

2015 Aerospace Manufacturing Attractiveness Rankings

April 2015

*Geographic manufacturing
attractiveness index and
analysis for the commercial
aircraft industry*



Welcome to the *2015 Aerospace Manufacturing Attractiveness Rankings*. In December of 2013, PwC released a research paper on the US aviation manufacturing industry: *Aviation's Second Golden Age: Can the US Aircraft Industry Maintain Leadership?* In that paper, we released our initial aerospace manufacturing attractiveness index. Receiving a favorable response to this index, we have updated the rankings for 2015 and made some improvements to our methodology.

The 2015 index primarily uses a weighted average of variables. For the global ranking, the three categories of variables are costs, industry size, and infrastructure/stability/talent. For the US state ranking, variables are categorized under tax rates, operating costs, industry size and educational attainment. The analysis looks at how countries and US states compare against each other in terms of their attractiveness as locales for commercial aircraft manufacturing and provides an interesting view on the wide diversity of options to locate sites and/or R&D facilities.

Major enhancements from last year's global rankings methodology include the addition of infrastructure, regulatory and corruption metrics. These additions help provide a more robust assessment of the manufacturing environment in which the aerospace companies are (or will be) operating. Refinements from last year's rankings methodology include the use of proportionality in our industry rankings to better reflect the size and scale of the aerospace industry among countries (e.g., the US has seven times the number of suppliers as the next largest country).

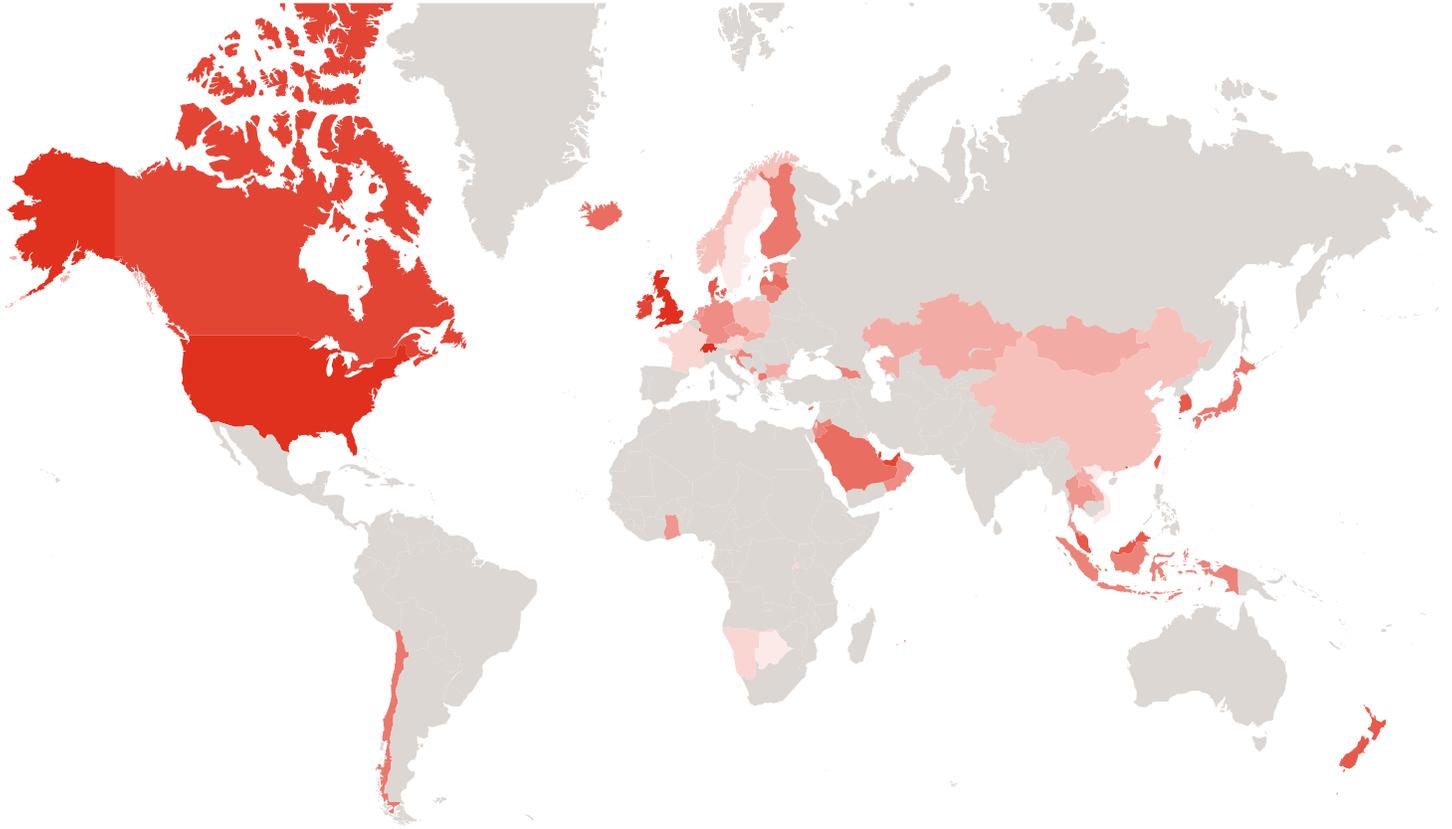
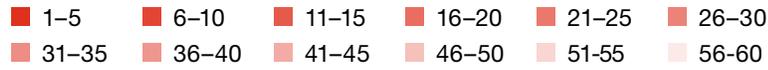
This year's state rankings now include the addition of a separate category for tax and the use of 'effective' tax rates instead of 'statutory' rates, which better reflects the various tax incentives offered by states. Operating costs now reflect both industry wage rates and overall employee wages which provides a better gauge of wage dynamics in the state and a more appropriate weighting to labor (relative to other expenses).

We hope you enjoy the second annual aerospace attractiveness rankings and analysis and welcome a deeper conversation regarding the findings and its potential impact on your expansion strategy.

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Global rankings and commentary



Top ten countries by rank

Country	Cost rank	Industry rank	Infrastructure/ stability/ talent rank	Overall rank
United States	51	1	21	1
Singapore	7	140	3	2
Hong Kong SAR, China	4	142	5	3
Switzerland	10	141	2	4
United Kingdom	21	122	11	5
Canada	11	134	10	6
Qatar	1	142	19	7
United Arab Emirates	2	142	20	8
Luxembourg	14	142	8	9
Ireland	12	142	22	10

Source: Oxford Economics; World Economic Forum; World Bank, Capital IQ; OECD; EU; PwC analysis

Note: Please find complete study results in appendix.

In the global manufacturing attractiveness index, the United States ranked #1, compared to #4 in the previous ranking. The US rank, and improvement, reflects the overall size of the industry and the addition of proportionality to the industry metric. The US aerospace industry has more than seven times as many suppliers than the #2 ranked country—the United Kingdom.

The US industry rank was sufficient to overcome moderate rankings in the cost and infrastructure/stability/talent categories. The US ranked #51 in cost, the lowest among the top ten countries. Considering the cost category, the US is competitive in terms of pay and productivity (ranked ten), but #101 in tax cost. The US ranked #21 in the infrastructure/stability/talent category. Within this area, the US ranked well in most metrics including scientific research institutions and research services, but ranked #47 in STEM education (Science Technology, Engineering, and Math), dragging down the overall ranking which was the second lowest among the top ten countries.

Other countries remaining in the top ten from our prior analysis include Singapore, the UK, and Canada. Newcