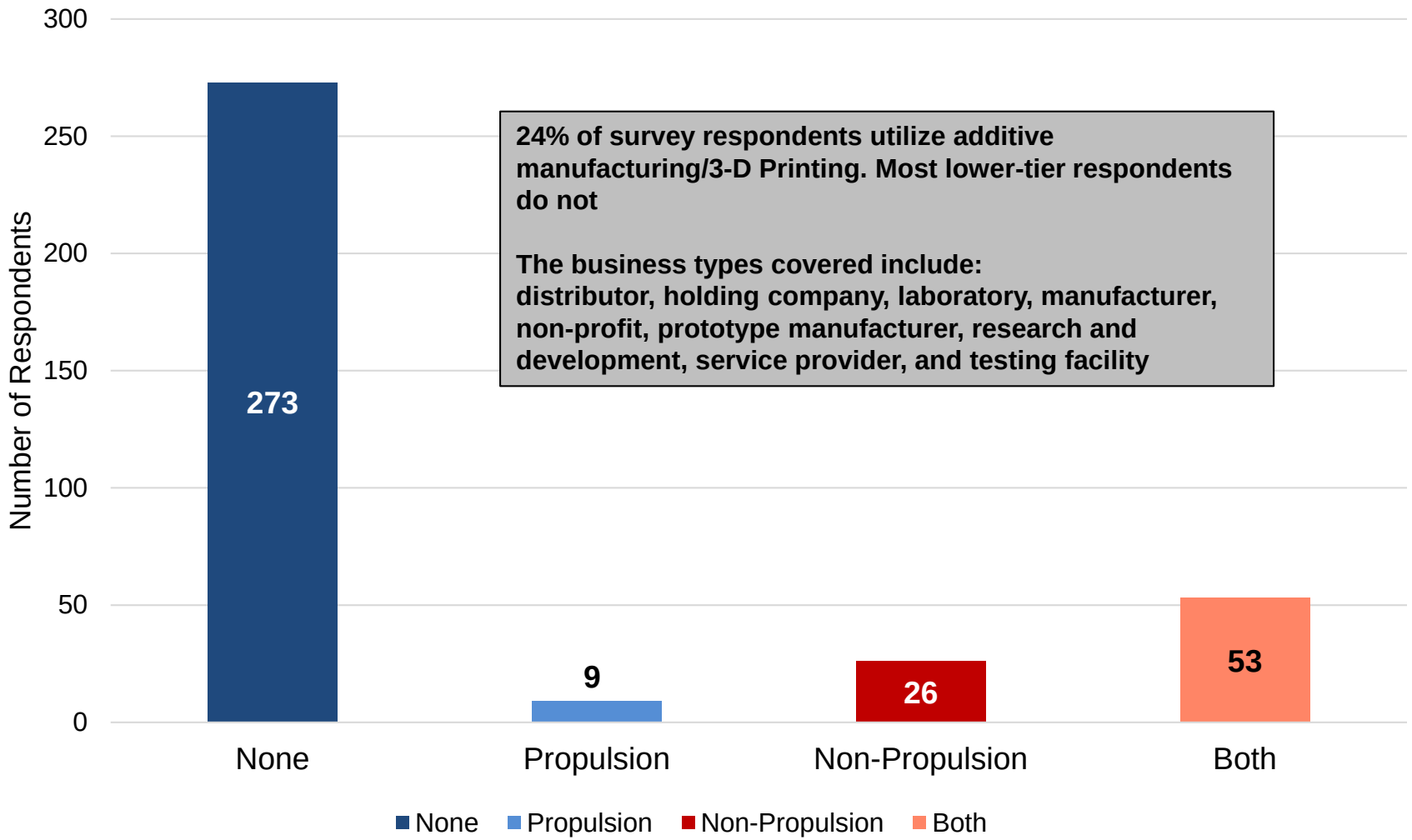
Additive Manufacturing / 3-D Printing

Level of Involvement



24% of survey respondents utilize additive manufacturing/3-D Printing. Most lower-tier respondents do not

The business types covered include: distributor, holding company, laboratory, manufacturer, non-profit, prototype manufacturer, research and development, service provider, and testing facility

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

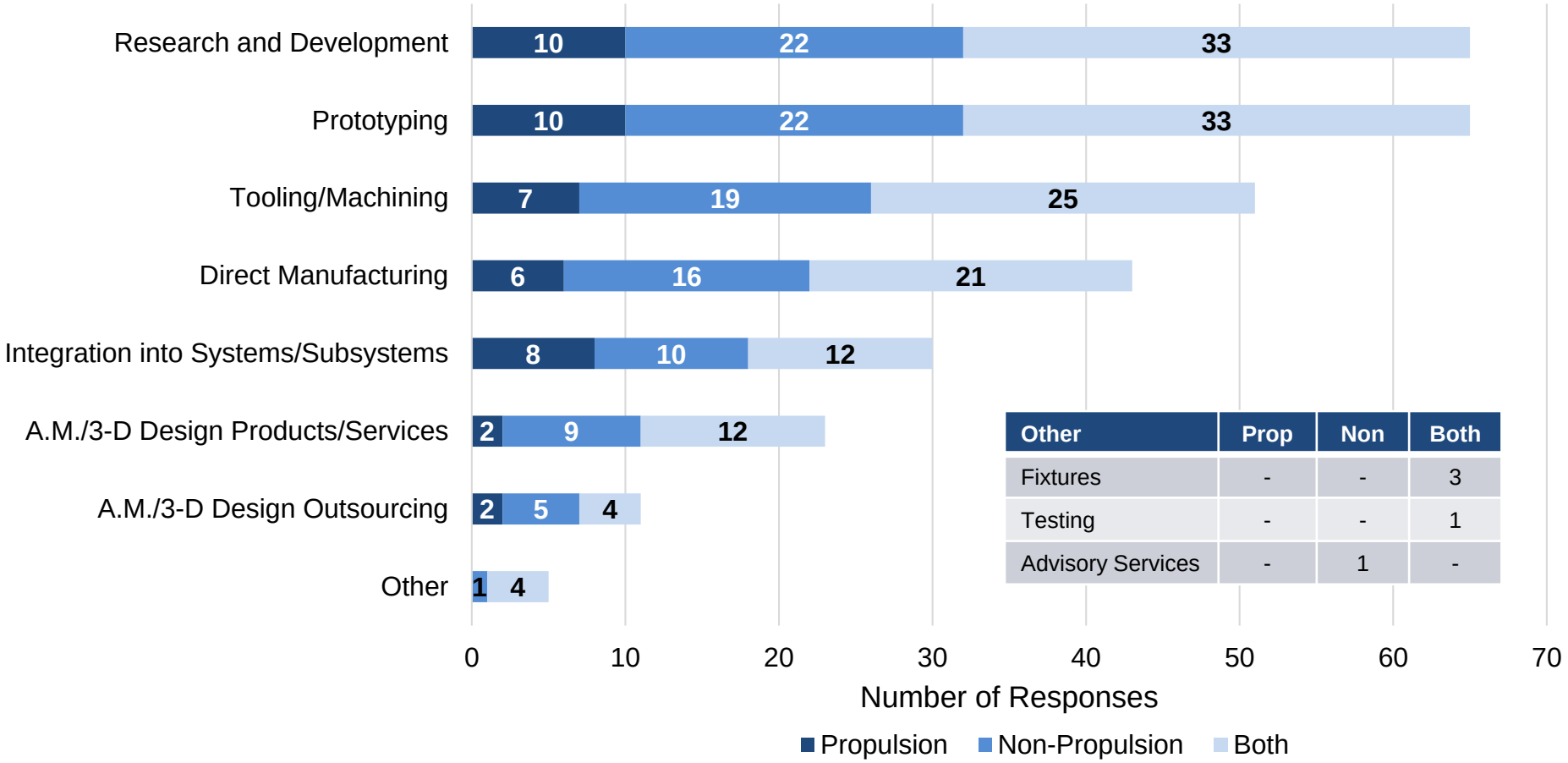
Q14, A

361 Respondents

Additive Manufacturing / 3-D Printing

Participation

Participation By Application Area



Other	Prop	Non	Both
Fixtures	-	-	3
Testing	-	-	1
Advisory Services	-	1	-

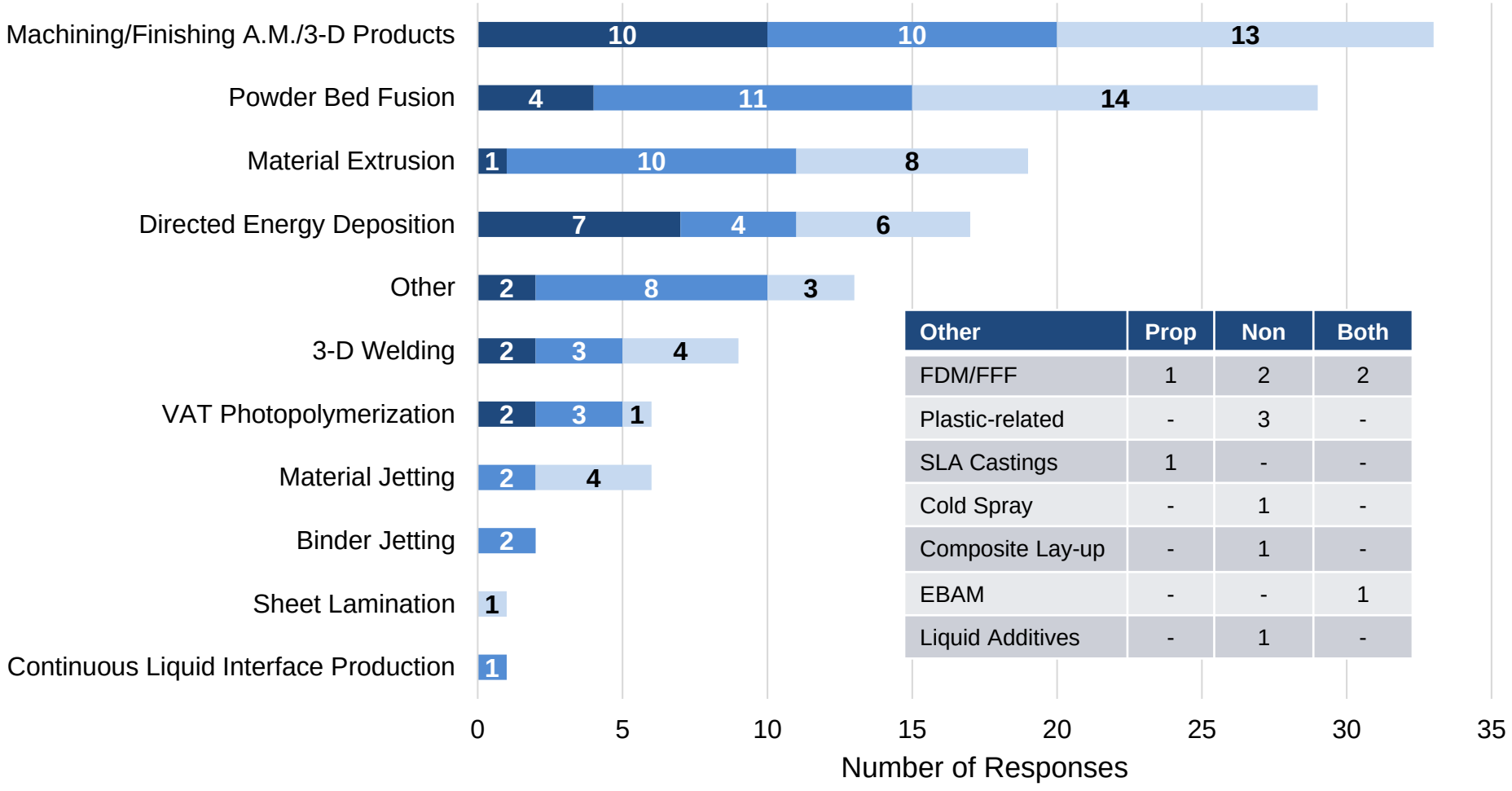
Q14, B

88 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Additive Manufacturing / 3-D Printing

Participation By Process Type



Other	Prop	Non	Both
FDM/FFF	1	2	2
Plastic-related	-	3	-
SLA Castings	1	-	-
Cold Spray	-	1	-
Composite Lay-up	-	1	-
EBAM	-	-	1
Liquid Additives	-	1	-

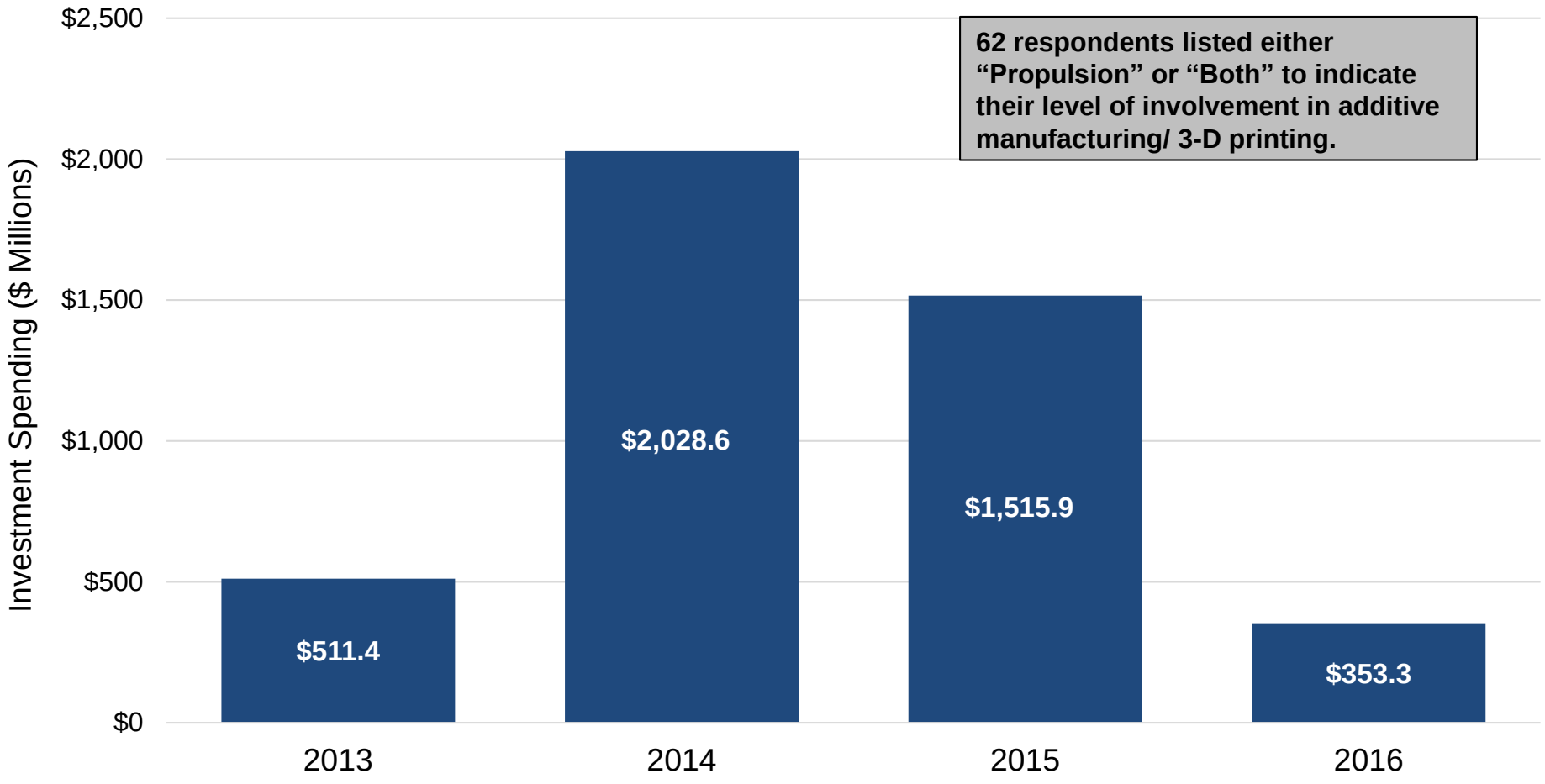
Q14, C

88 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Additive Manufacturing / 3-D Printing

Propulsion-Related Investment – 2013-2016



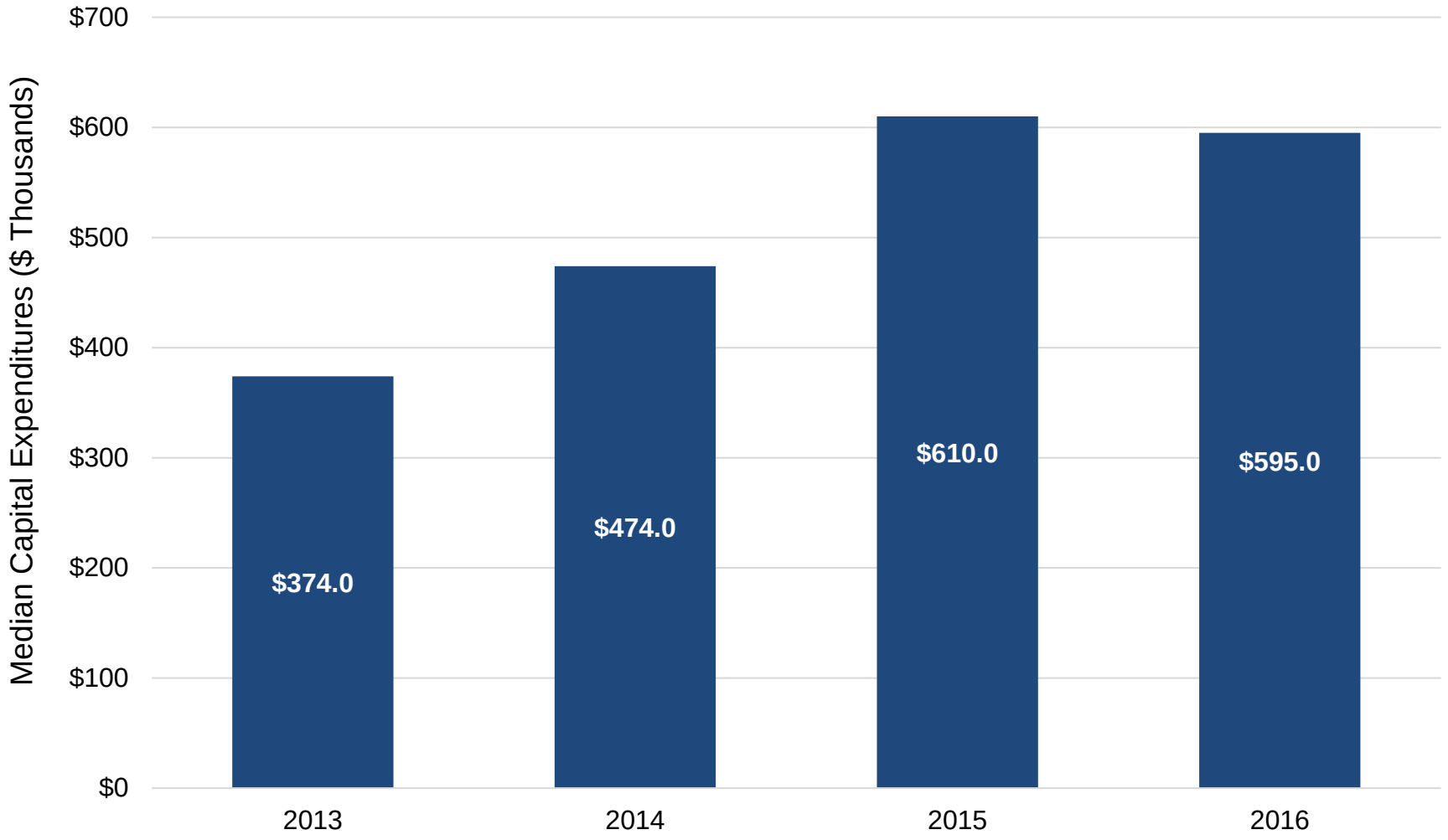
Q14, D

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

62 Respondents

Capital Expenditures

Median Capital Expenditures by Year – 2013-2016



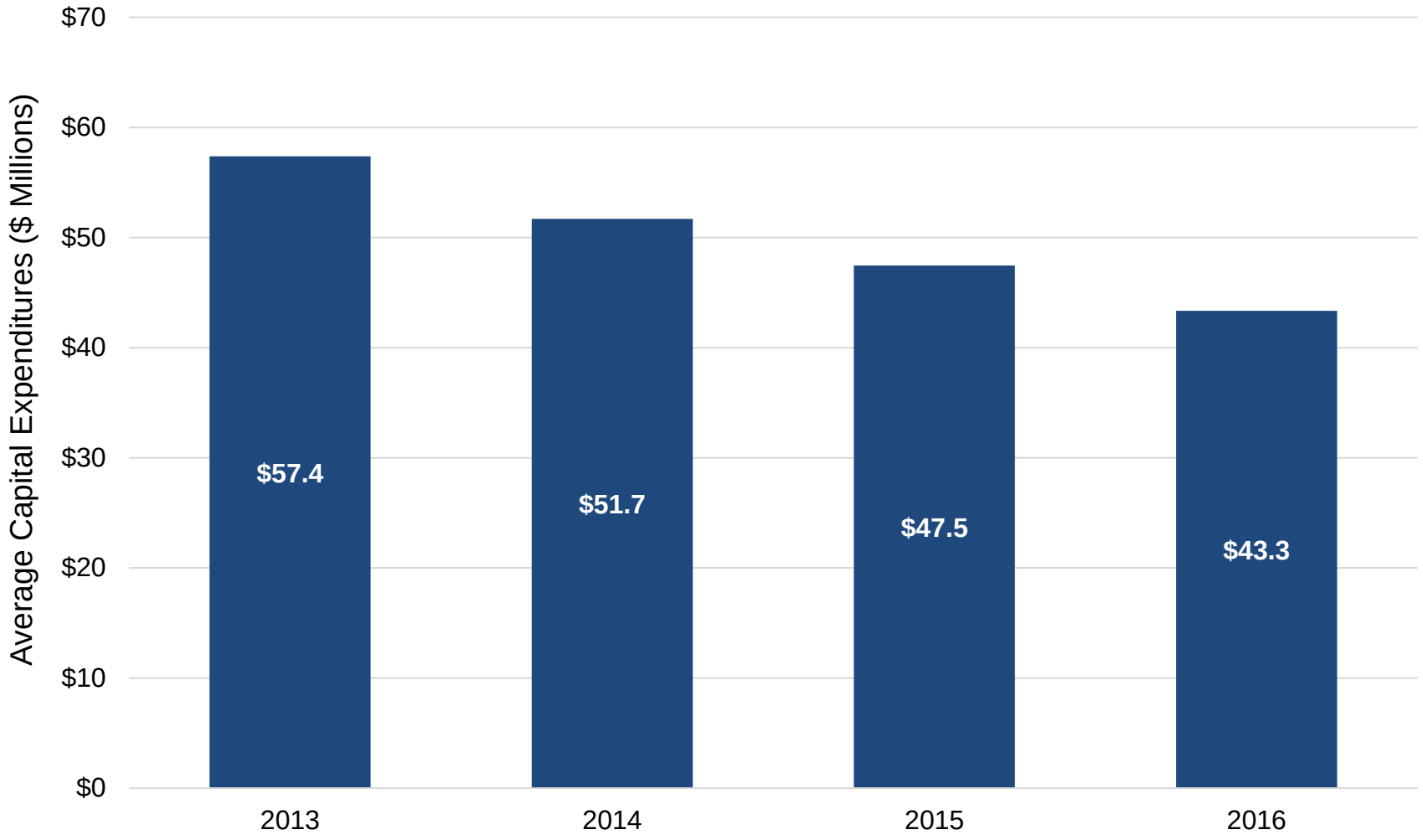
Q15a, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

338 Respondents

Capital Expenditures

Average Capital Expenditures by Year – 2013-2016



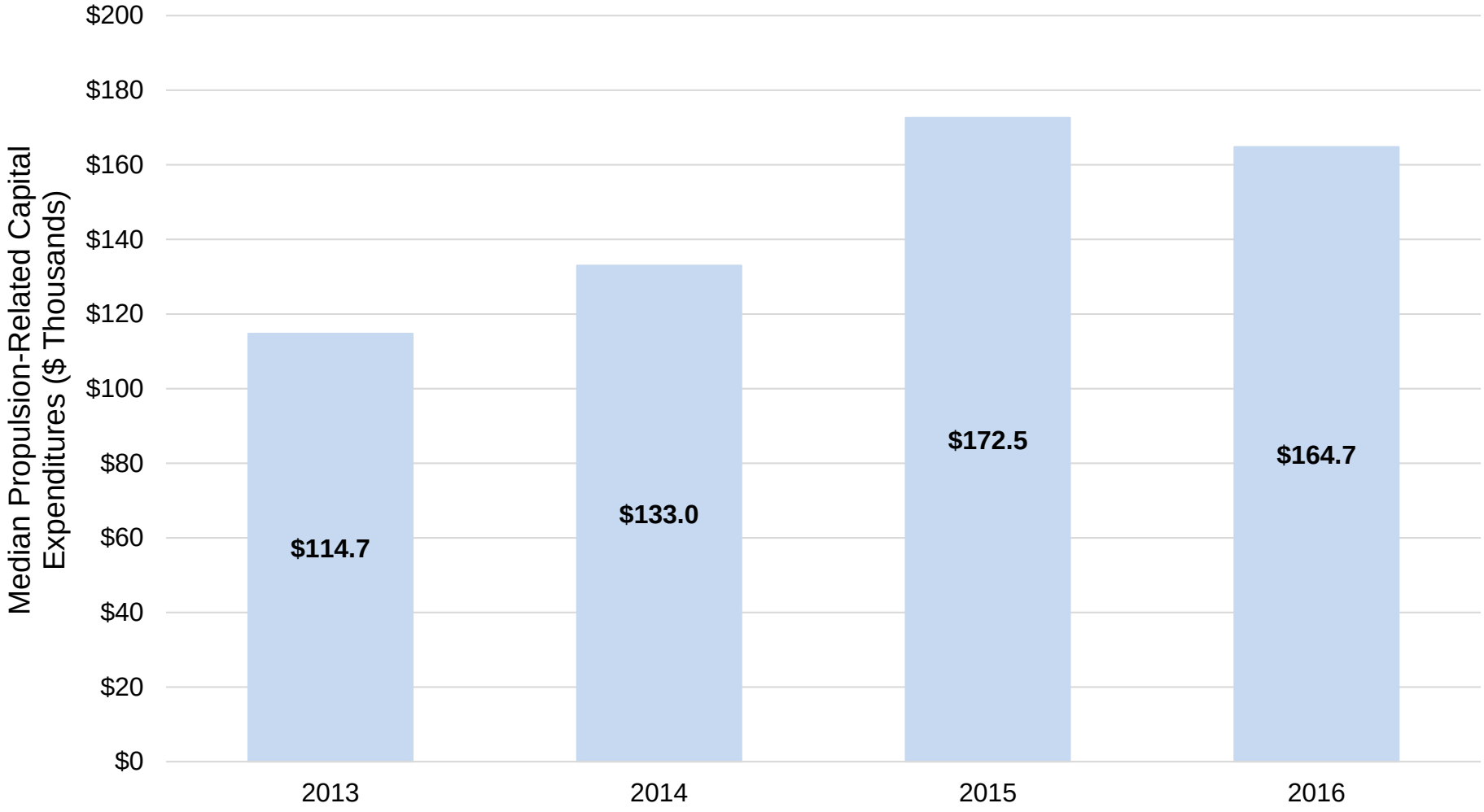
Q15a, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

338 Respondents

Capital Expenditures

Median Propulsion-Related Capital Expenditures by Year – 2013-2016



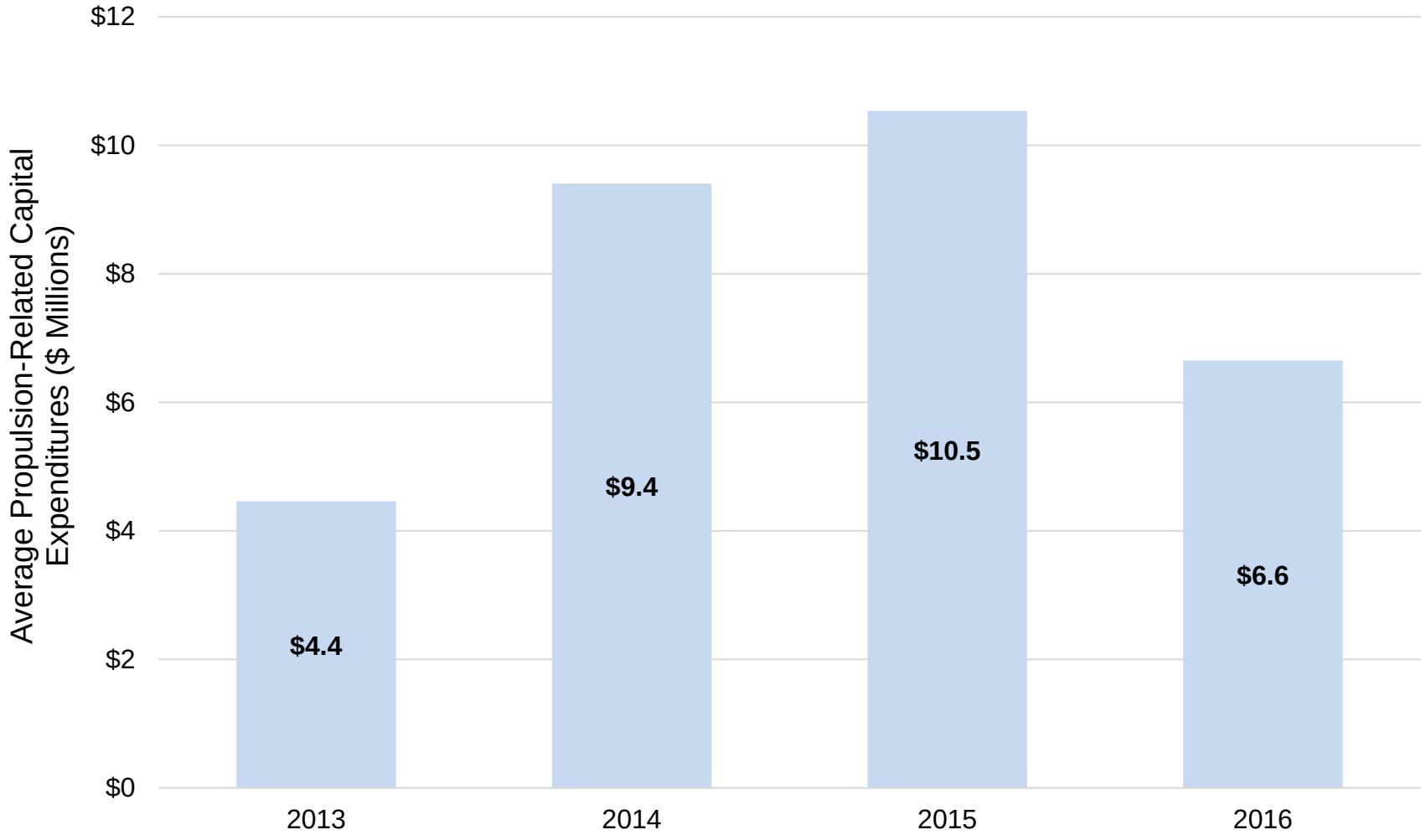
Q15a, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

153 Respondents

Capital Expenditures

Average Propulsion-Related Capital Expenditures by Year – 2013-2016



Q15a, A

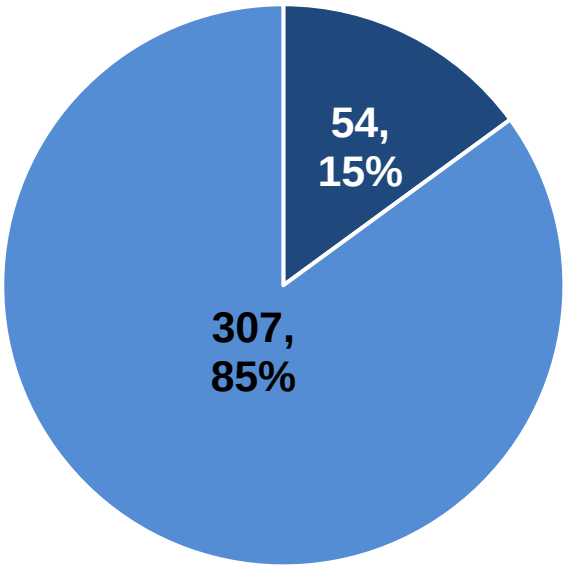
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

153 Respondents

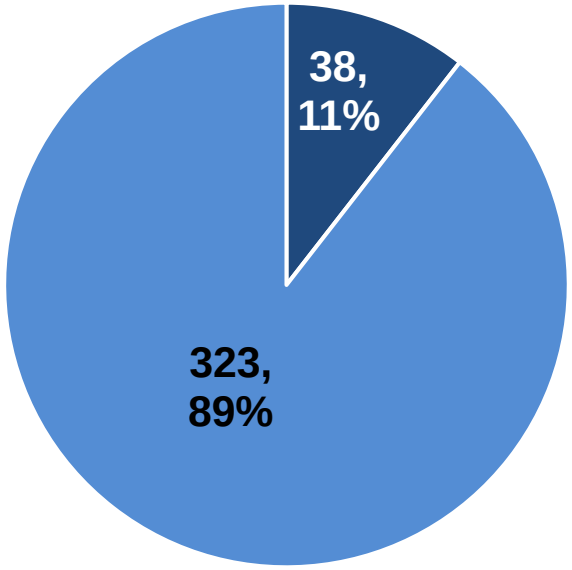
Capital Expenditures

Organization CapEx Adversely Impacted by Reductions in USG Spending – 2013-2016

Overall CapEx



Propulsion-Related CapEx



15a, B

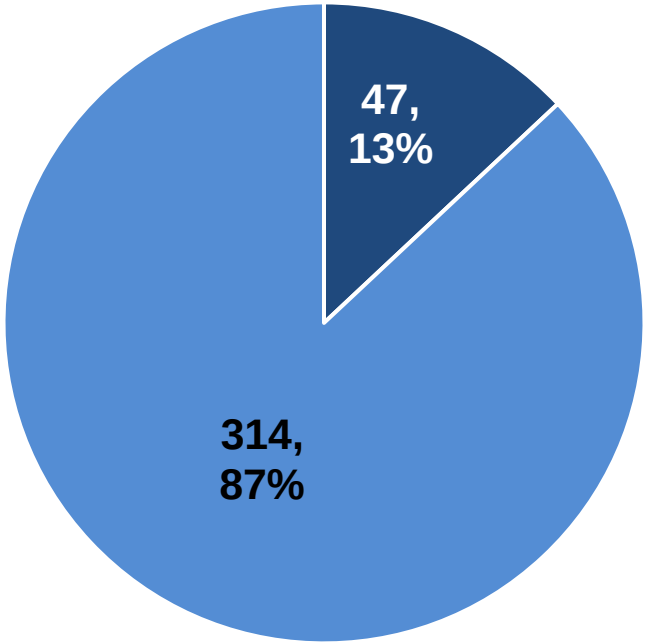
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

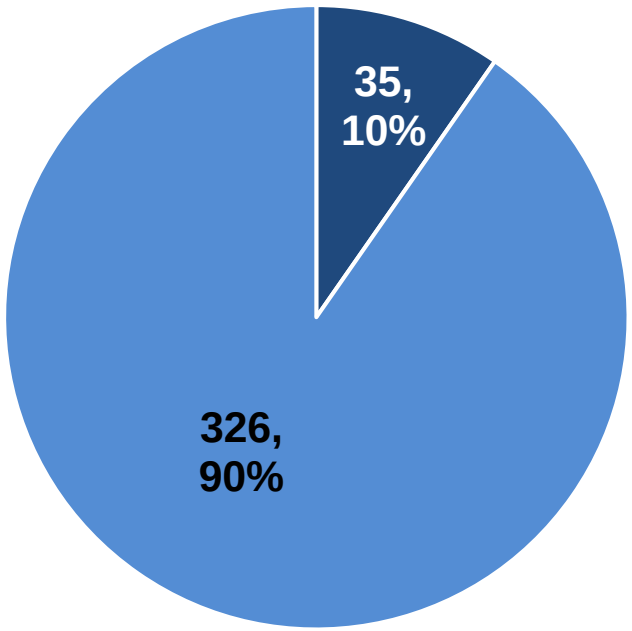
Capital Expenditures

Anticipate Organization's CapEx Will Be Adversely Impacted by Reductions/Fluctuations in USG Spending – 2017-2020

Overall CapEx



Propulsion-Related CapEx



15a, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Production/Capacity

Capacity and Utilization - 2016

- "Utilization" refers to the fraction of an organization's potential output that is actually being used in current production. Potential output is based on a 7 day-a-week, 3x8-hour shift production schedule
- 311 organizations reported an average utilization rate of 61.4%, with 231 of these organizations reporting a propulsion-related utilization rate of 38.8%
- 262 organizations reported an average of 18 weeks to reach 100% utilization, with 240 organizations reporting an average of 22 weeks to reach 100% propulsion-related utilization
- Some organizations had difficulty reporting utilization rates because they are distributors, service providers, etc.

Q15a, C

311 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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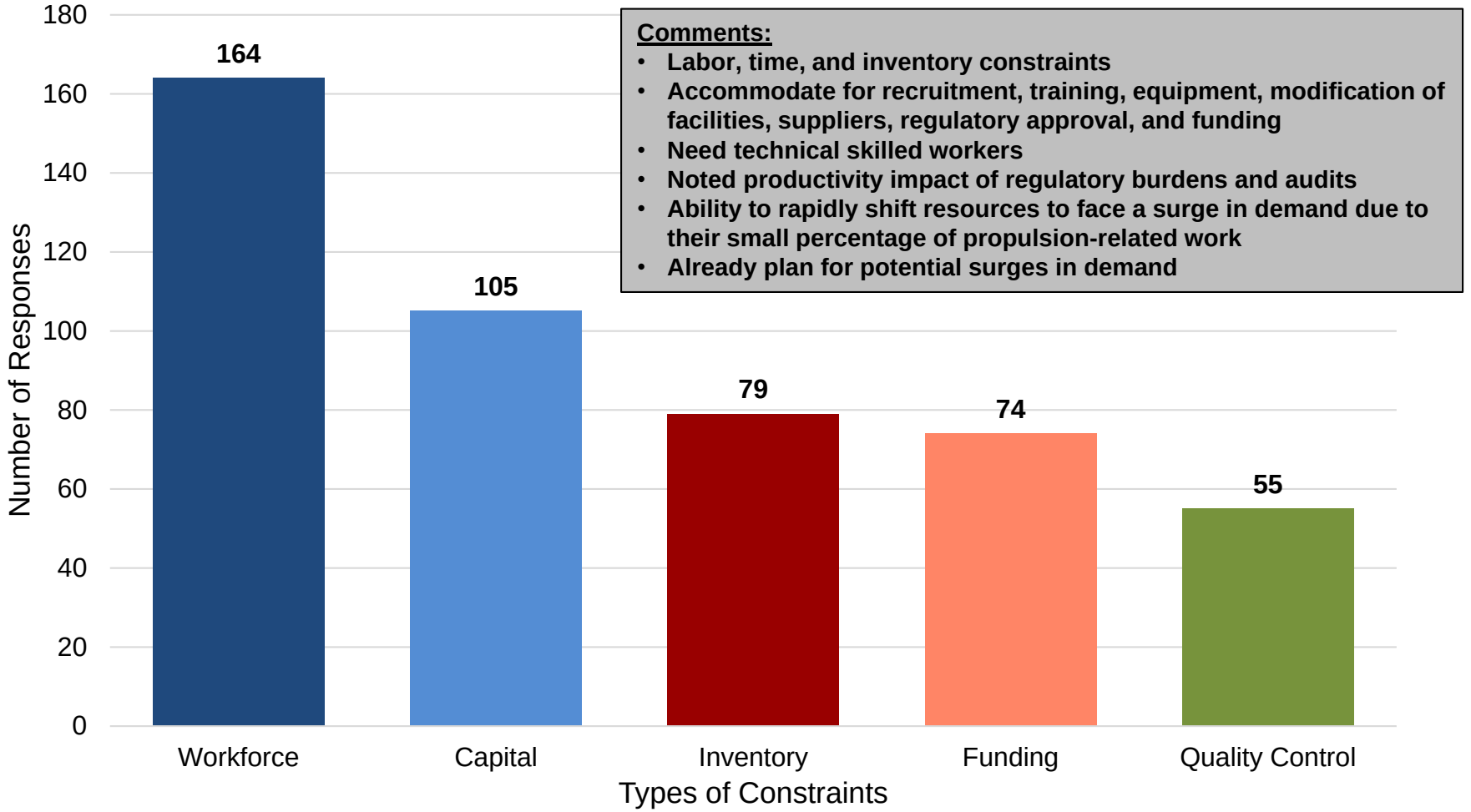
Production/Capacity

Which constraints listed would your organization face during a surge in demand for propulsion-related products?



Comments:

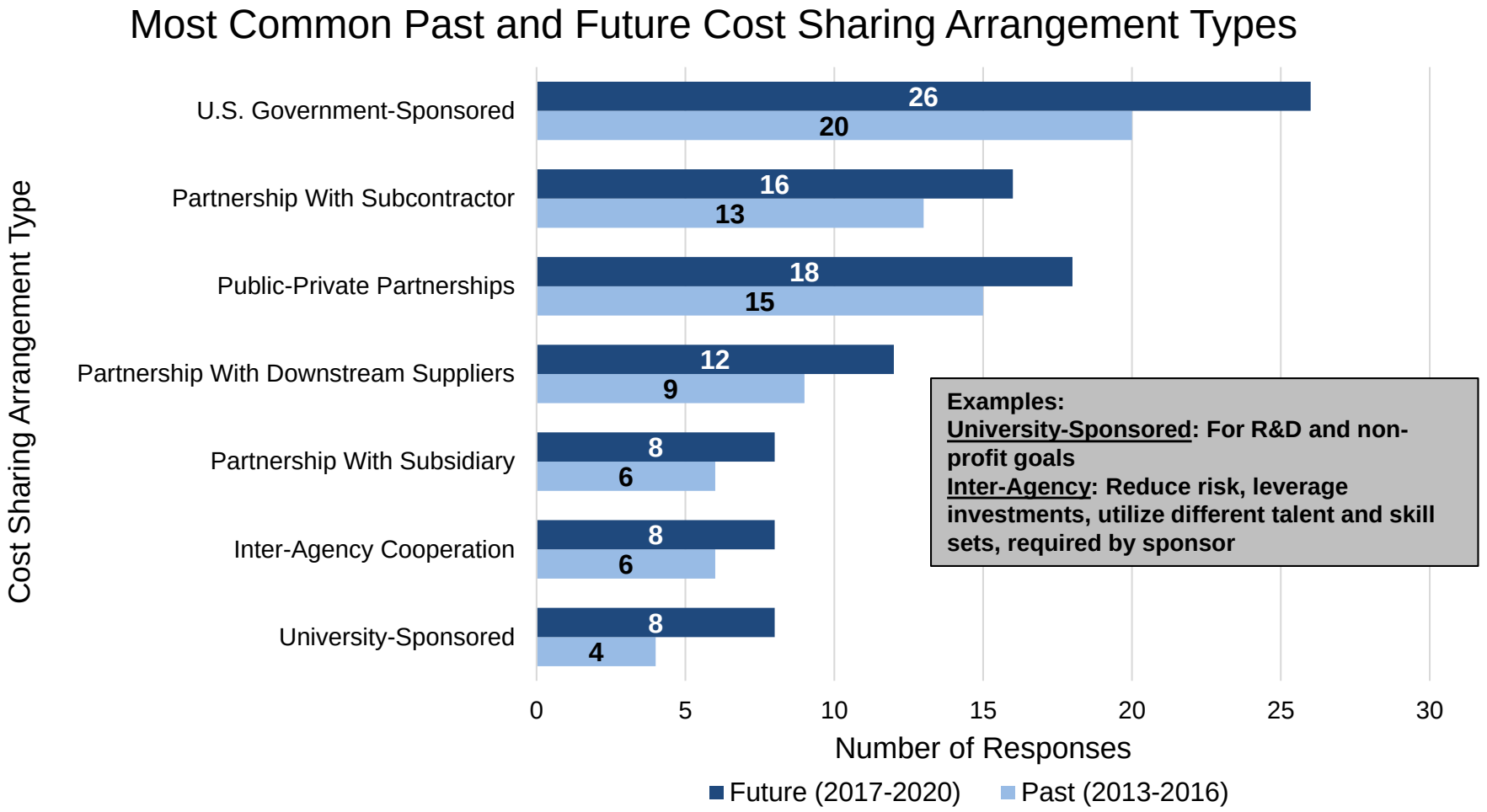
- **Labor, time, and inventory constraints**
- **Accommodate for recruitment, training, equipment, modification of facilities, suppliers, regulatory approval, and funding**
- **Need technical skilled workers**
- **Noted productivity impact of regulatory burdens and audits**
- **Ability to rapidly shift resources to face a surge in demand due to their small percentage of propulsion-related work**
- **Already plan for potential surges in demand**

Q15a, C

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

311 Respondents

Participation in Propulsion-Related Cost Sharing Arrangement Types



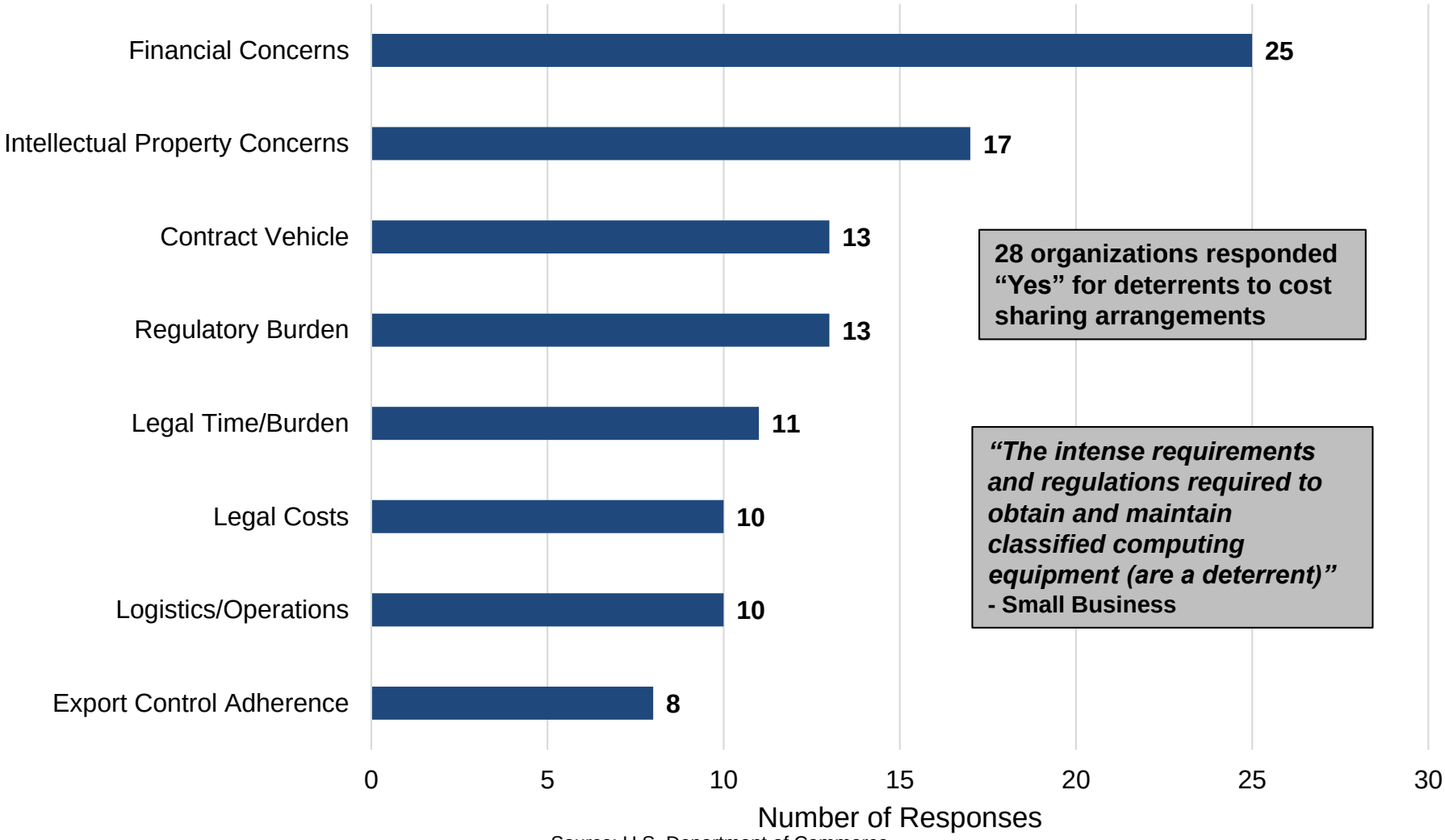
Q15b, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Cost Sharing Arrangements

By Deterrents



28 organizations responded "Yes" for deterrents to cost sharing arrangements

"The intense requirements and regulations required to obtain and maintain classified computing equipment (are a deterrent)"
- Small Business

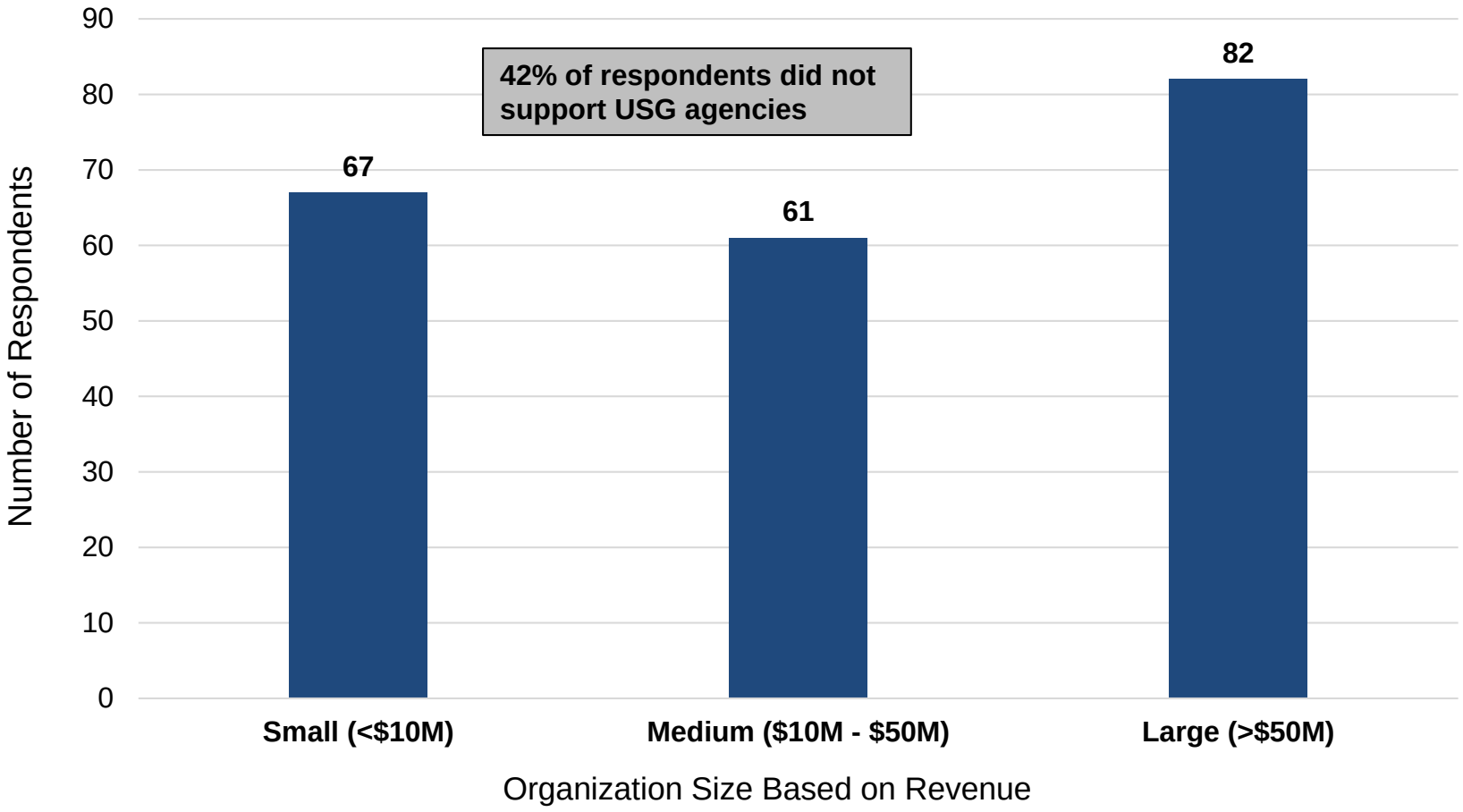
Q15b, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

28 Respondents

Support to USG

Support to U.S. Government Agencies by Organization Size 2013-2017



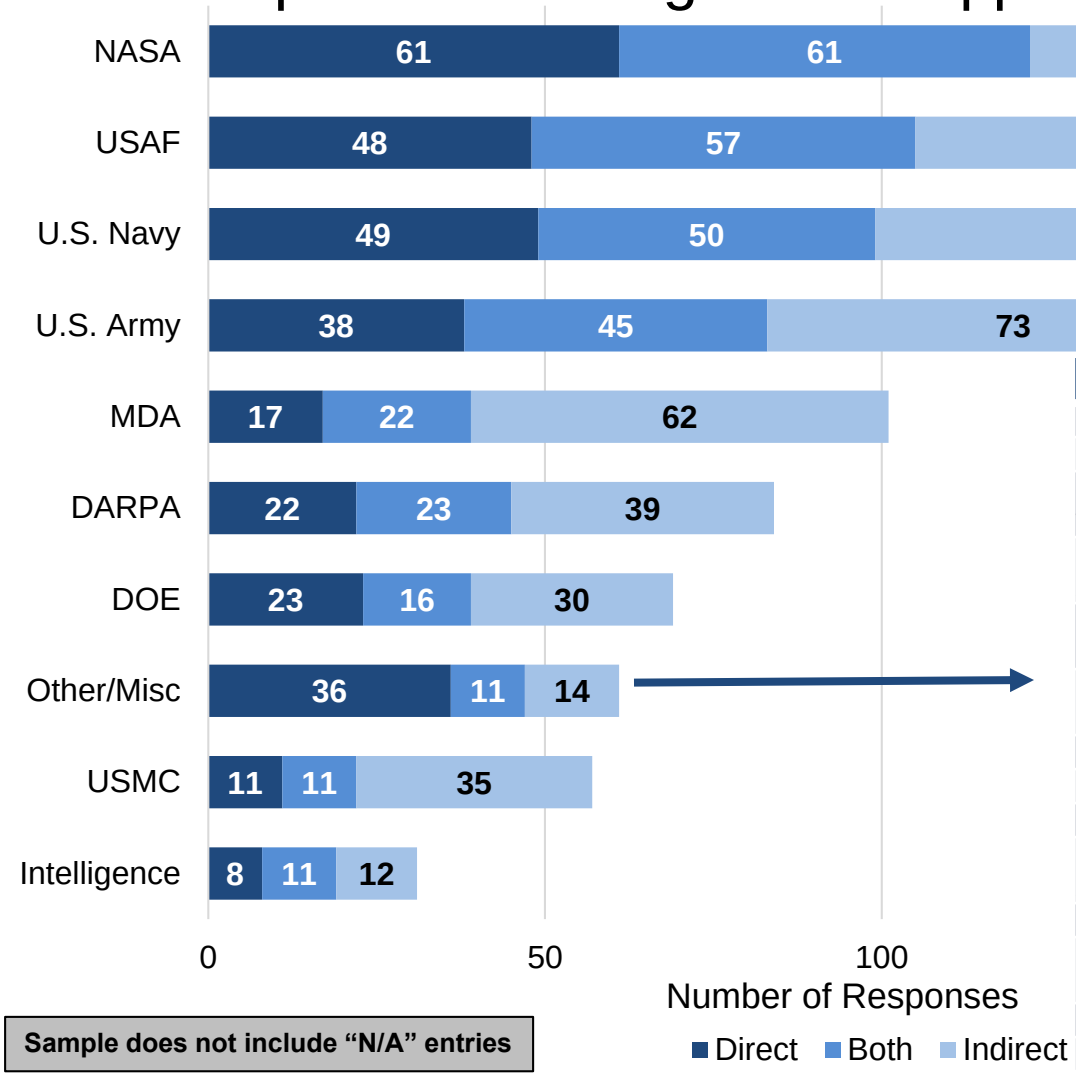
Q5c, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

210 Respondents

Support to USG

Top 10 Federal Agencies Supported (All Contracts)



Other	Direct	Both	Indirect
DOD Other	14	4	4
Misc.	6	1	3
Department of Transportation	4	1	1
Defense Logistics Agency	4	-	-
National Science Foundation	2	1	-
Research Laboratories	1	2	-
Classified	-	1	2
Coast Guard	1	-	1
EPA	2	-	-
Department of Agriculture	1	-	1
U.S. Postal Service	-	-	1
Nuclear Regulatory Commission	1	-	-
FDA	-	-	1
IRAPA	-	1	-

Sample does not include "N/A" entries

Q5a, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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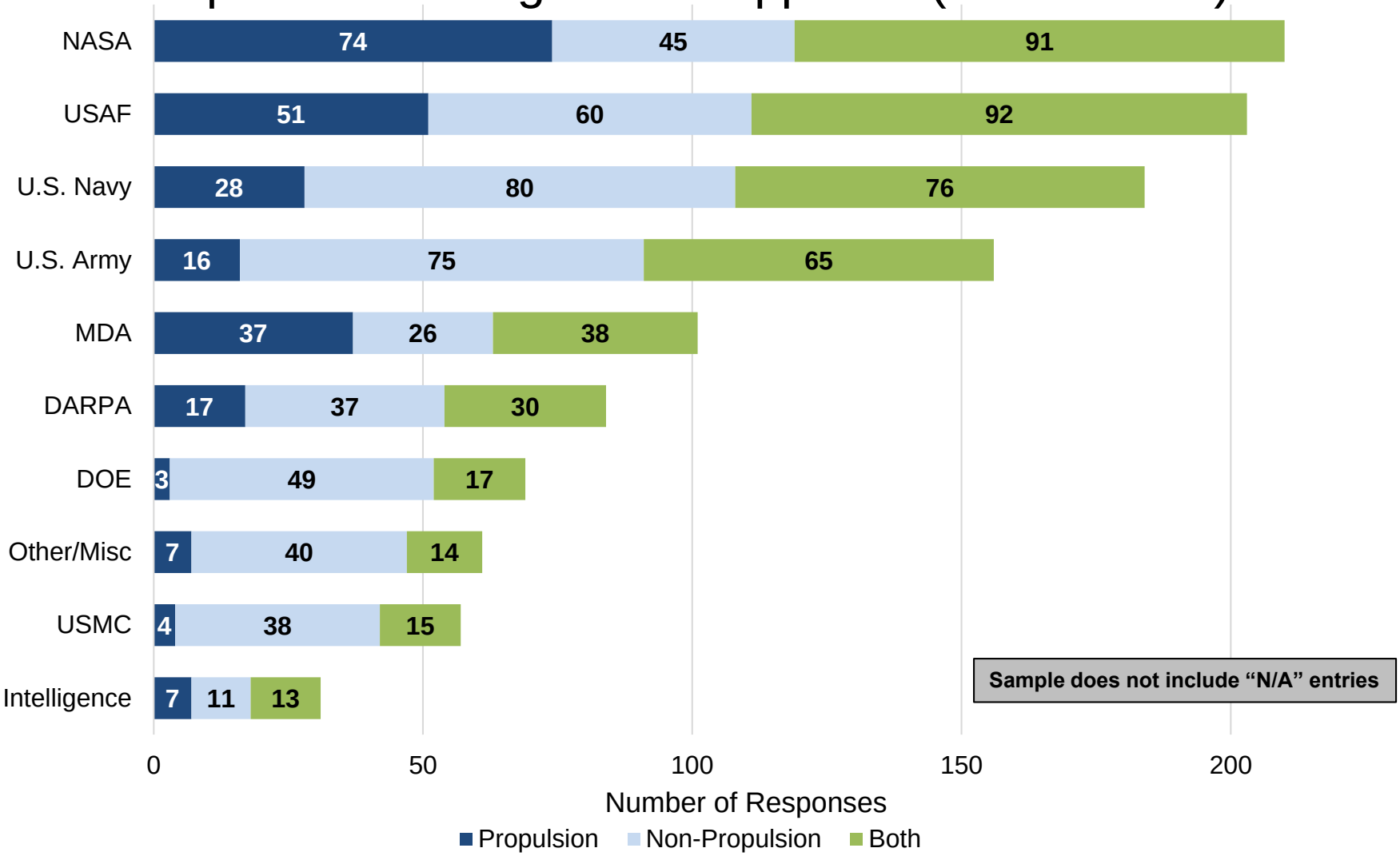
210 Respondents

Propulsion-Related Support to USG

Top 10 Federal Agencies Supported (All Contracts)



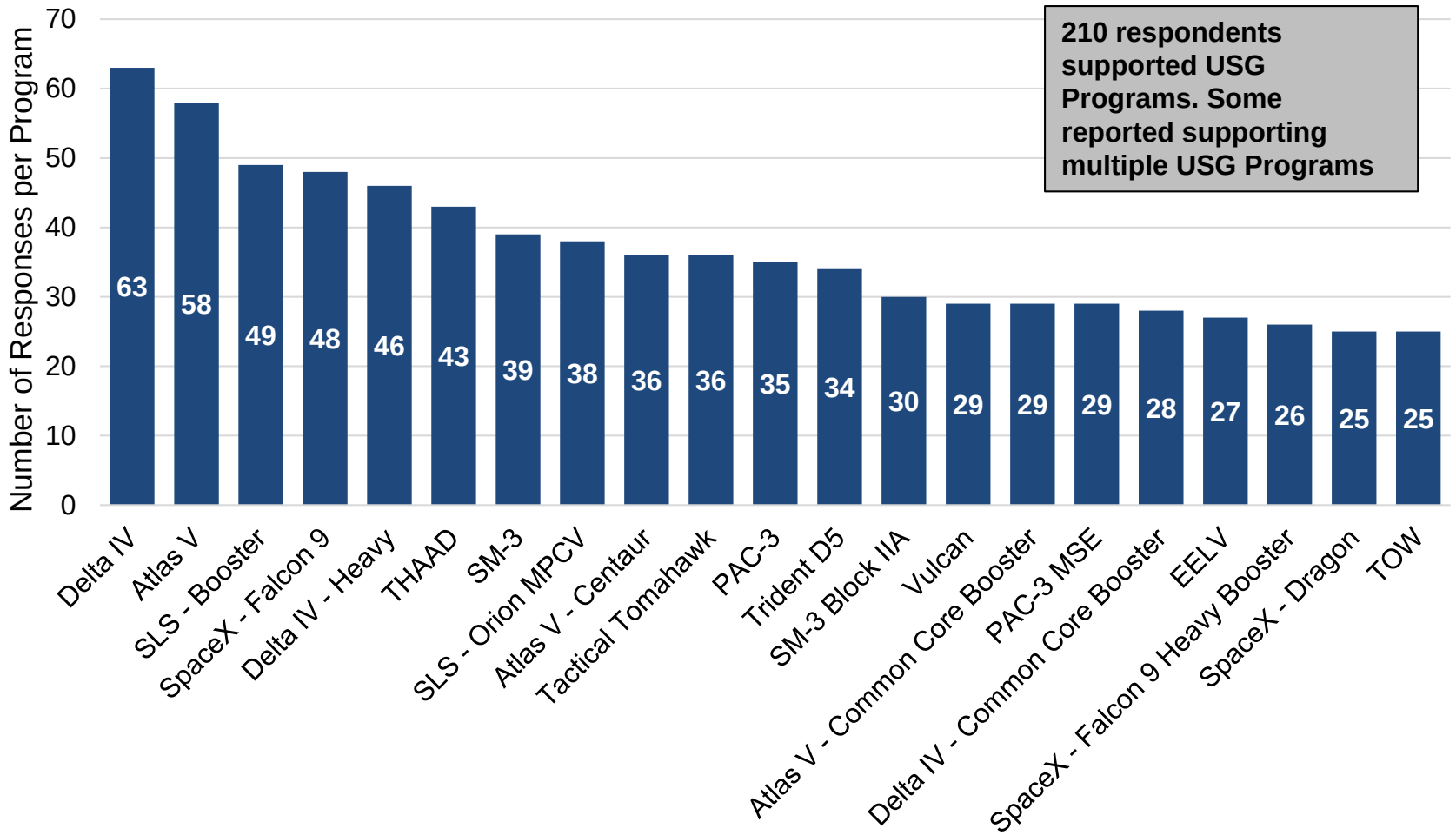
Q5a, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

210 Respondents

Support to USG

Programs Supported by 25 or More USG Dependent Respondents



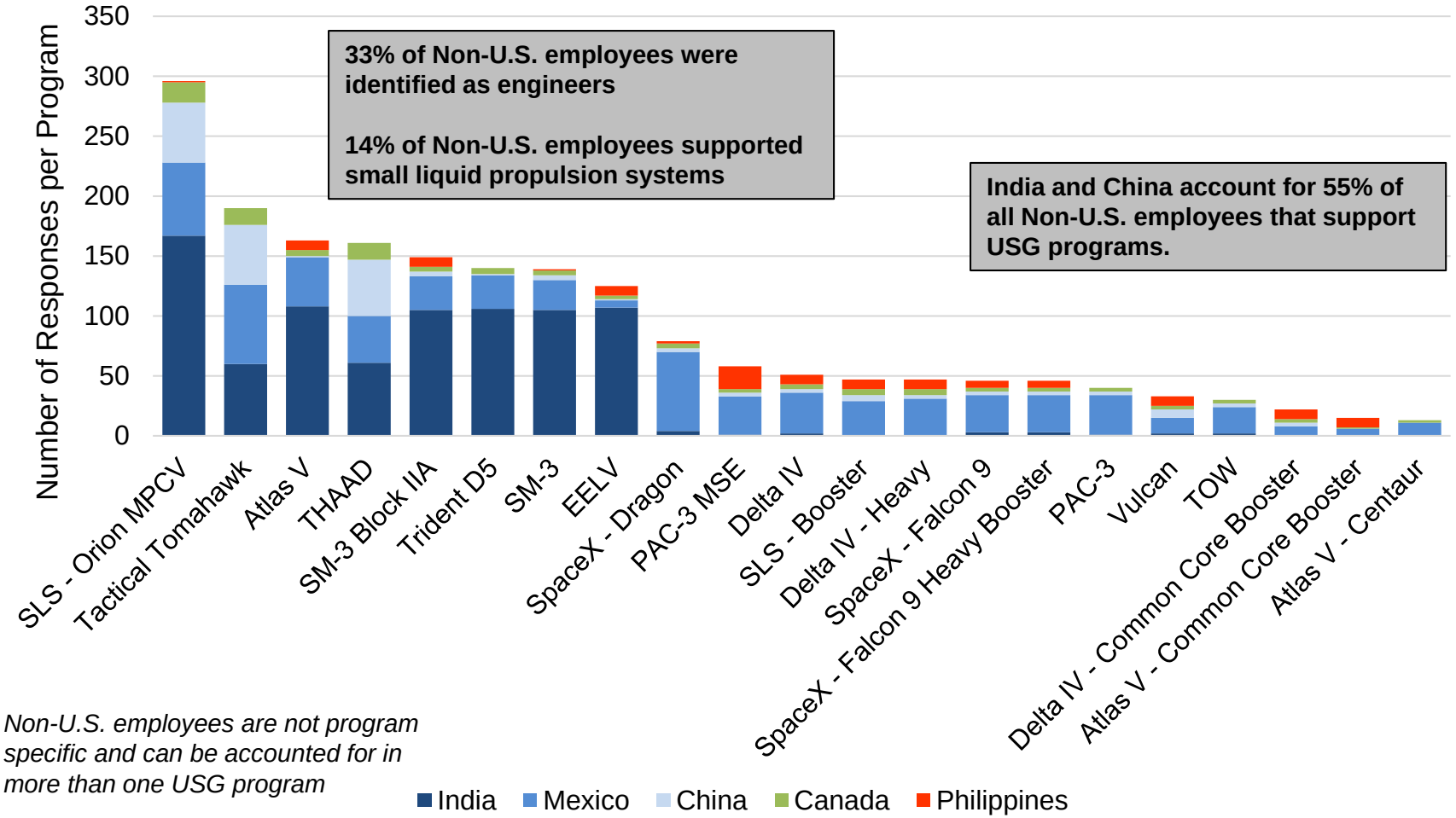
Q5c, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

210 Respondents

Support to USG

Programs Supported by 25 or More USG Dependent Respondents With Non-U.S. Employees (Top 5 Countries)



Non-U.S. employees are not program specific and can be accounted for in more than one USG program

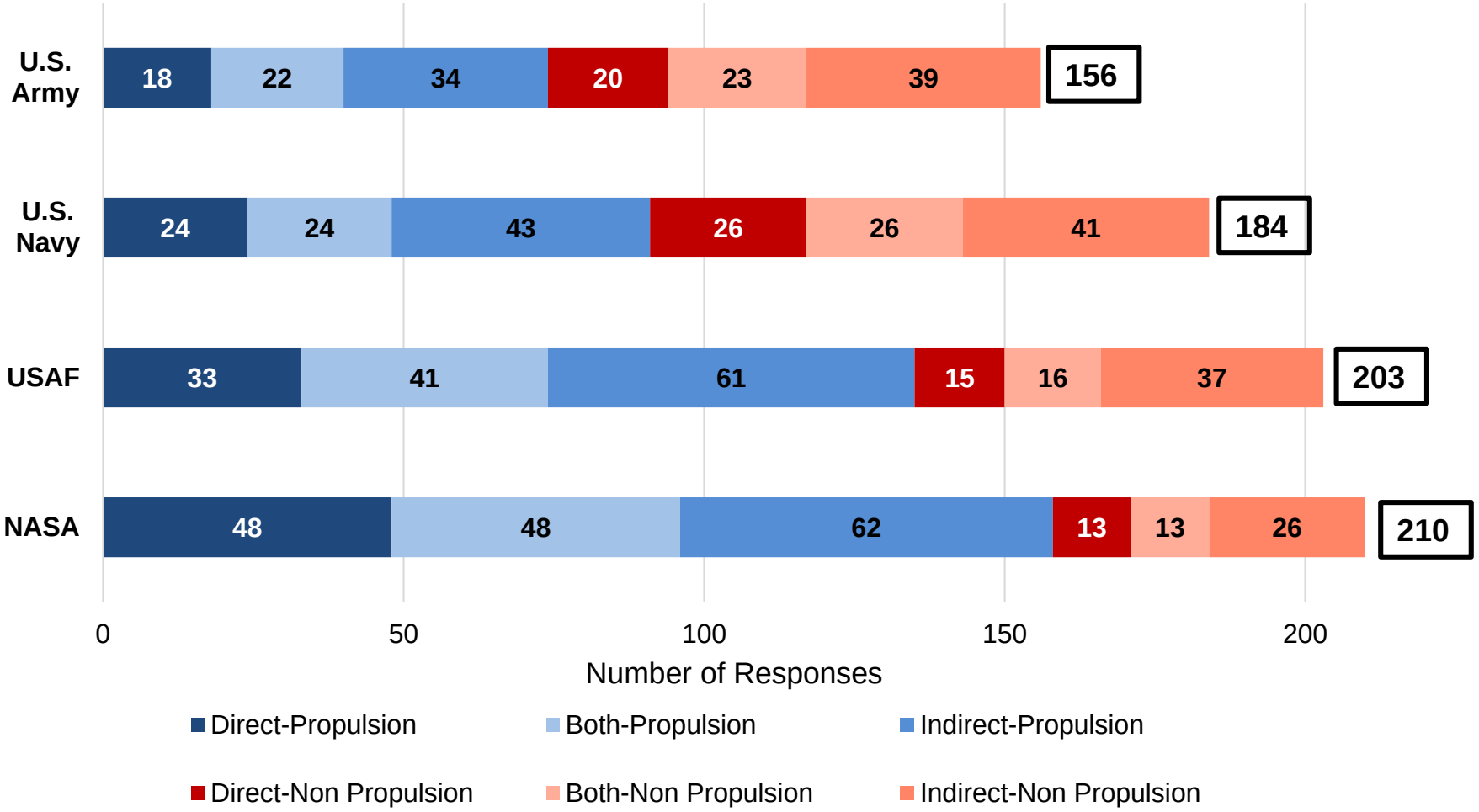
Q5c, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

210 Respondents

Support to USG

Propulsion/Non-Propulsion-Related Support to USG JANNAF Agencies

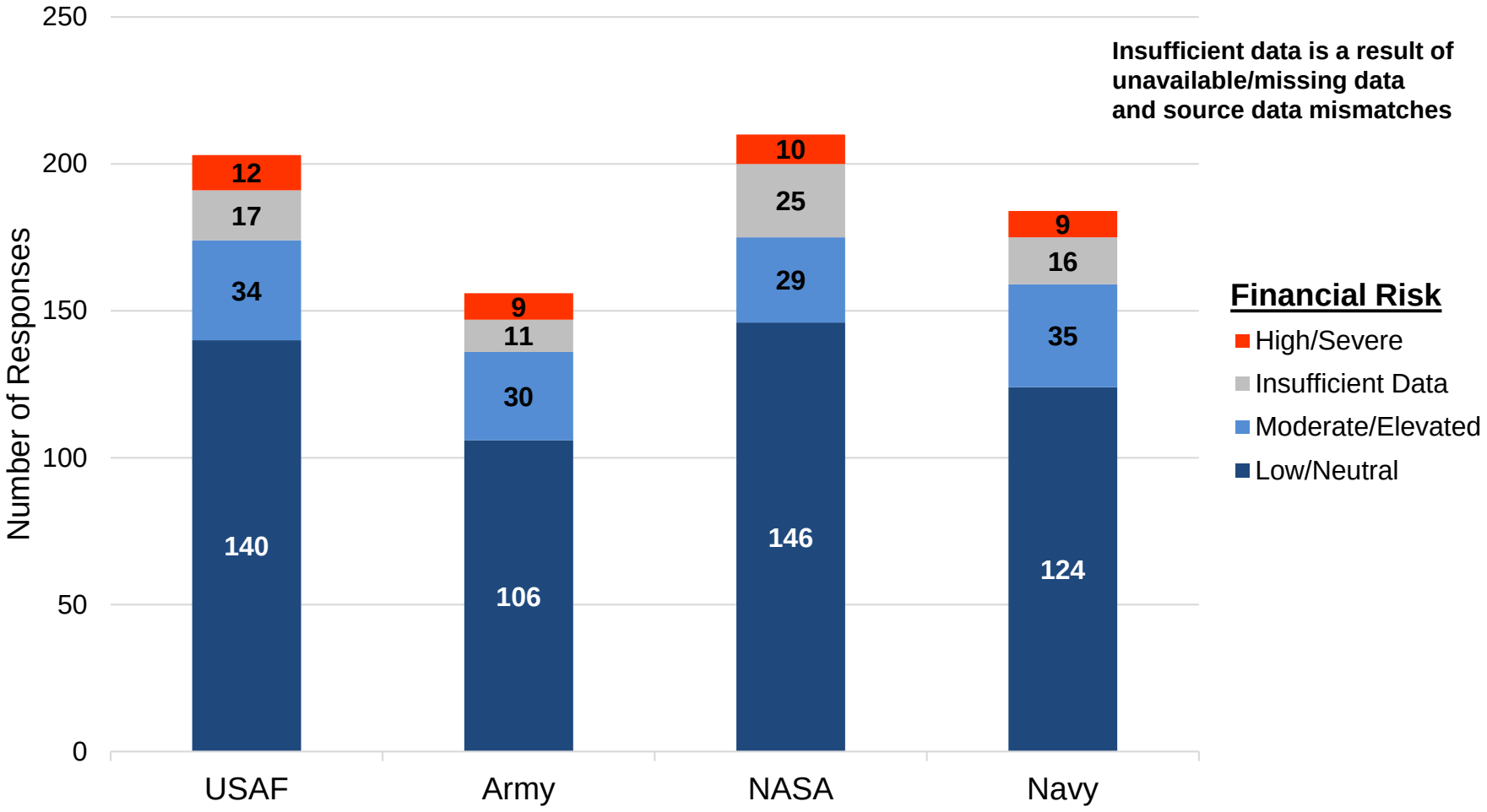


Q5a, A-E

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

210 Respondents

Financial Risk of Organizations that Support USG JANNAF Agencies



Q5a

210 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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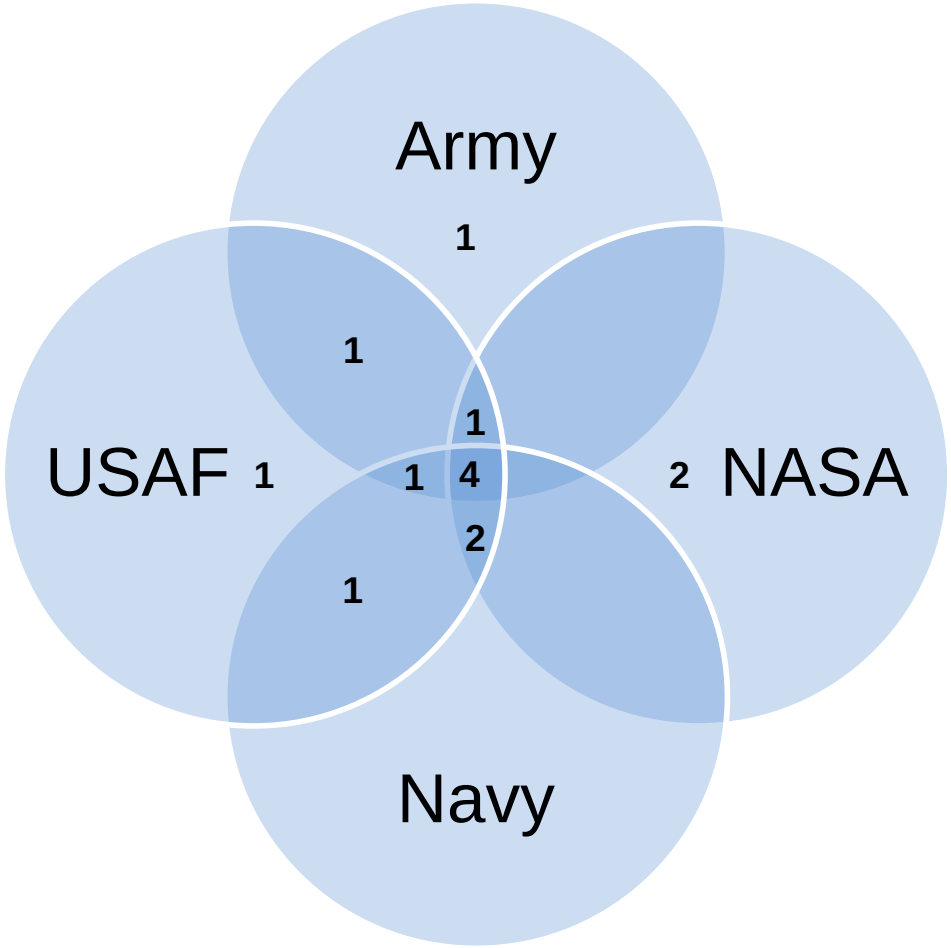
High/Severe Risk Organizations That Support

USG JANNAF Agencies – 2013-2016



4 out of 16 or 25% of high/severe risk organizations support all 4 listed USG JANNAF Agencies across 10 programs

Not Shown:
USAF & NASA: 1
Army & Navy: 1

***Denotes respondents that support all JANNAF agencies**

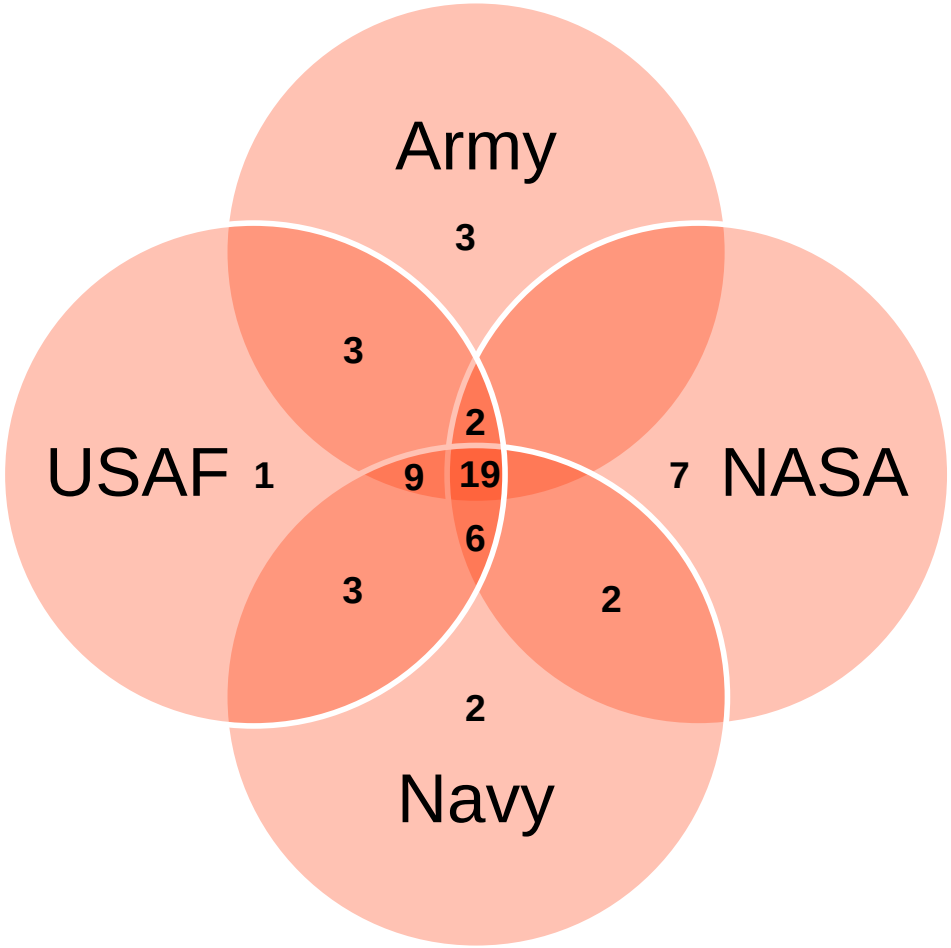
USG/Commercial Program*	Number of Respondents
SpaceX - Falcon 9	2
M270 MLRS	2
RAM	2
Antares	1
Atlas V	1
SLS Exploration Upper State	1
EELV	1
Griffin	1
Javelin	1
MGM-140 (ATacMS)	1

Q5a

16 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

High/Severe & Moderate/Elevated Risk Organizations that Support USG JANNAF Agencies – 2013-2016



19 out of 63 or 30% of high/severe or moderate/elevated risk organizations support all 4 listed USG JANNAF Agencies across 10 programs

Not Shown:
USAF & NASA: 3
Army & Navy: 3

***Denotes respondents that support all JANNAF agencies**

USG/Commercial Program*	Number of Respondents
Atlas V	7
Delta IV	6
Delta IV - Heavy	6
Atlas V - Centaur	5
Atlas V - CCB	5
Delta IV - CBC	5
Vulcan	5
Antares	4
Blue New Shepard	4
CST100	4

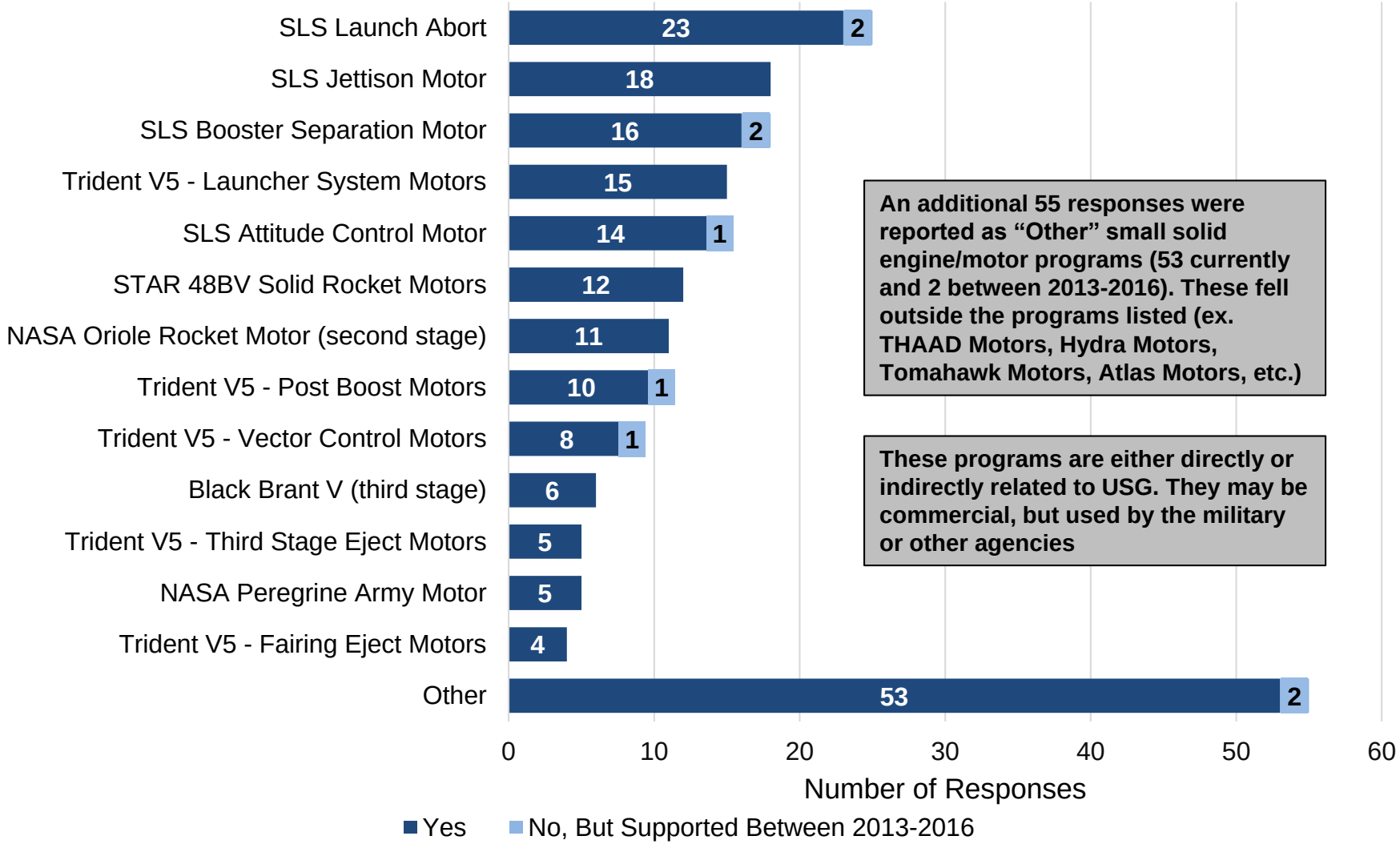
Q5a

63 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Support to USG

Participation in Small Solid Engine/ Motor Programs – 2017-2018



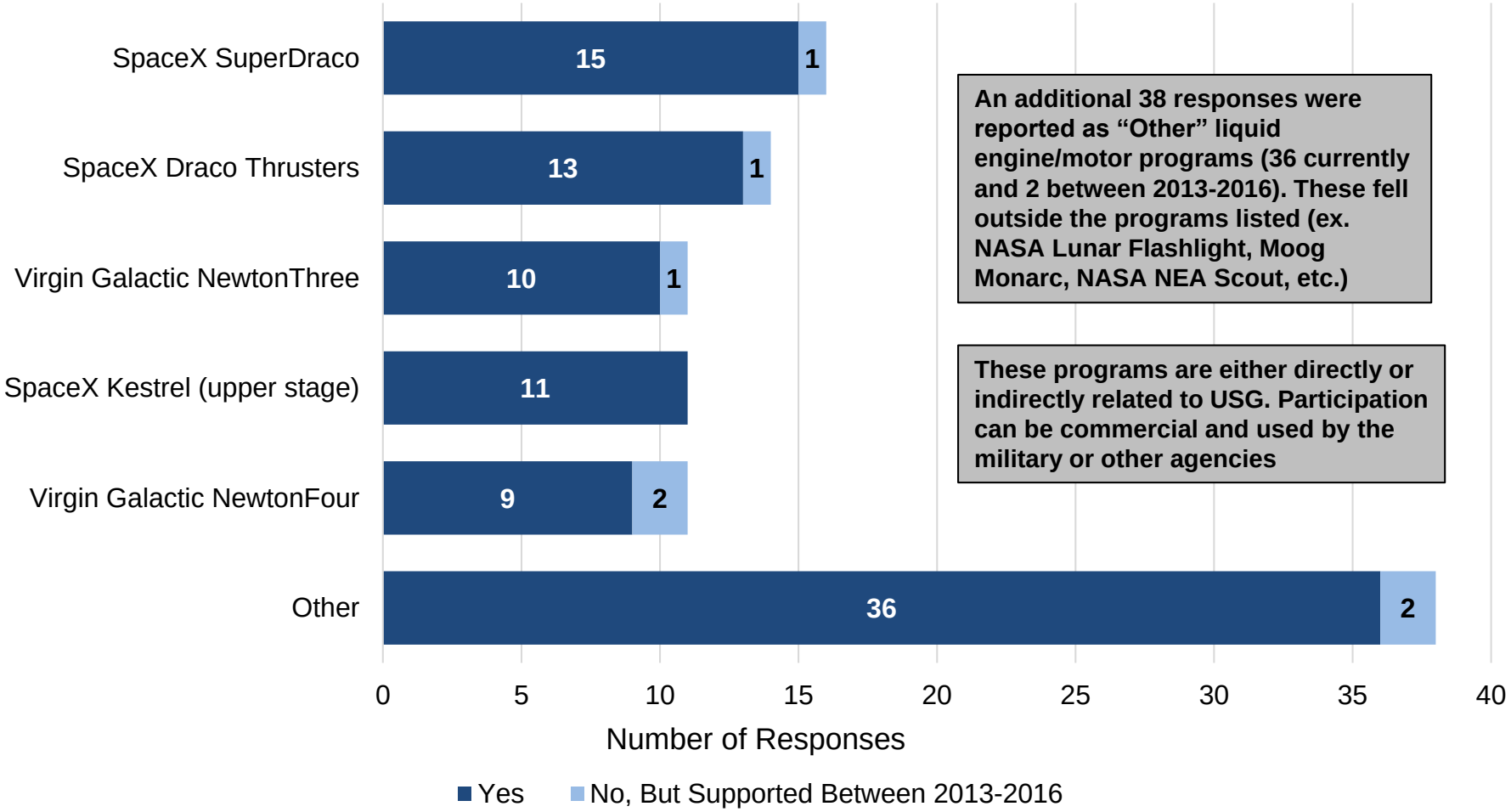
Q5b, A

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Support to USG

Participation in Small Liquid Engine/Motor Programs – 2017-2018



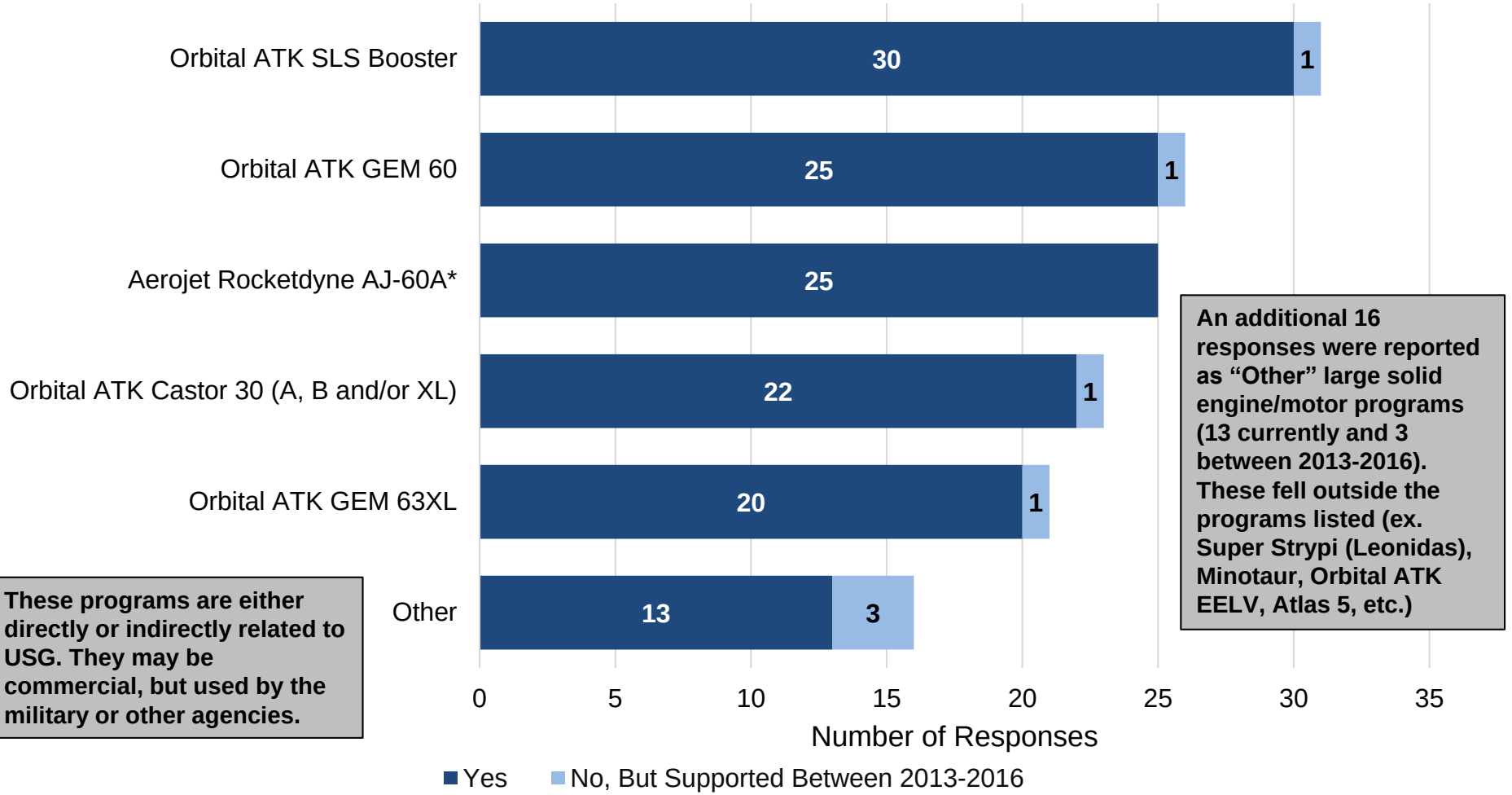
Q5b, B

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Support to USG

Participation in Large Solid Engine/Motor Programs – 2017-2018



These programs are either directly or indirectly related to USG. They may be commercial, but used by the military or other agencies.

An additional 16 responses were reported as "Other" large solid engine/motor programs (13 currently and 3 between 2013-2016). These fell outside the programs listed (ex. Super Strypi (Leonidas), Minotaur, Orbital ATK EELV, Atlas 5, etc.)

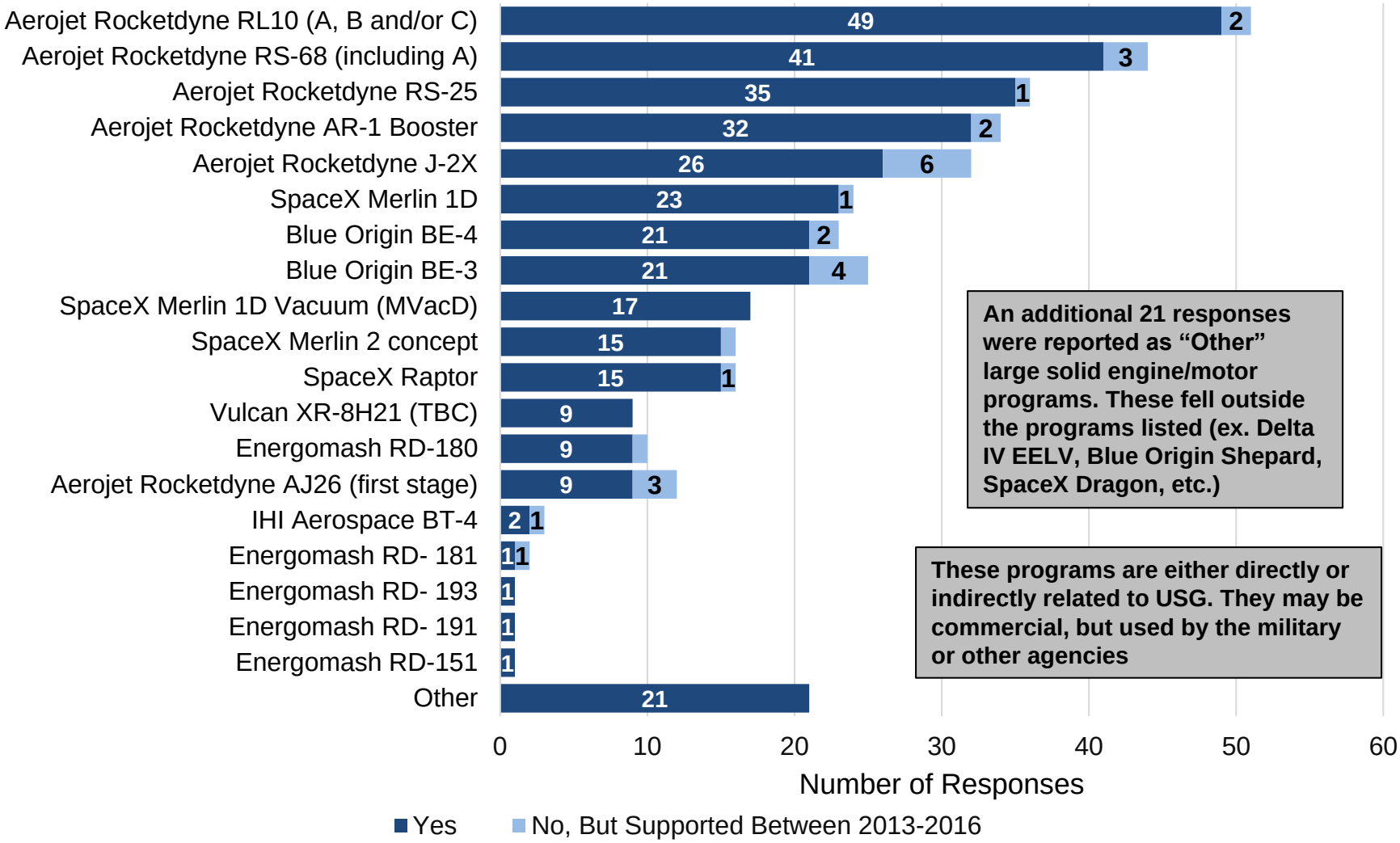
Q5b, C

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Support to USG

Participation in Large Liquid Engine/Motor Programs – 2017-2018



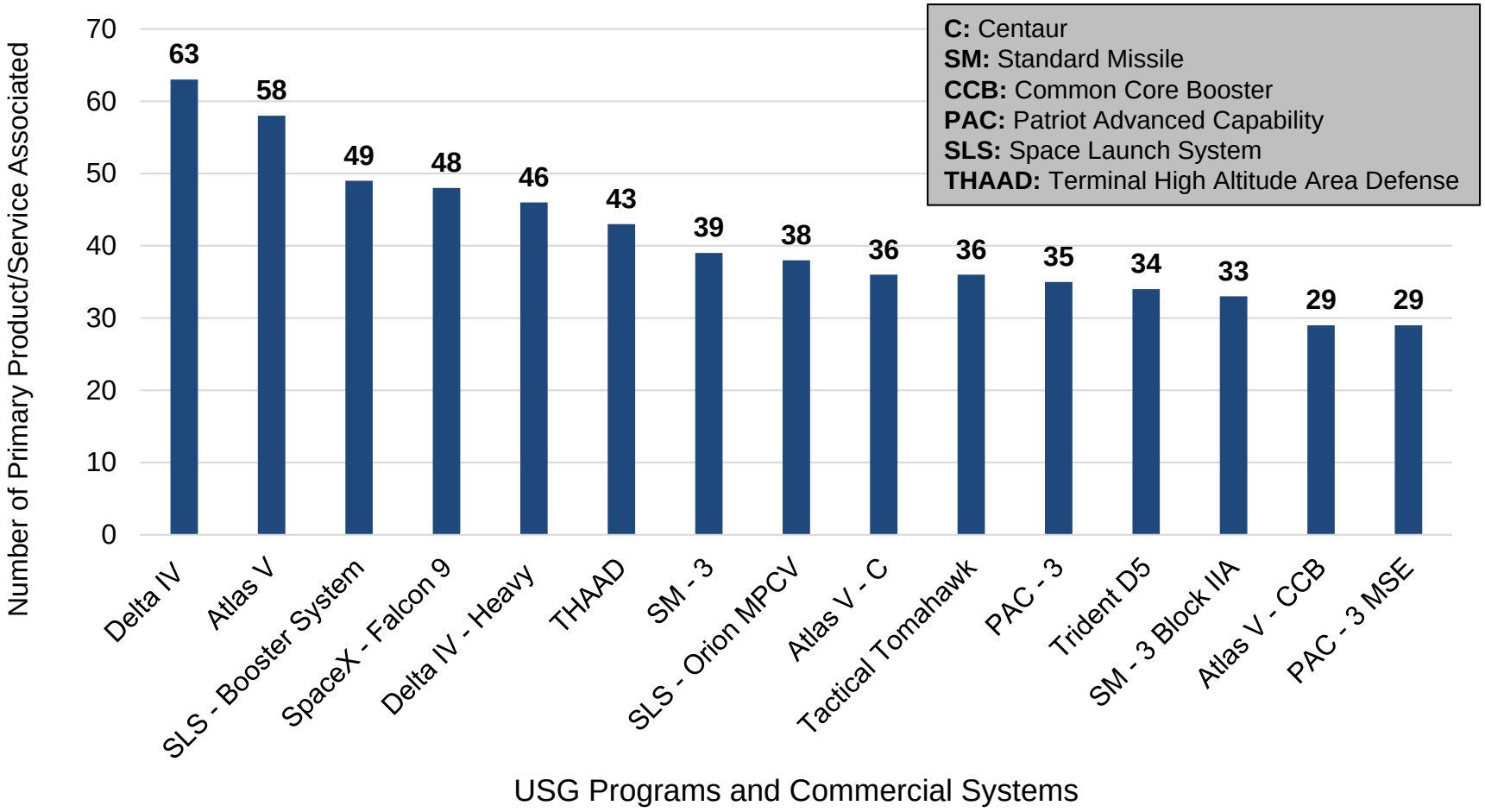
Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Q5b ,D

361 Respondents

Support to USG

Top 15 Supported USG Programs and Systems



Q5c, B

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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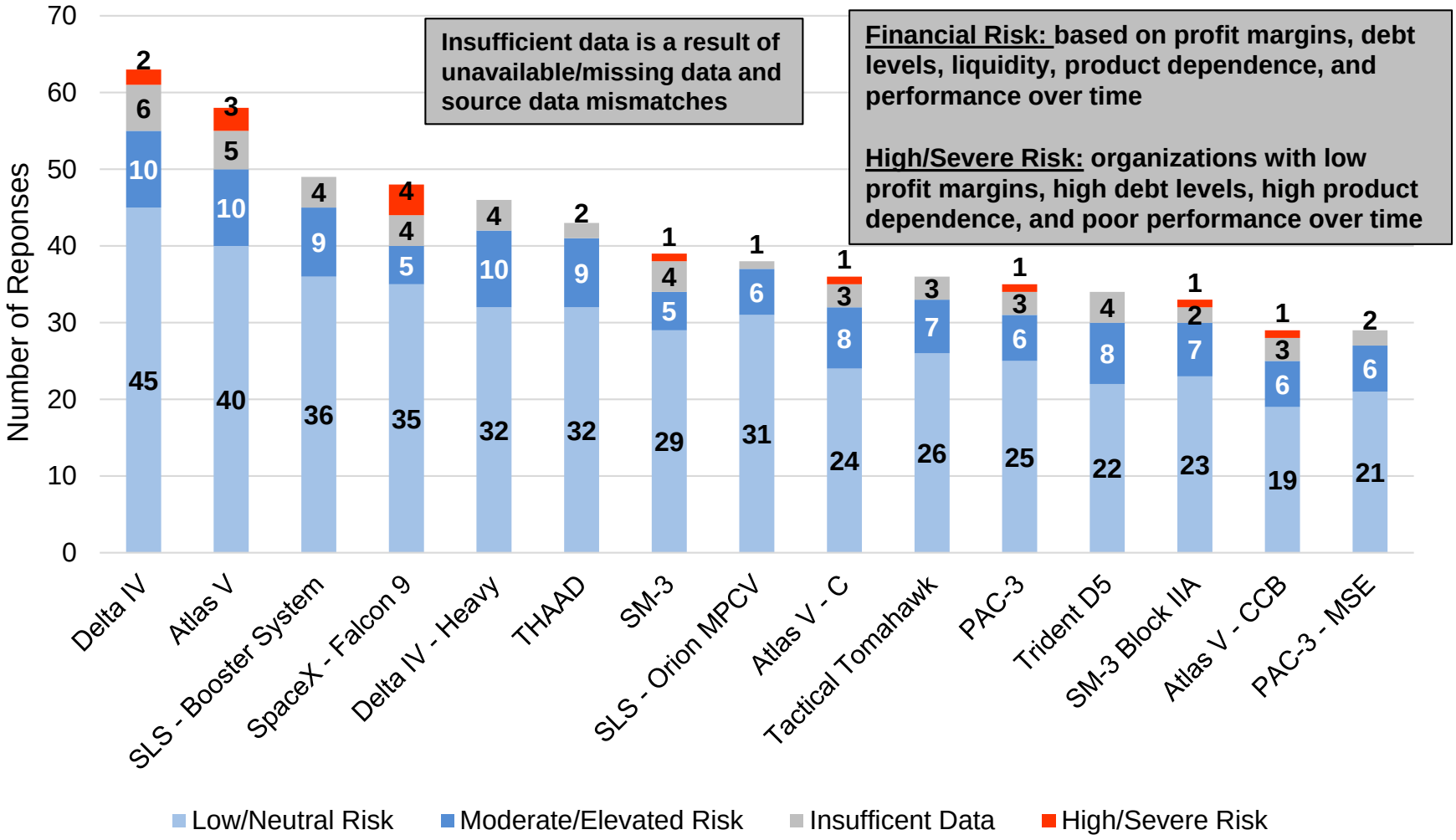
Support to USG

Financial Risk of Organizations by Program/System - 2016



Q5c, B

210 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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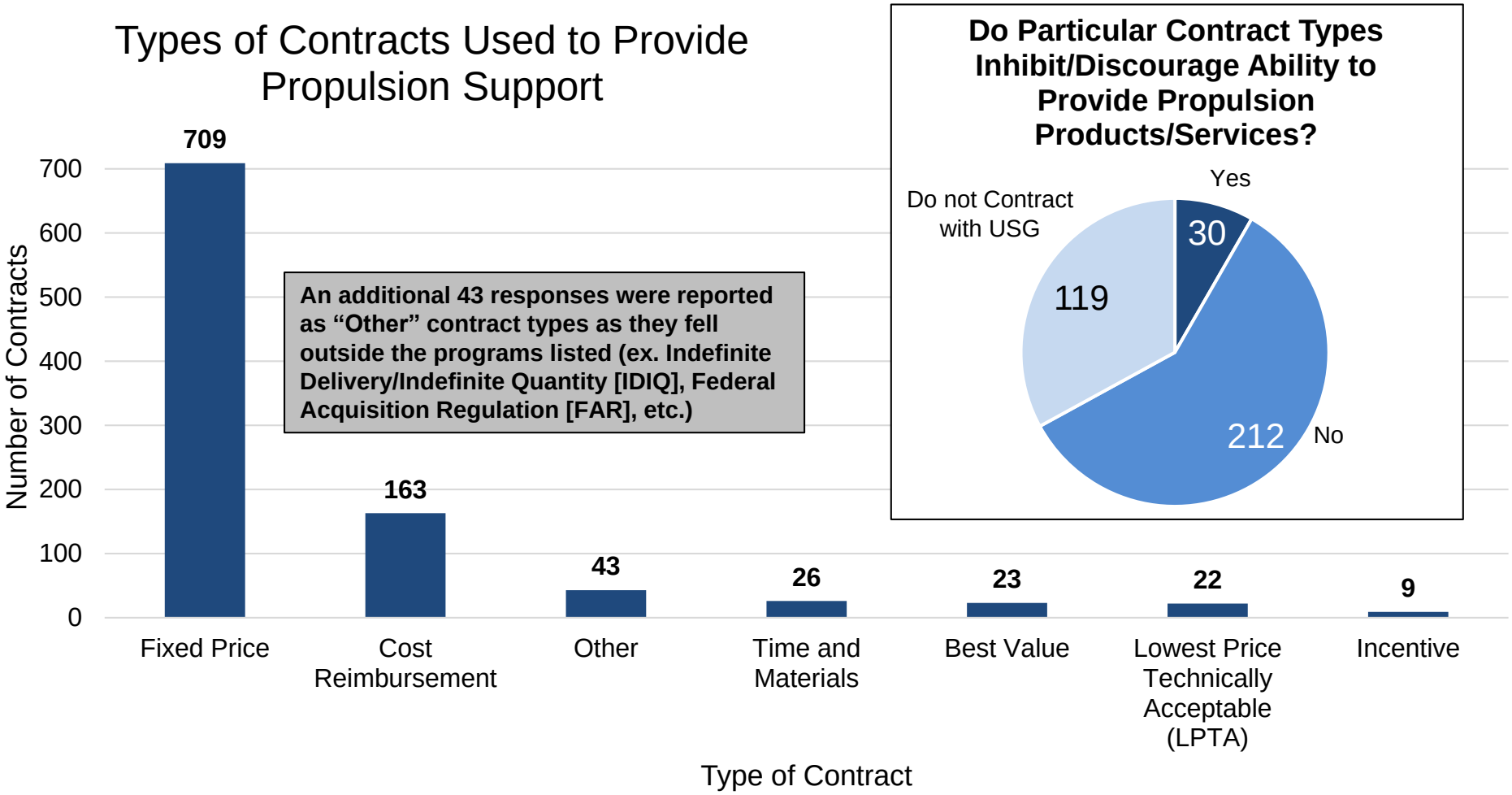
USG Contract Information

Most Common Propulsion-Related Contract Type



Q16, B-C

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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242 Respondents

USG Contract Information

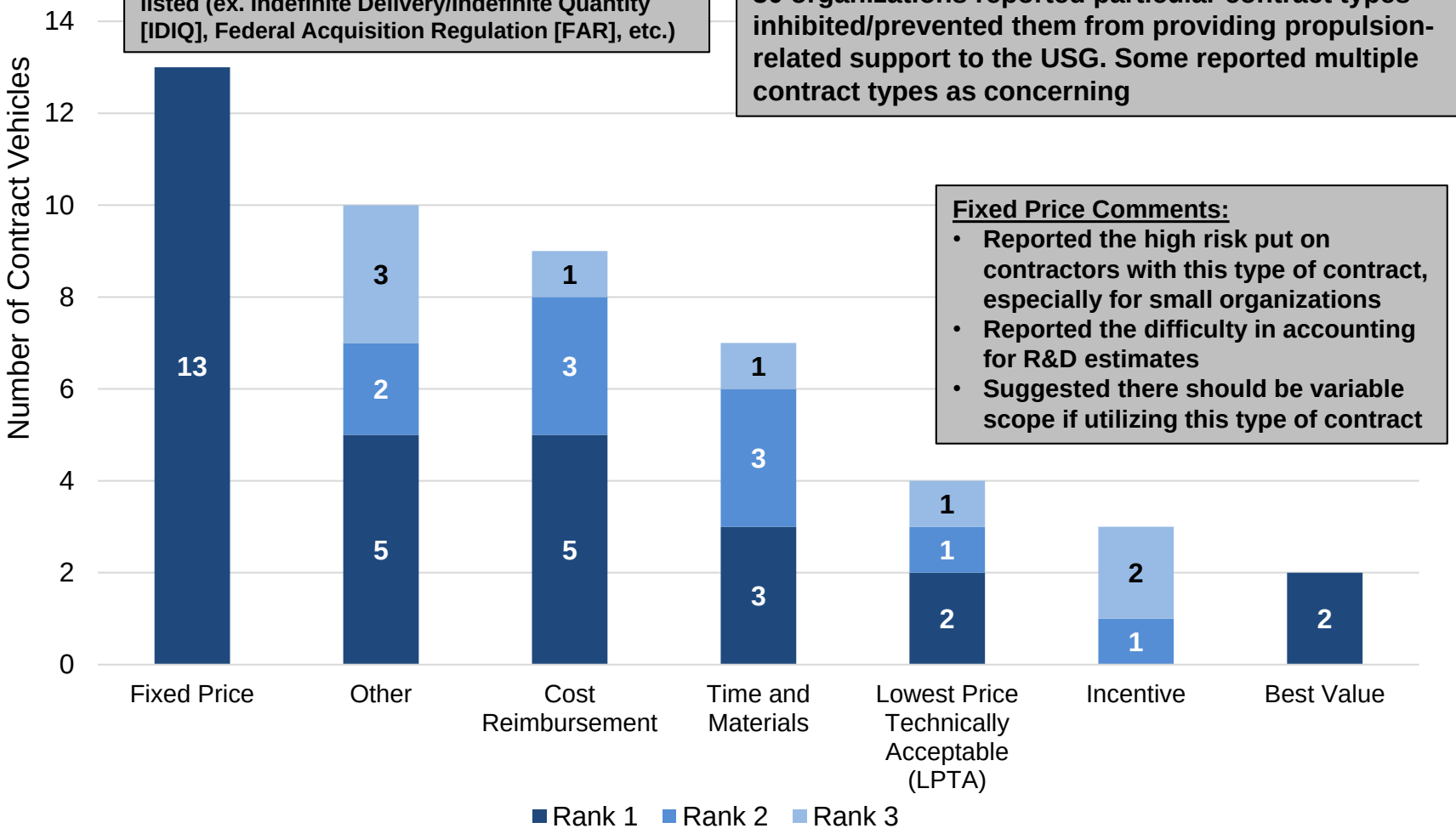
Most Concerning Contract Vehicles, Ranked 1-3

"Other" included contract types beyond those listed (ex. Indefinite Delivery/Indefinite Quantity [IDIQ], Federal Acquisition Regulation [FAR], etc.)

30 organizations reported particular contract types inhibited/prevented them from providing propulsion-related support to the USG. Some reported multiple contract types as concerning

Fixed Price Comments:

- **Reported the high risk put on contractors with this type of contract, especially for small organizations**
- **Reported the difficulty in accounting for R&D estimates**
- **Suggested there should be variable scope if utilizing this type of contract**



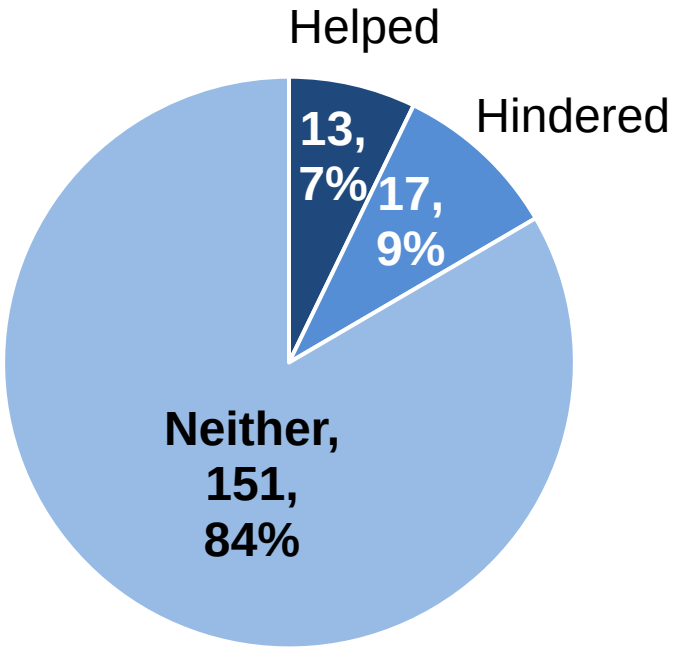
Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Q16, C, 1-3

30 Respondents

USG Contract Information

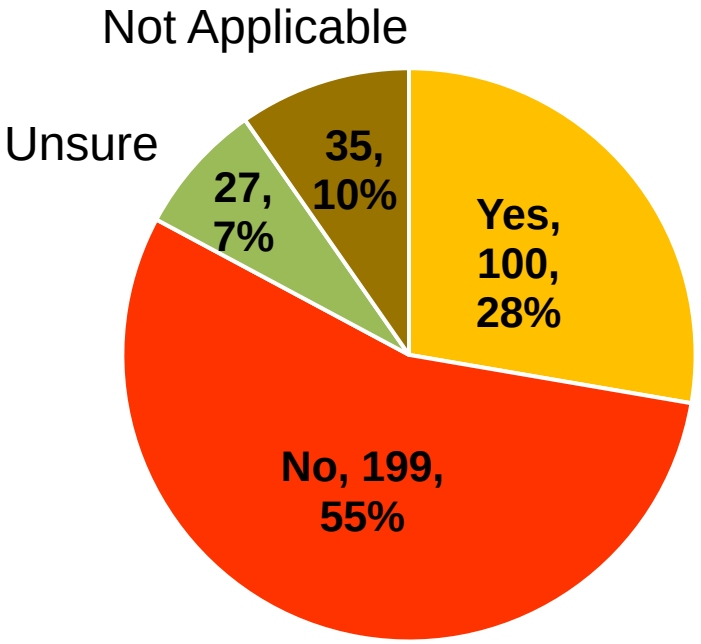
Effect of USG Acquisition Reform on Business Lines*



* Blank responses were not included

"Nobody comes to the small companies to get knowledge. USG not willing to understand lower tier and know who is making the parts for the programs." – Small Company

Does Your Organization Consider Itself Dependent on the USG?



Dependency is based on an organization's own assessment of its sustainability and operations

Q16, D-E

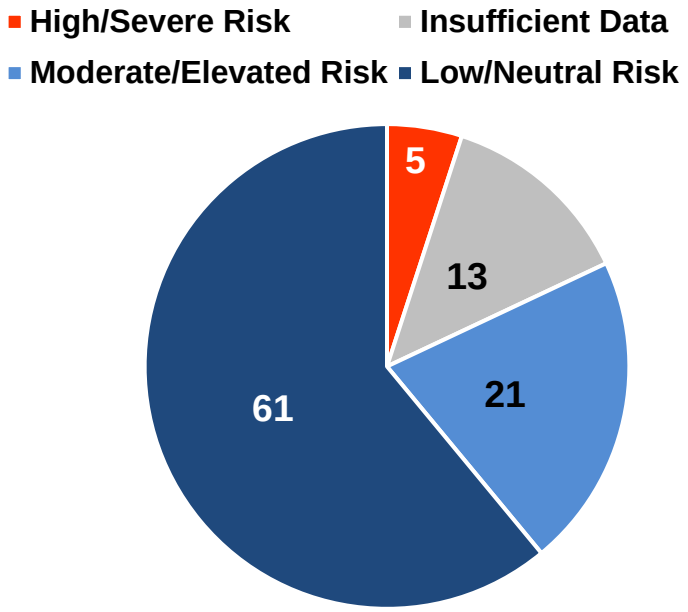
361 Respondents

Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018

Perceived Support to USG

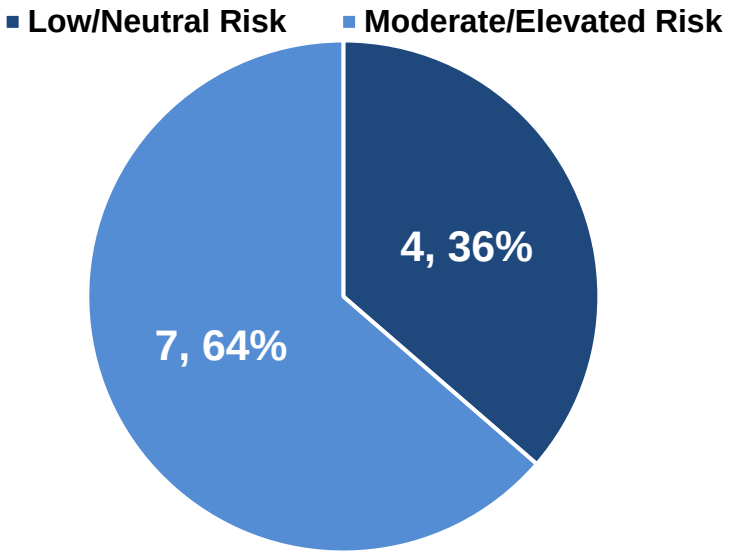
Perceived Dependence USG - 2016

Respondents that are USG Dependent by Financial Risk



Of the 100 organizations that identified their dependence on USG, 13 respondents did not provide enough data to calculate financial risk.

Financial Risk of Respondents that are USG Dependent and Engaging in DMSMS Activities



11 respondents identified being dependent on USG and identified engaging in DMSMS activities.

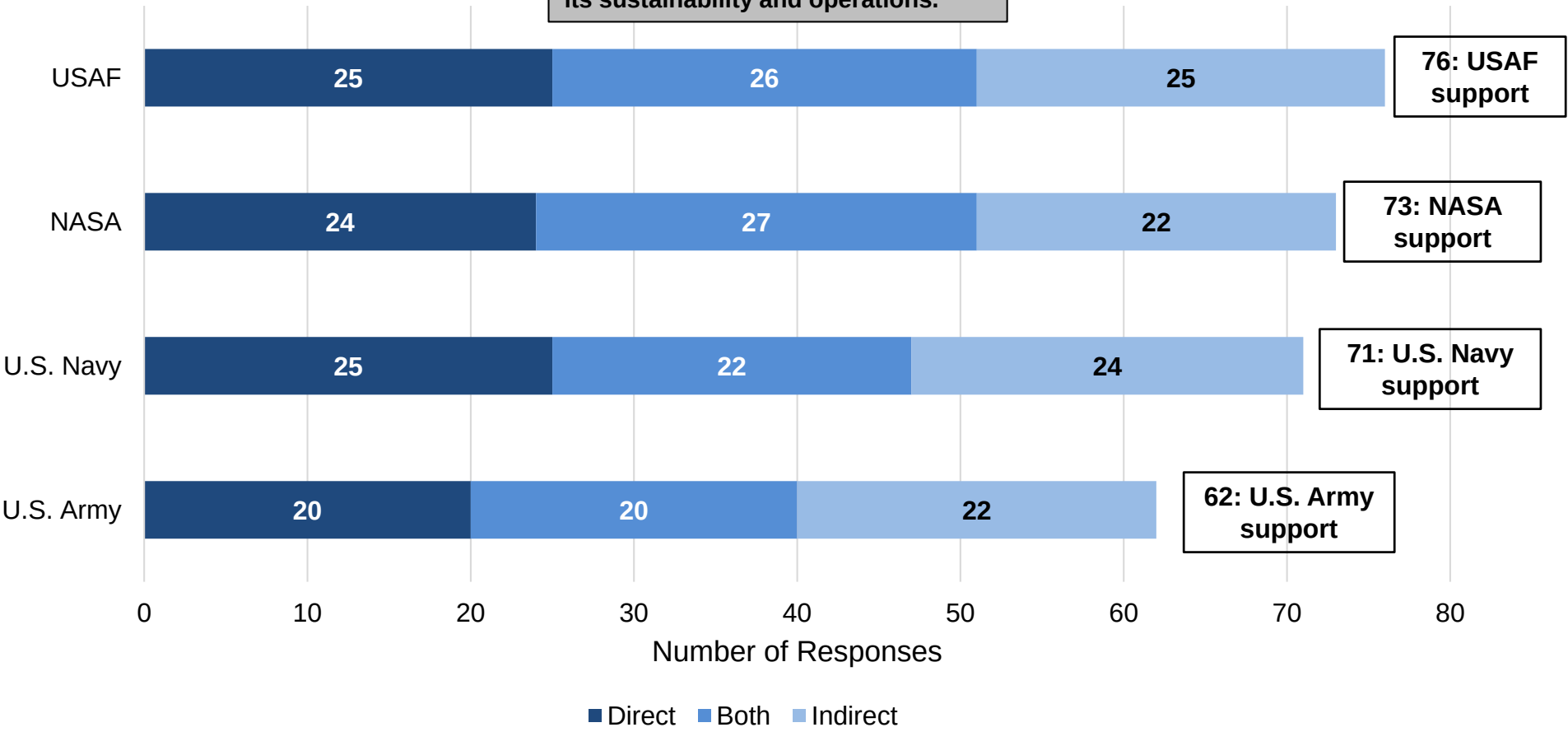
Q16, E

100 Respondents

Perceived Support to USG

Self-Determined Dependence USG JANNAF Agencies

Dependency is based on an organization's own assessment of its sustainability and operations.



Q16, E, 1

100 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Counterfeit Parts

- Six organizations reported identifying counterfeit parts in 2013, 2014, and 2015
- Reported counterfeit parts included bearings, fabrications, electrical systems and components, and igniter systems and components
- Four organizations identified counterfeit parts as originating in the U.S., while two organizations identified counterfeit parts as originating outside the U.S.
- Nineteen organizations identified cyber security breaches as a threat to long-term viability. Of the nineteen organizations identified, three organizations also identify counterfeit parts as a threat

17b, D

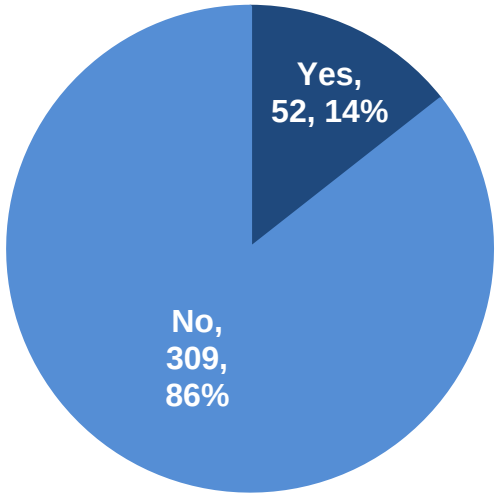
6 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

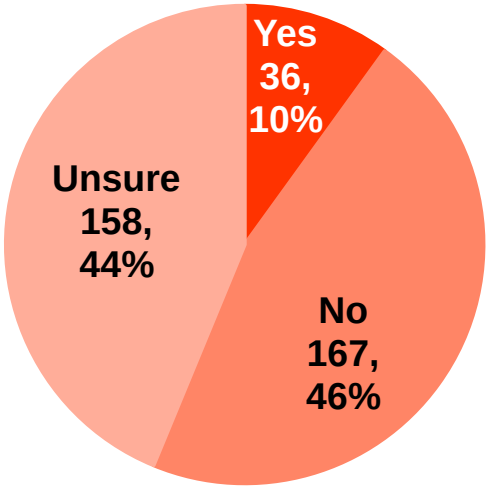
U.S. Air Force Release of Surplus ICBM Motors

Respondent Perspectives - 2016

Are you familiar with USAF plans to release surplus ICBM motors into the commercial market?



Does your organization perceive the release of ICBM motors as damaging?



Indicate your organization's anticipated harm/benefit resulting from the proposed release of surplus ICMB solid rocket motors by USAF

Perceived Harm	Respondents (361)
Direct	14
Indirect	16
Both	6
Unsure	158
None	167

Perceived Benefit	Respondents (361)
Direct	12
Indirect	3
Both	4
Unsure	82
None	260

17b, E

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Propulsion-Related Patents

- How many of your organization's patents registered with U.S. Patent and Trademark Office (PTO) are propulsion-related?
- Thirty (30) respondents reported a total of 1,119 propulsion-related patents from 2013-2017
  - Of the 30 respondents identified: 15 were large companies, 7 were medium companies, and 8 were small companies
- A single organization reported detecting a patent infringement
- The organization reported being unable to resolve the patent infringement issue
  - "They published proprietary information which they were prohibited from doing under an NDA they signed." – Small Company

17b, G

30 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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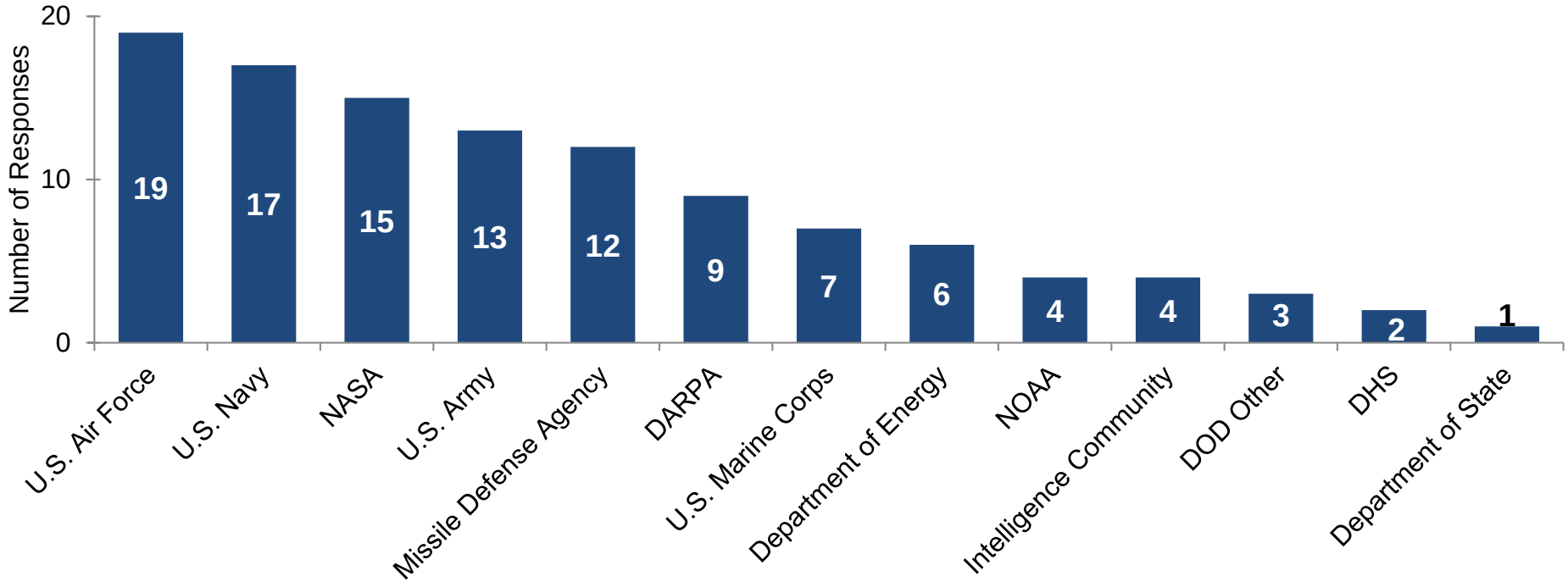
Diminishing Manufacturing Sources & Material Shortages (DMSMS)

- 19 respondents indicated their facilities engage in DMSMS activities
- A Diminishing Manufacturing Sources and Material Shortages (DMSMS) issue is the loss, or impending loss, of manufacturers or suppliers of items, raw materials, or software
- Support of U.S. Agencies by those 19 respondents:



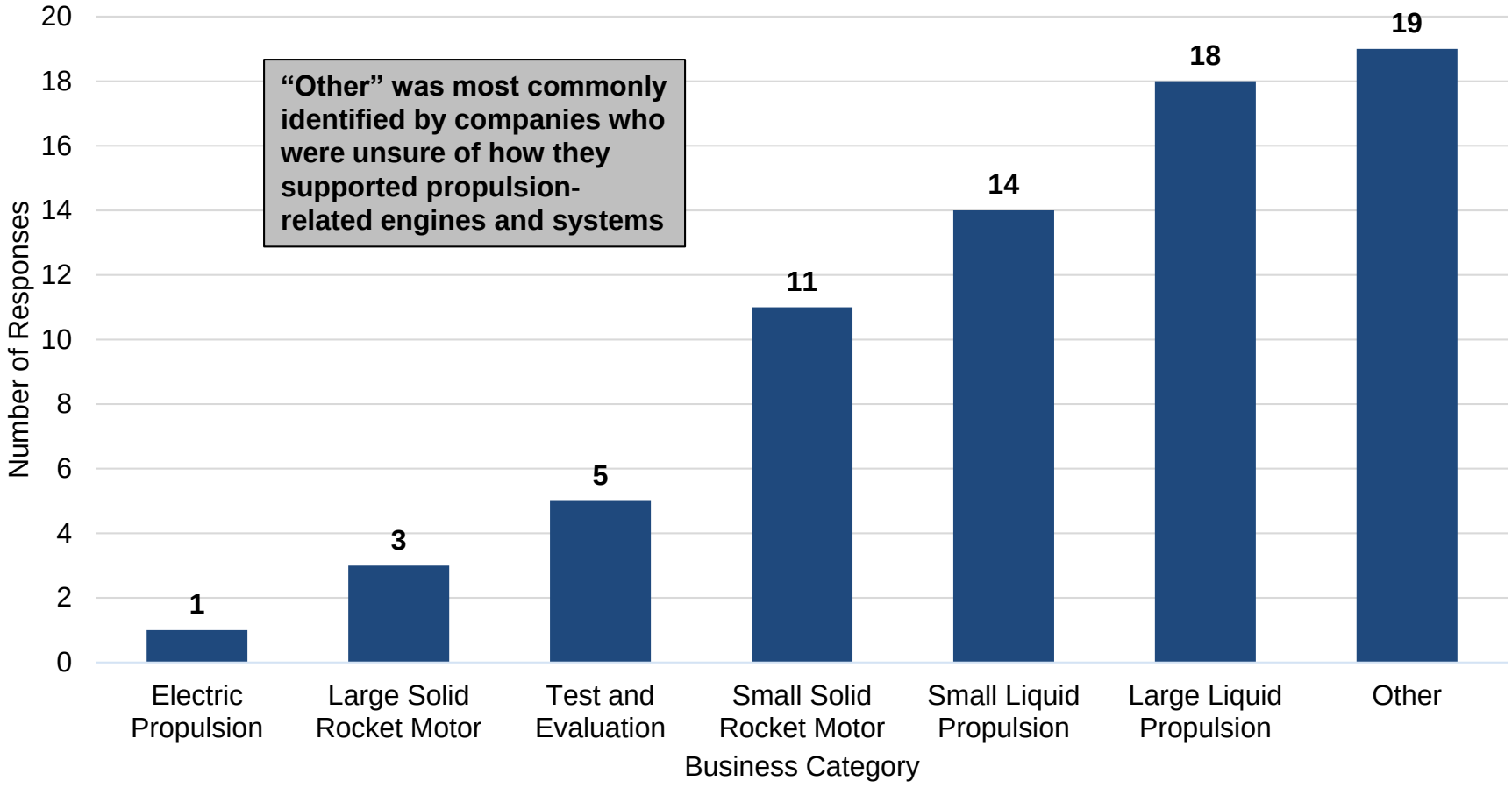
Q17b, C

19 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Diminishing Manufacturing Sources & Material Shortages (DMSMS)

Propulsion Industrial Base Support – By Business Categories

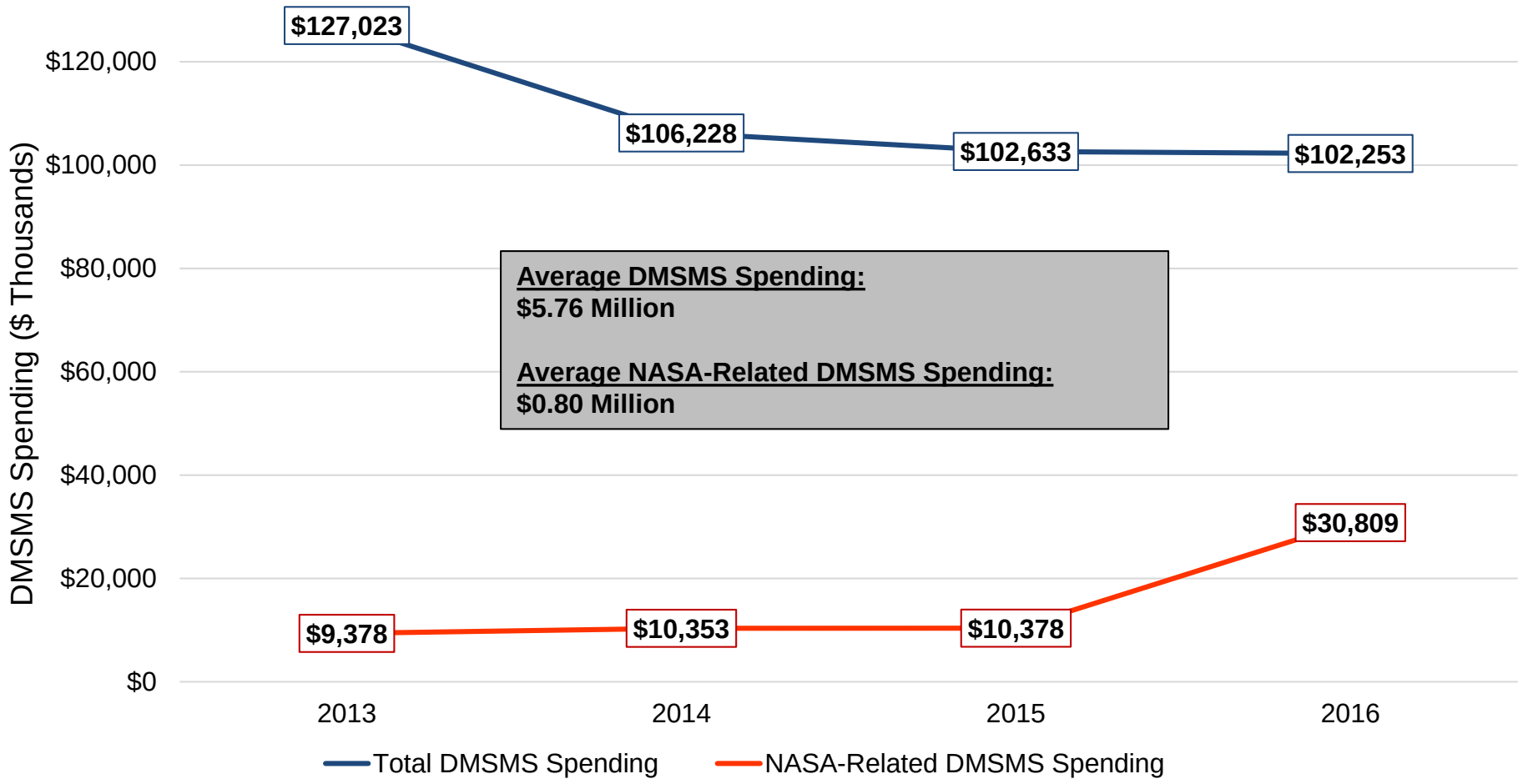


Q17b, C

19 Respondents

Diminishing Manufacturing Sources & Material Shortages

By DMSMS Spending – 2013-2016



Q17b, C

19 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Security: Cyber/Physical

- **Cyber Security:** The body of technologies, processes, and practices designed to protect networks, computers, programs, and data from attack, damage, or unauthorized access

- **Commercially Sensitive Information (CSI):** Privileged or proprietary information which, if compromised through alternation, corruption, loss, misuse, or unauthorized disclosure could cause serious harm to the organization owning it

- **CSI Can Include:** Customer/client financial records, intellectual property, internal communications, manufacturing and production line information, patents and trademarks, R&D information, and supplier/supply chain information

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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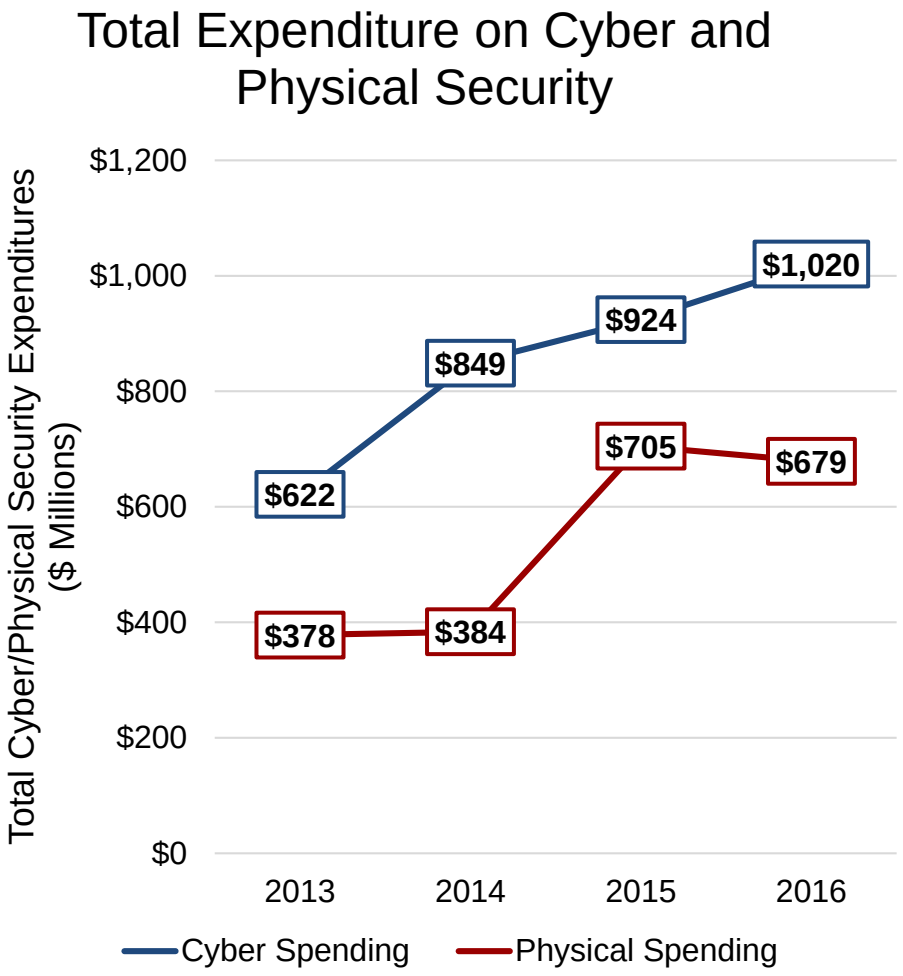
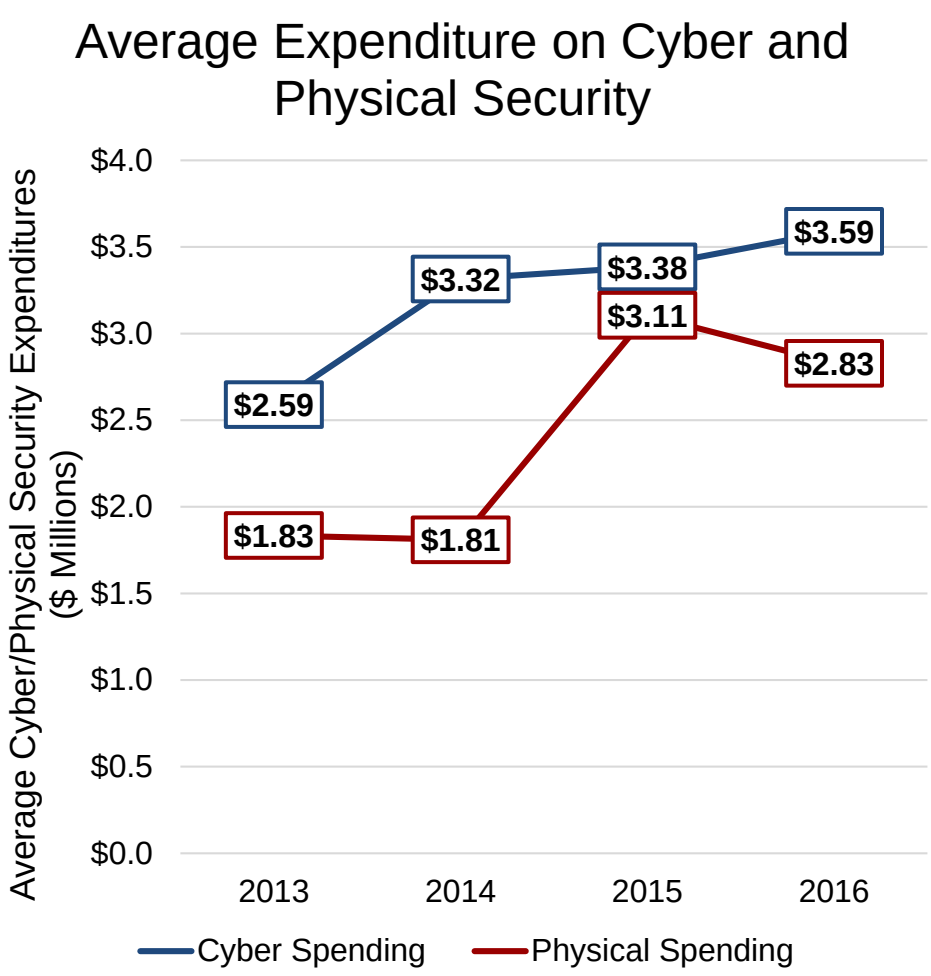
Security: Cyber/Physical

Expenditures – 2013-2016





Q18, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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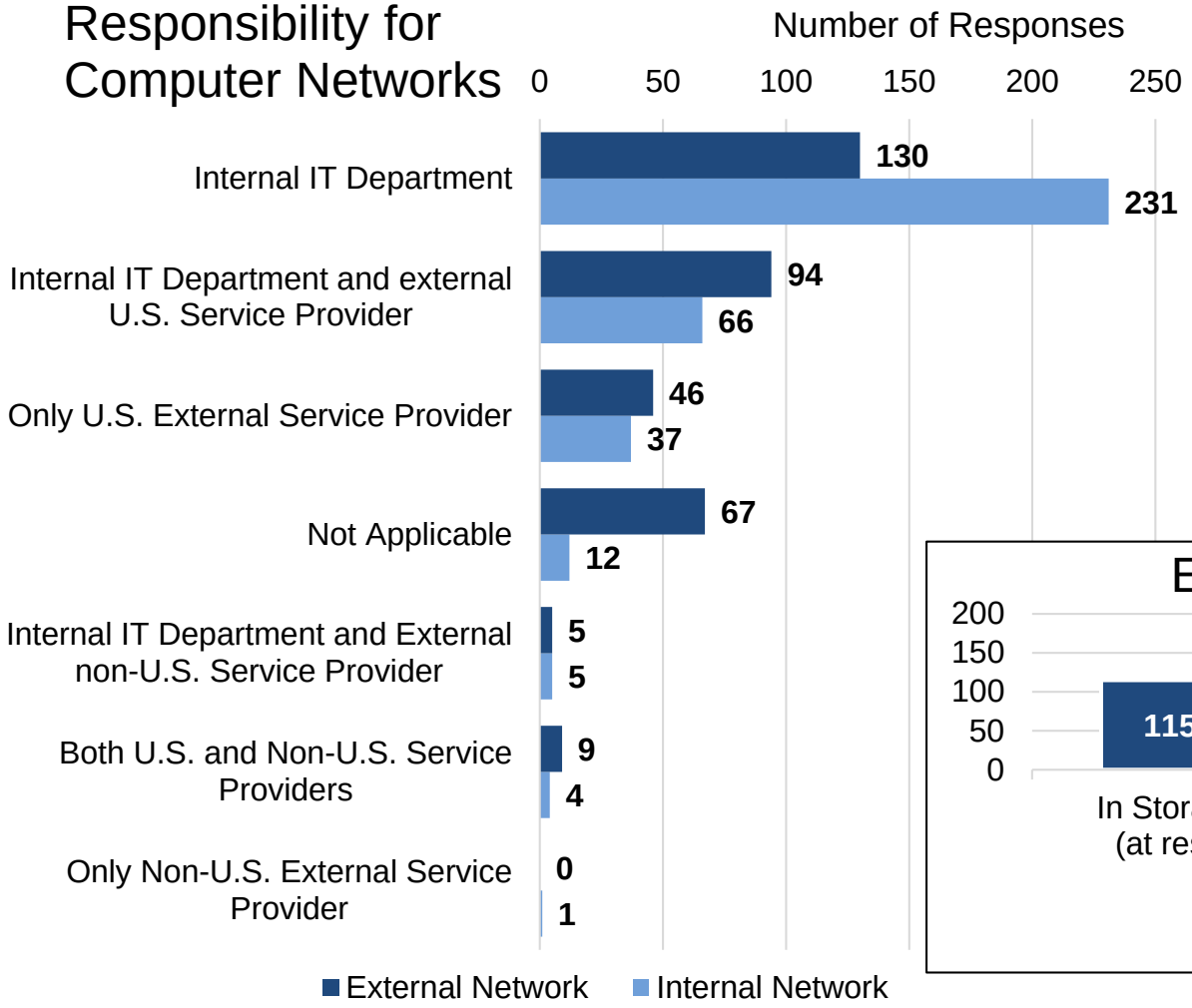
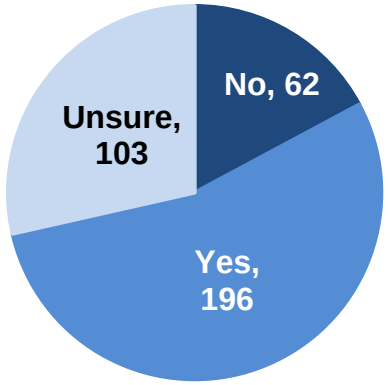
Security: Cyber/Physical

Network Administration – 2016

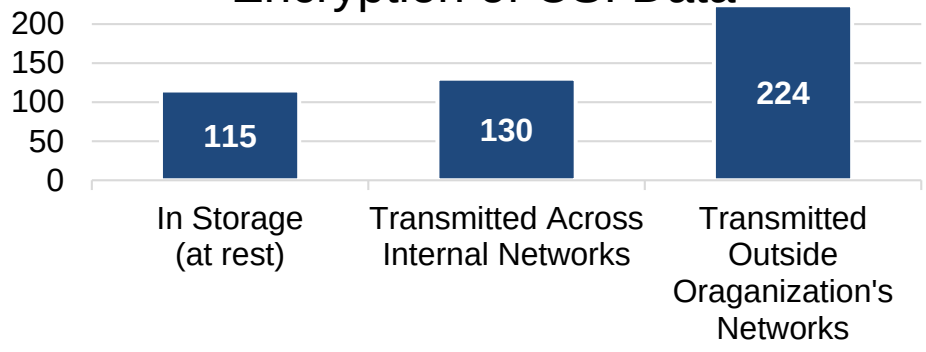
Responsibility for Computer Networks



Able to Detect the Theft of CSI?



Encryption of CSI Data



Q18, C

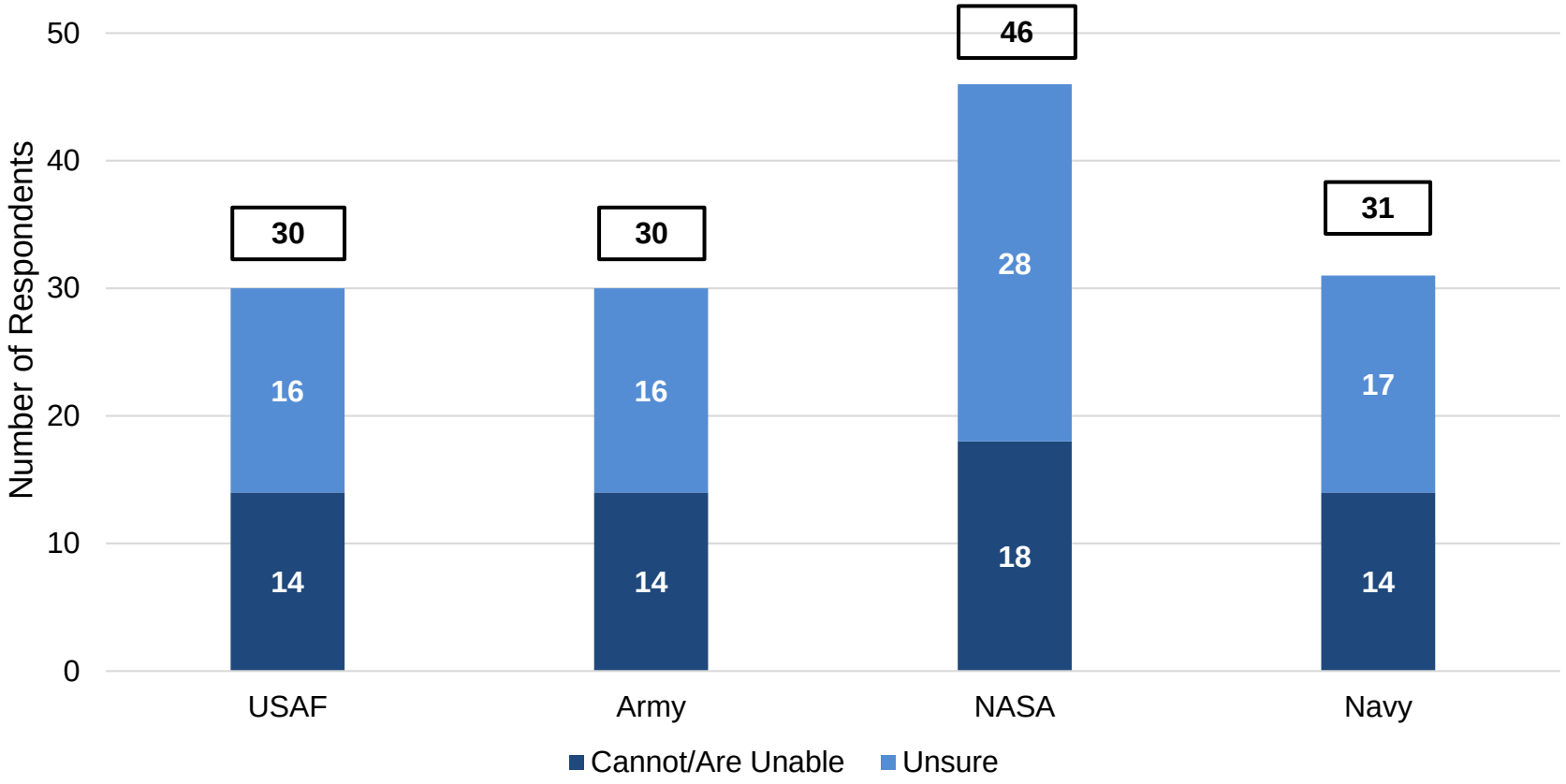
Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

361 Respondents

Security: Cyber/Physical

Direct JANNAF Suppliers and CSI Theft Detection

Organizations that Cannot/Are Unable to Detect CSI Theft



Q18, E

165 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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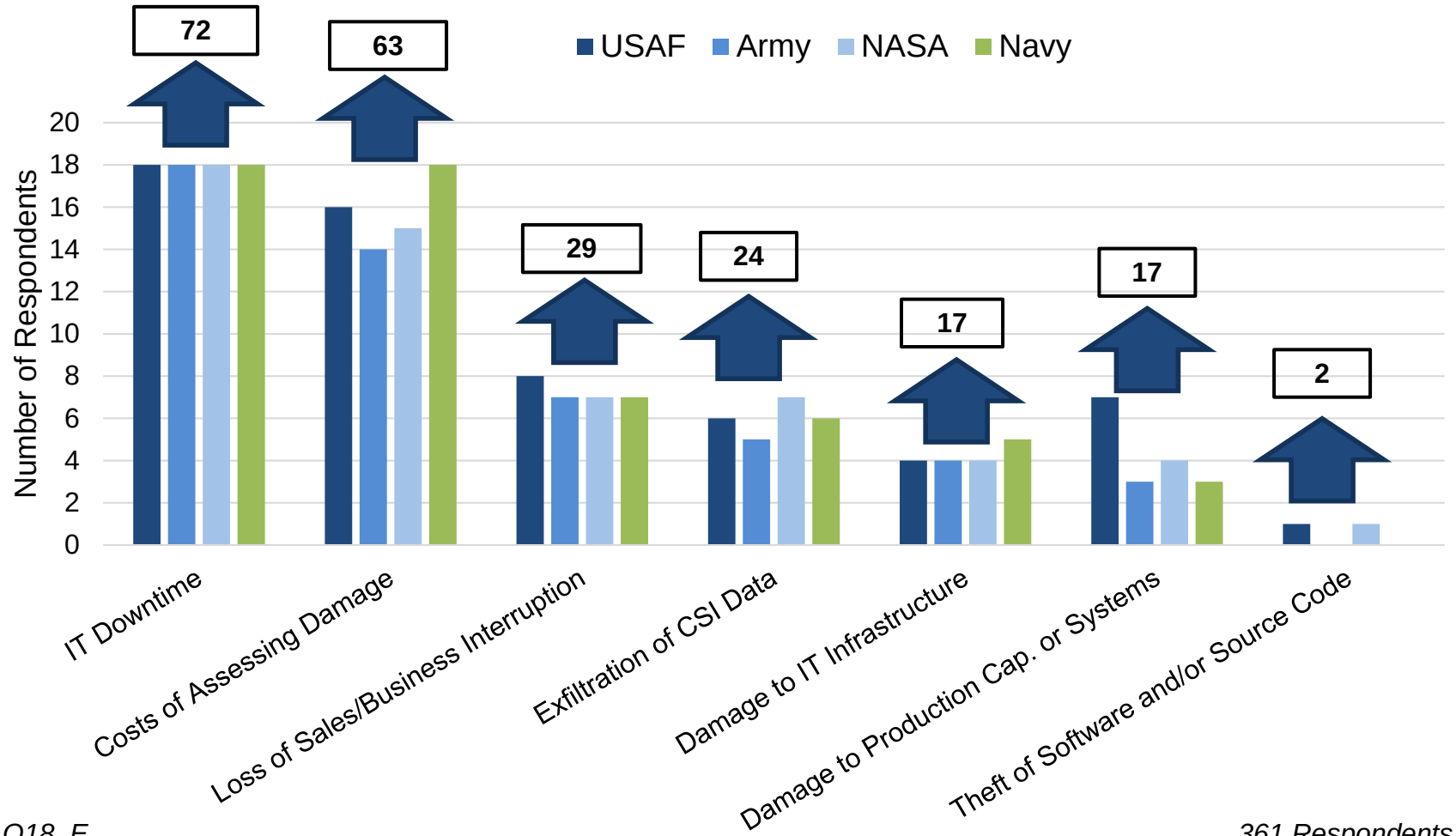
Security: Cyber/Physical

Direct JANNAF Suppliers

Cyber Impacts by Type of DOD Service - 2013-2016



Q18, E

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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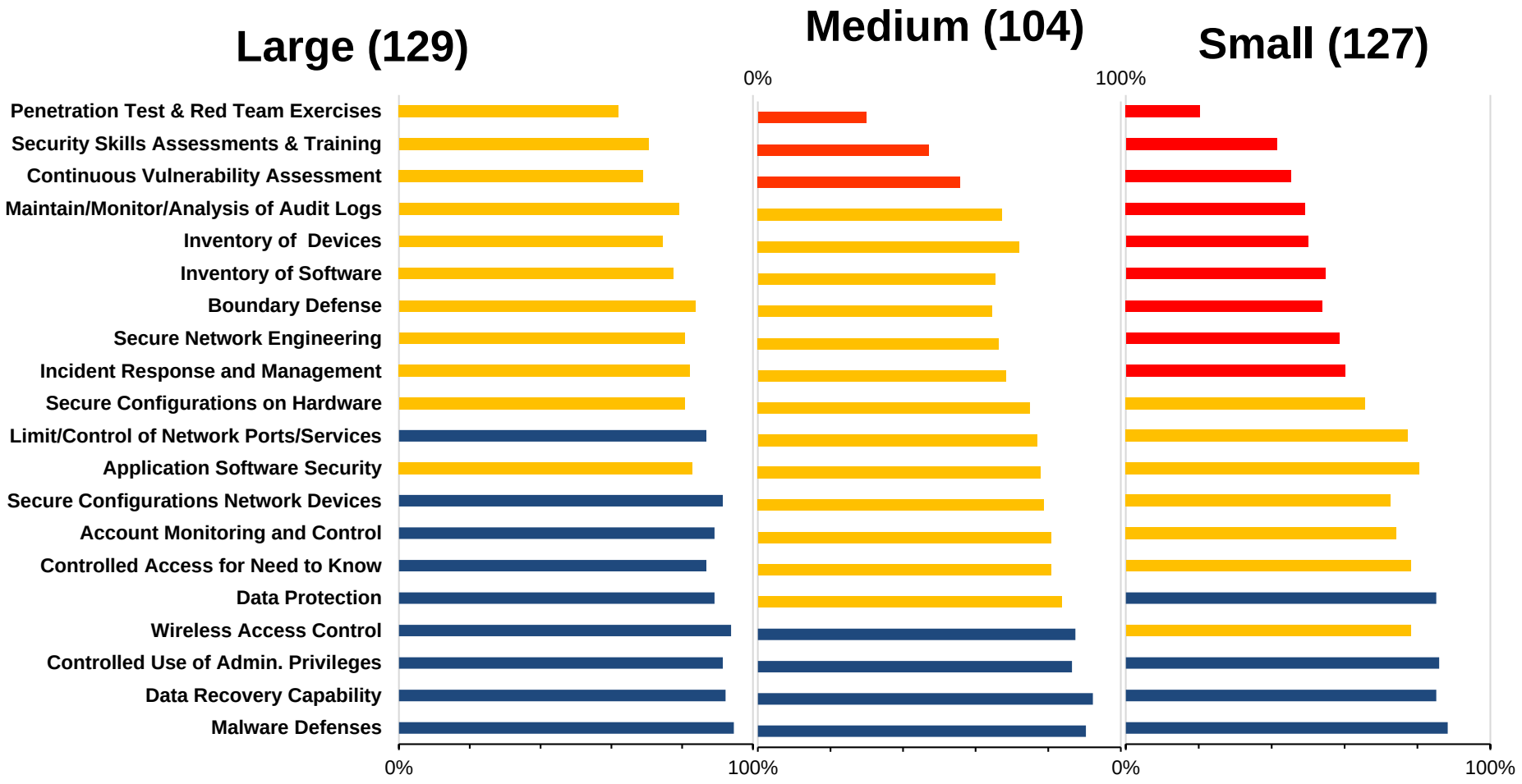
Security Measures by Organization Size

Large: >$50M Medium: $10M - $50M Small: <$10M (2016)



Values denote % of Companies (e.g. 85-100% of Large Companies employ Malware Defenses

1 respondent excluded because they did not begin sales until after 2016

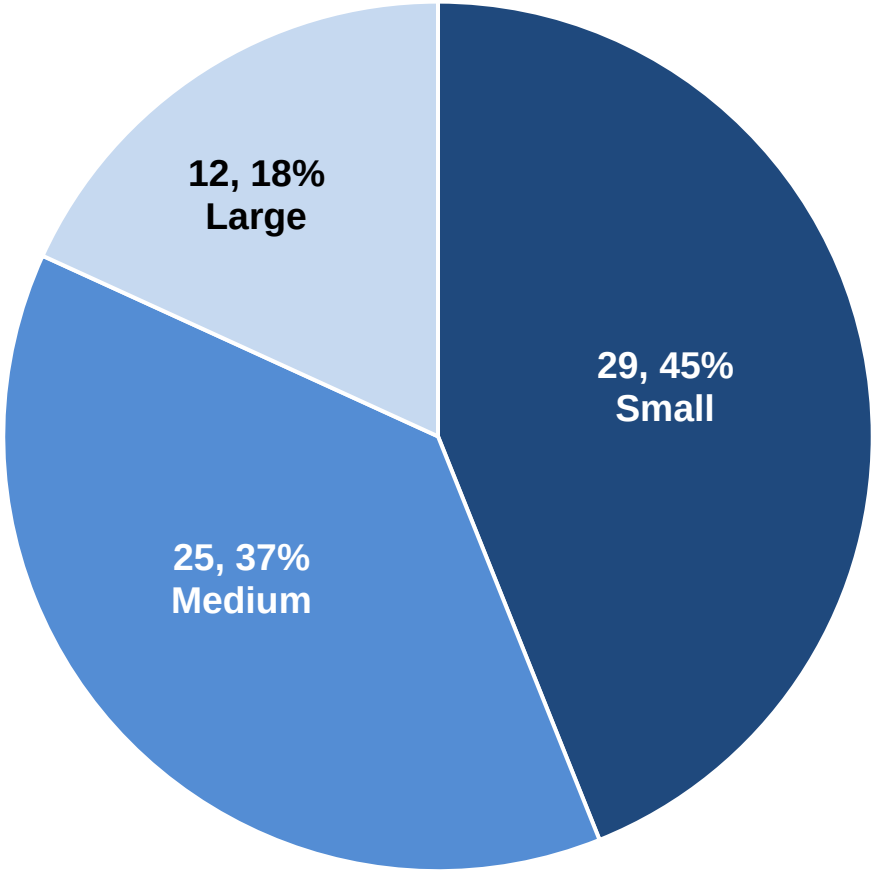
Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

Q18, D

360 Respondents

Companies Seeking Cyber Security Support

Large: >$50M Medium: $10M - $50M Small: <$10M (2016)



44% of companies seeking additional cyber security support are Small Businesses

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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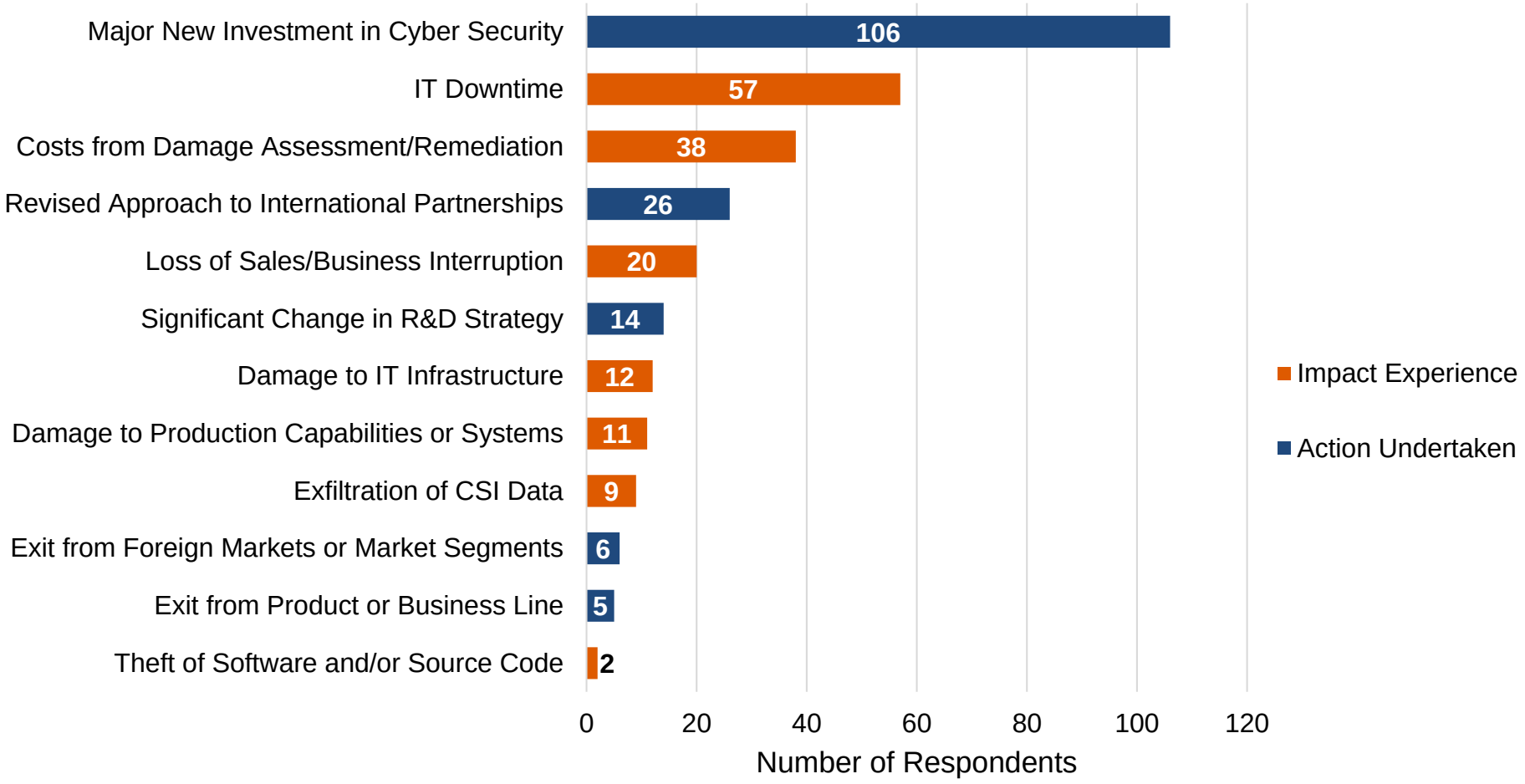
Q18, D

66 Respondents

Cyber Security

Impacts and Actions of Malicious Cyber Activity – 2013-2016



Q18, E

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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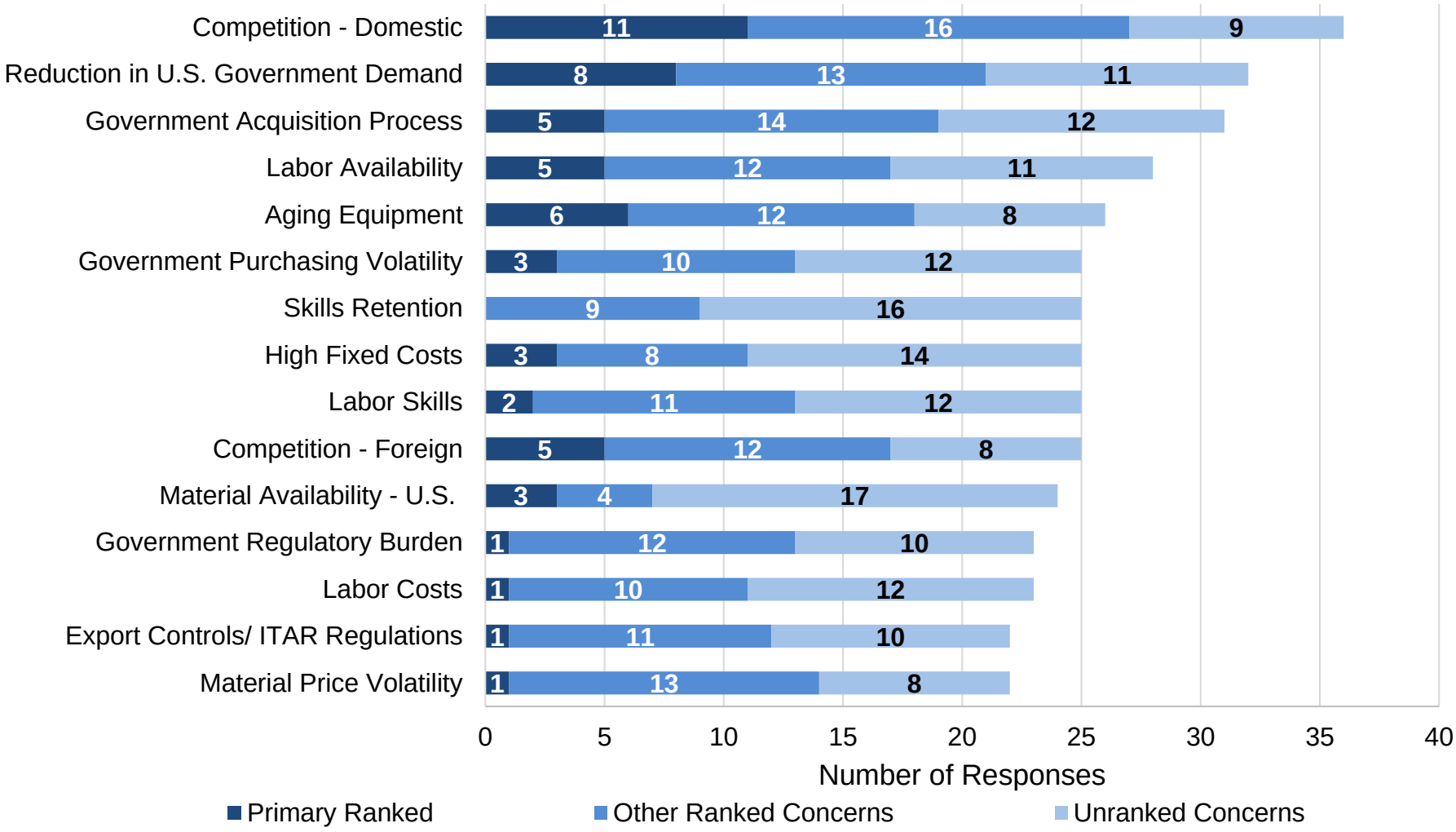
Top Organizational Challenges

Large-Size Organizations (>$50M) Top 15 Rankings



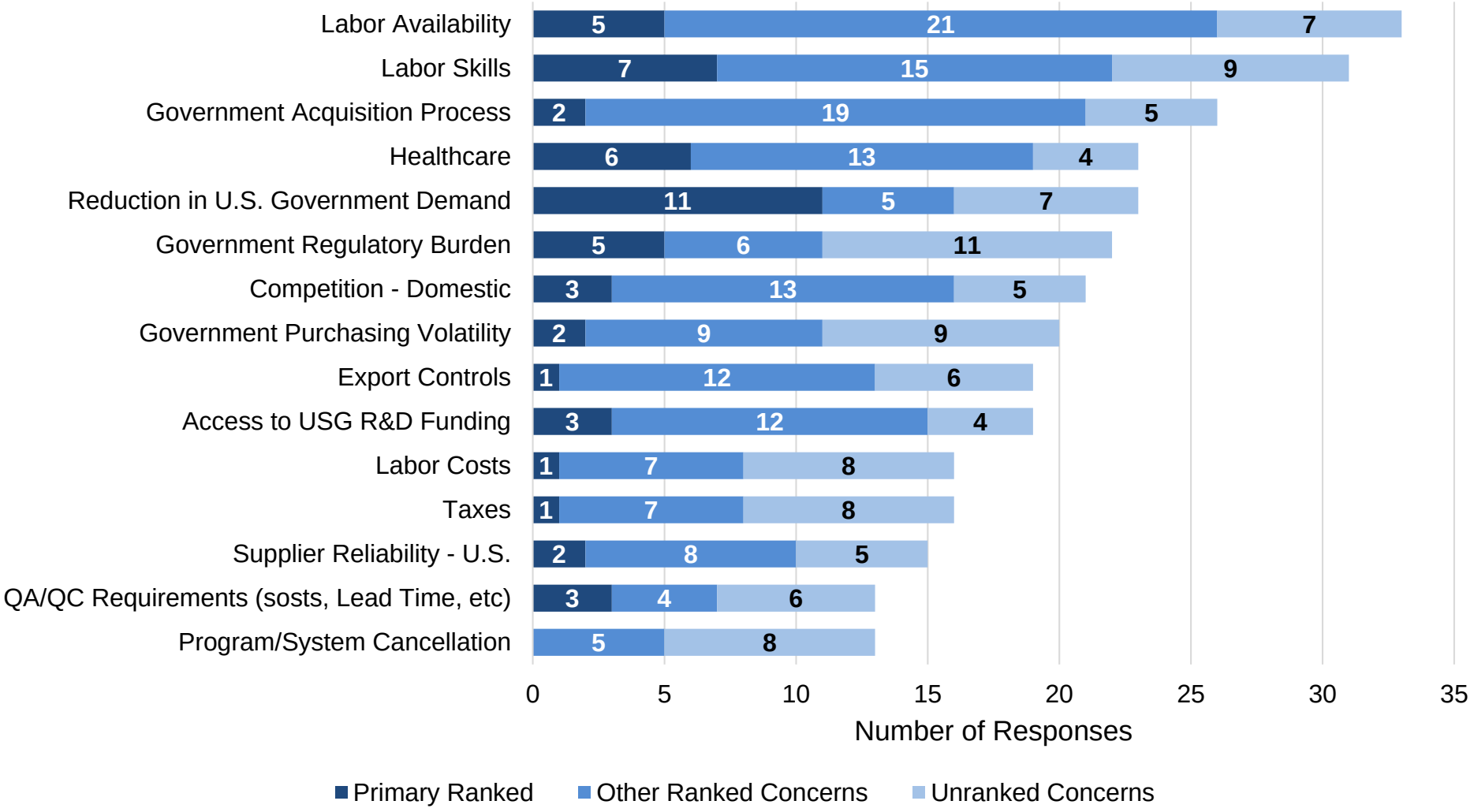
Q17a

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

129 Respondents

Top Organizational Challenges

Medium-Size Organizations ($10M - $50M) Top 15 Rankings



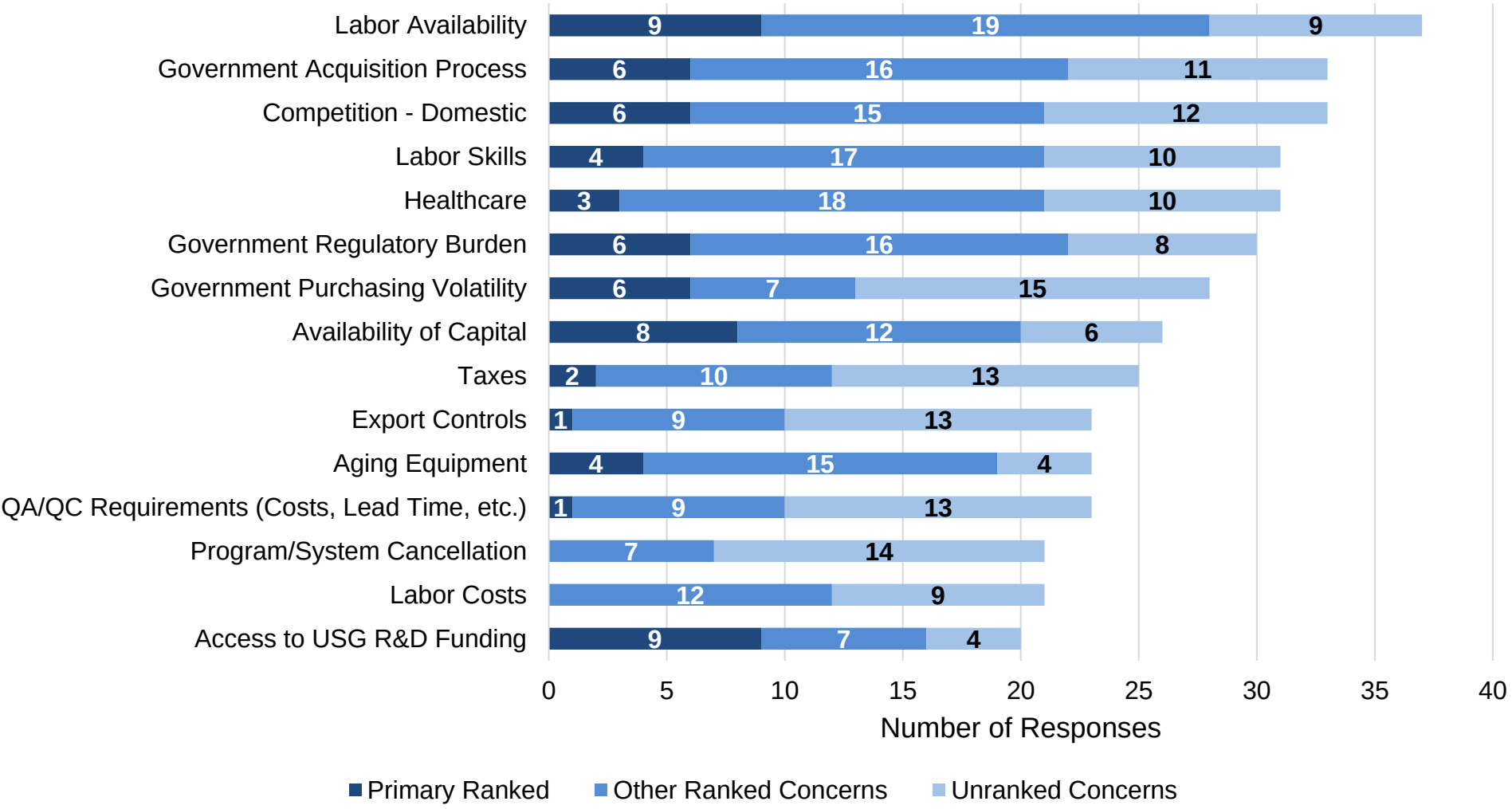
Q17a

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
FOR PUBLIC DISTRIBUTION

104 Respondents

Top Organizational Challenges

Small-Size Organizations (<$10M) Top 15 Rankings



Q17a

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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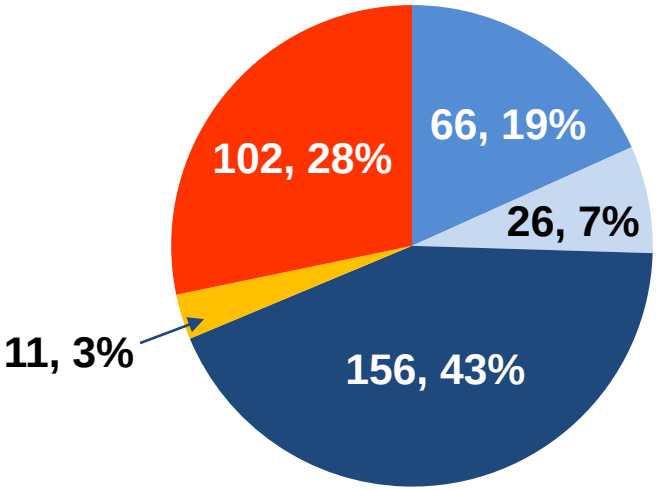
128 Respondents

Competitiveness/Long-Term Viability

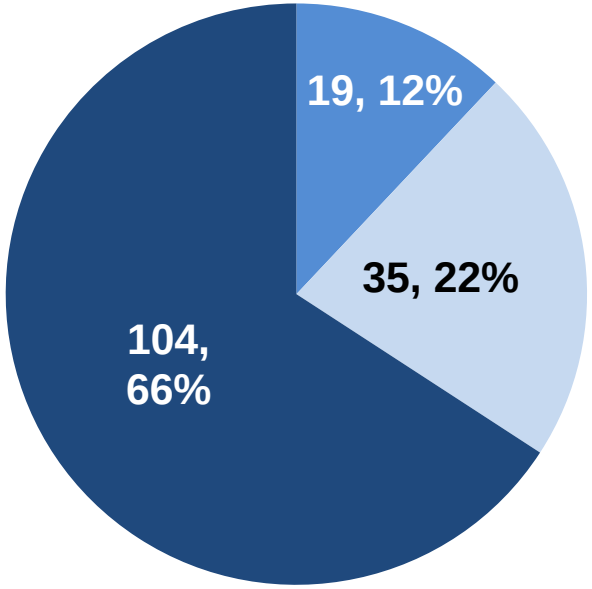
Export Controls

Sell Product/Services That Are Export Controlled (248)



248 of 361 respondents reported selling export controlled product/services.

Export Product/Services That Are Export Controlled (158)



158 of 361 respondents reported exporting product/ services that are export controlled

Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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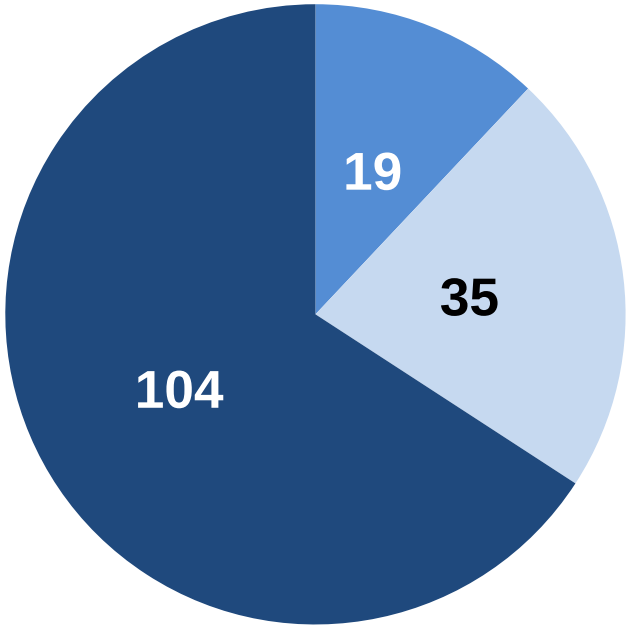
Q17b, A

361 respondents

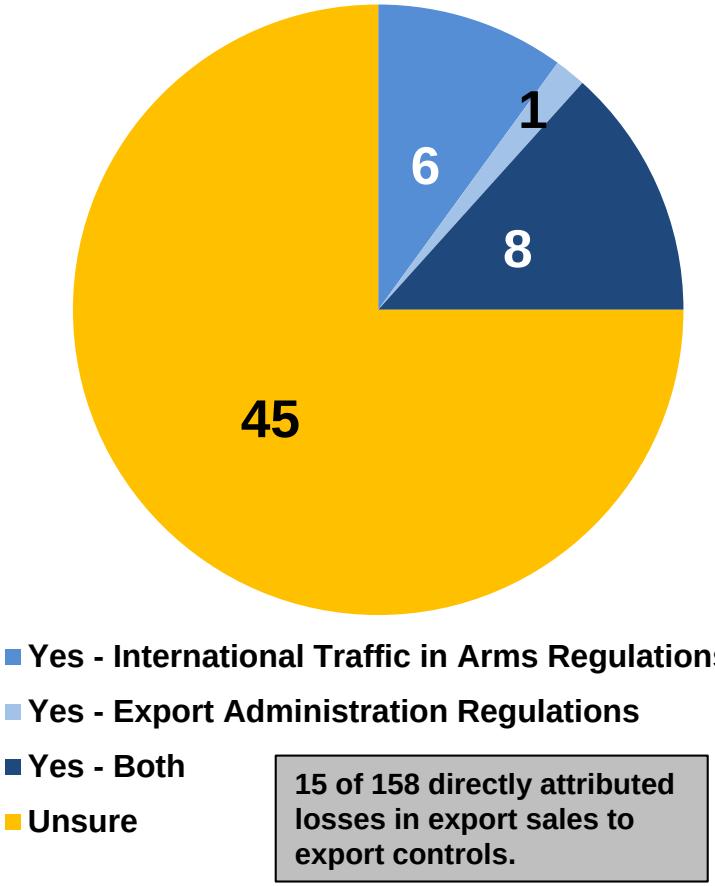
Competitiveness/Long-Term Viability

Export Controls – 2013-2016

Export Product/Services That Are Export Controlled (158)



Loss of Export Sales Opportunities of Propulsion-Related Products/Services (60)



15 of 158 directly attributed losses in export sales to export controls.

Q17b, A

Source: U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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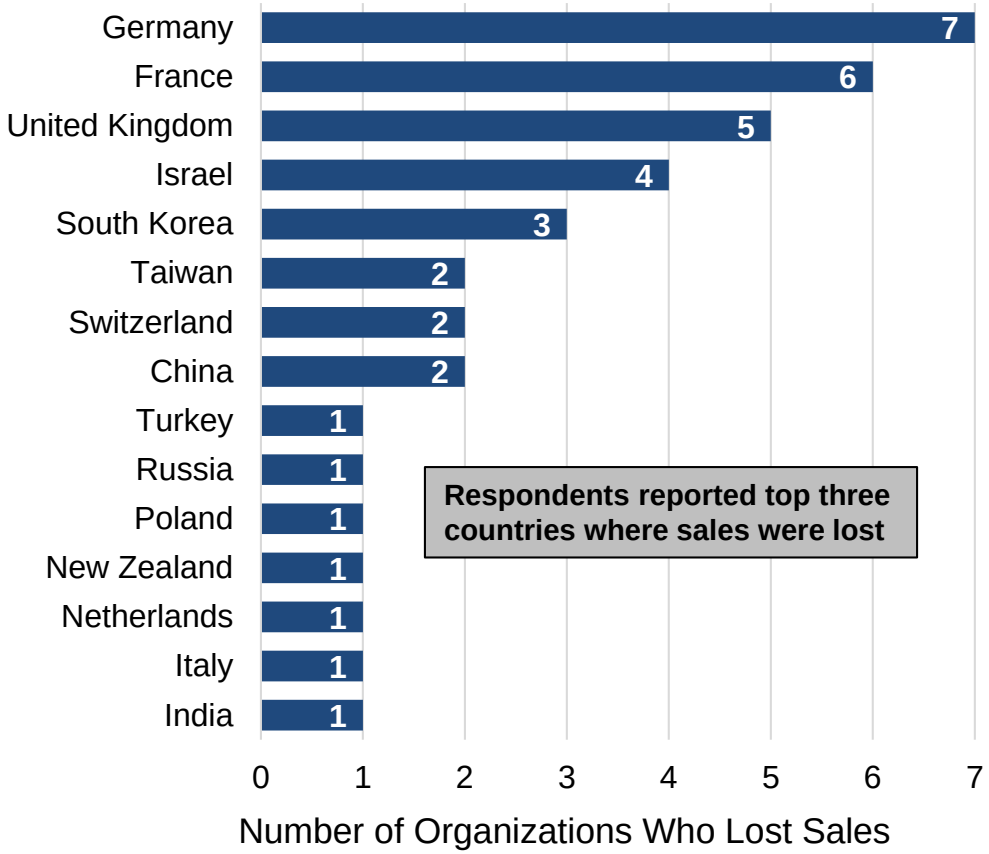
158 Respondents

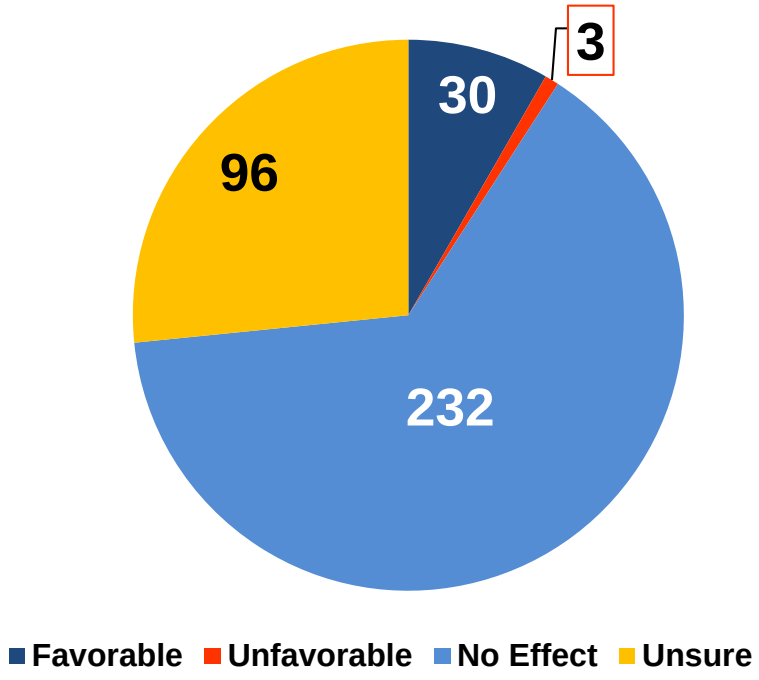
Competitiveness/Long-Term Viability

Export Controls – 2013-2016

Countries Where Export-Related Sales Were Lost



Impact of Export Control Reform on Propulsion-related Technology



17b, A&B

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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Competitiveness/Long-Term Viability

Export Controls – 2013-2016

Actions Taken in Response to Export Controls	ITAR	Both	EAR
Avoid Exporting	19	15	3
Incentivize "design-out"	14	6	-
Incentivize "ITAR Free"	13	6	-
Engage in Cost-sharing	7	3	1
Modify to avoid export-control	5	4	1
Reduce/eliminate investment in R&D	7	3	-
Related production outside the U.S.	6	3	-
Reduce/eliminate investment in production	6	3	-
Discontinue Production	2	5	1
Related R&D outside the U.S.	5	2	-

17b, A&B

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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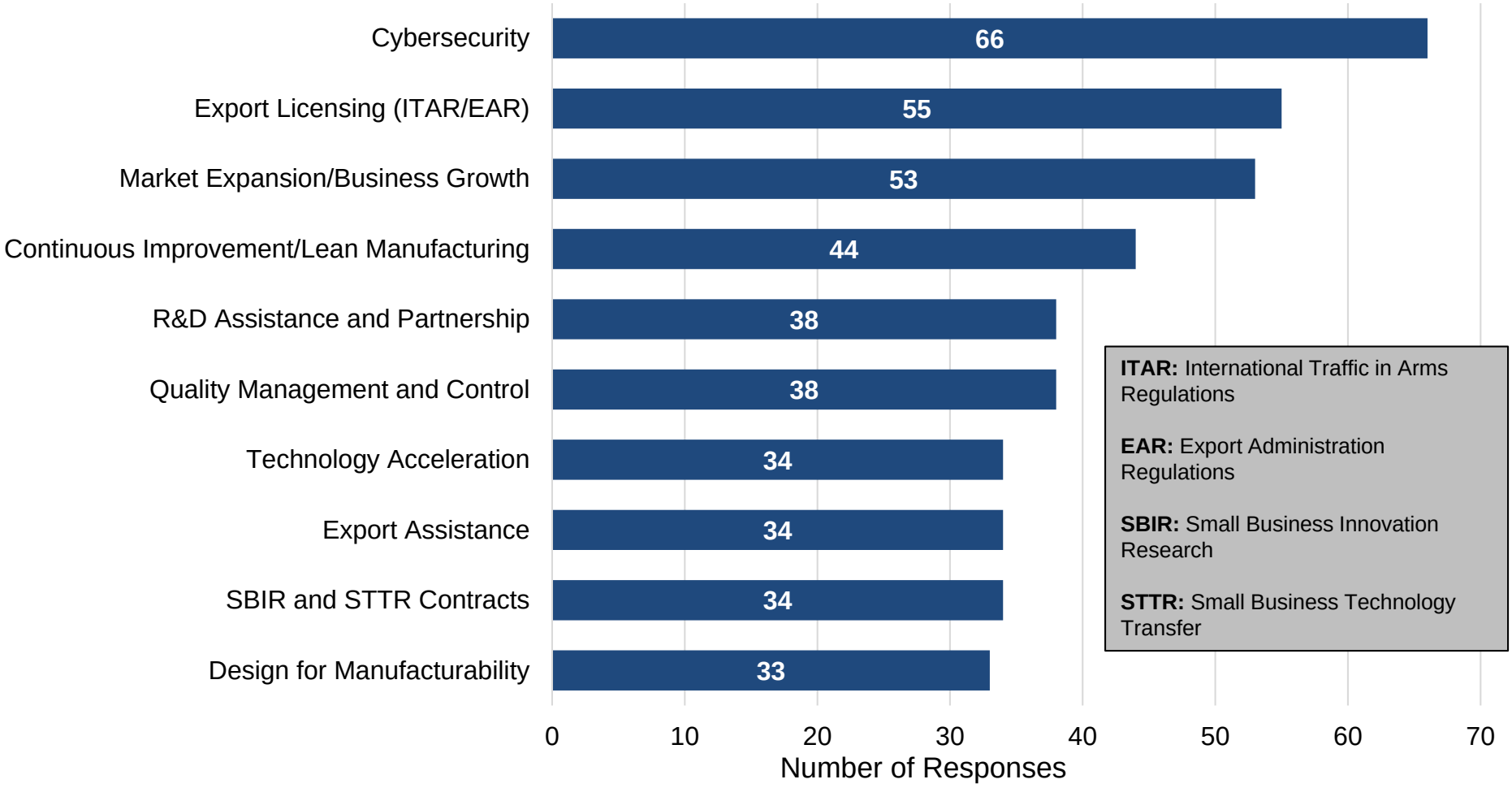
Outreach

Top 10 Areas that Organizations Request Information for USG Programs/Services



Q19, A

361 Respondents

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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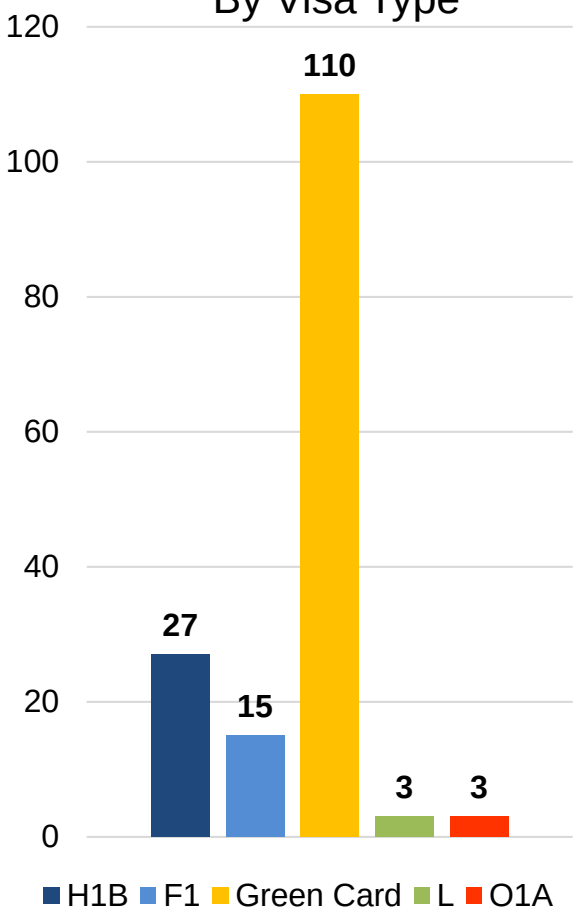
Highlight on China

Highlight

China and the Propulsion Supply Chain

Chinese Employees By Visa Type



A total of 158 Chinese Nationals (excluding Taiwan, Hong Kong, and Macau) were reported by 17 propulsion-related organizations. However, most do not work in propulsion-related roles for the surveyed organizations.

China and Ownership Structure

- Zero companies reported a Chinese parent company
- One company reported an internal/owned facility in China, with no anticipated change in the next four years
- Zero companies reported using external facilitates inside China

Quotes Regarding China and the Supply Chain

- "Chinese suppliers dump tungsten powders and semi-finished products in the U.S."
- "Undercutting of price structure by dumping of aluminum powder by China."
- "Availability of foreign made spherical aluminum powders, particularly in the case of China market dumping practices, in conjunction with the severe export licensing requirements for export of our product renders our Company unable to compete in the non-U.S. commercial market."

Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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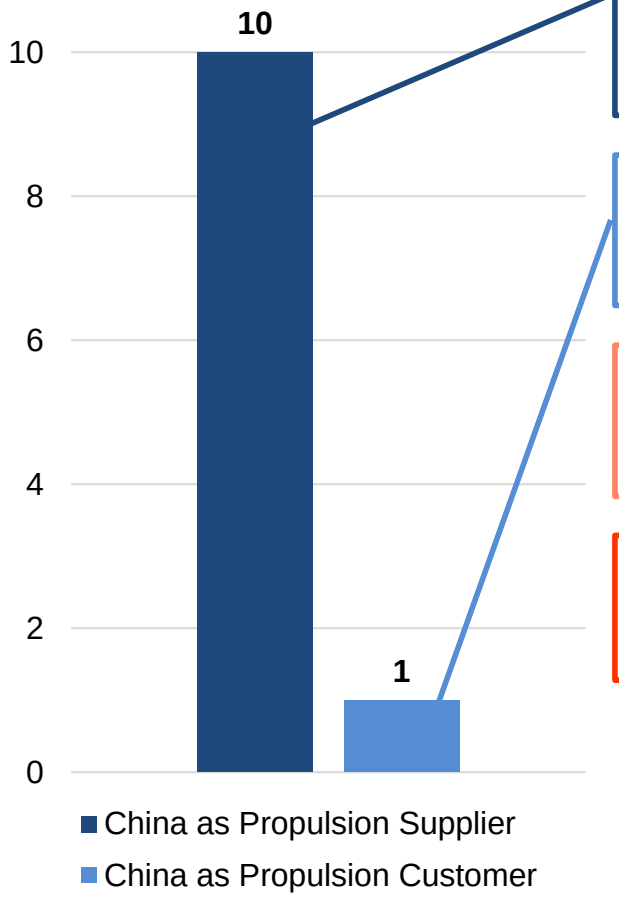
Highlight

China and the Propulsion Supply Chain

Supplier/Customer



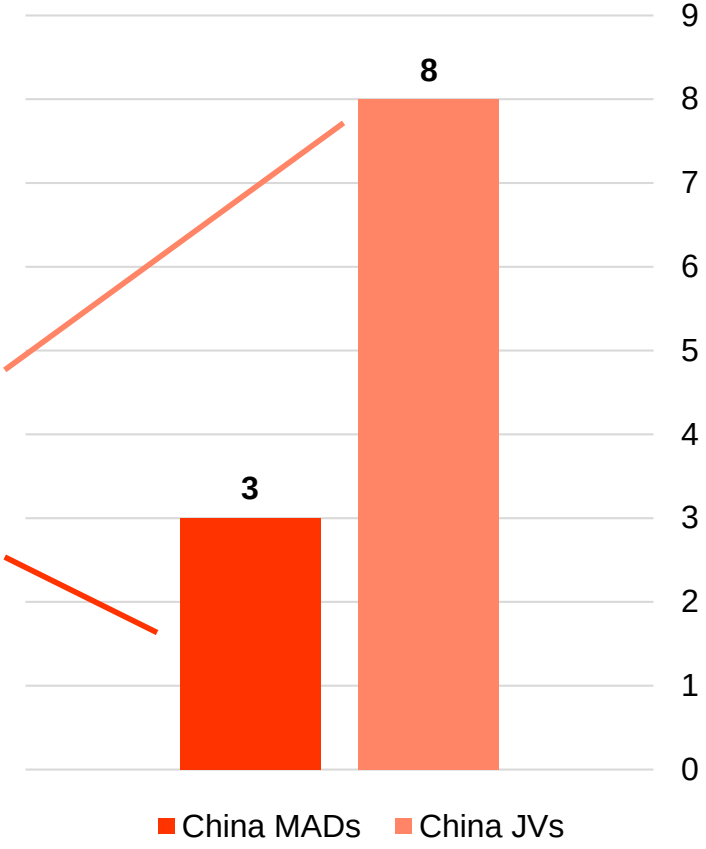
As a supplier, China provides Raw materials (including Additive Manufacturing Stock), Solid rocket propellant material, Weld wire, Other Systems and Services, and All Other

As a customer, China buys propulsion-related Raw materials (including Additive Manufacturing Stock)

Companies engaging in JVs in China reported “Broaden customer base” and “Improved access to foreign markets” as the top reasons

Companies engaging in MADs in China reported “Broaden customer base” and “Reduce costs” as the reasons

Mergers, Acquisitions, Divestures (MADs) and Joint Ventures (JVs)



Source: U.S. Department of Commerce,
Bureau of Industry and Security, Office of Technology Evaluation, RPIBA, 2018
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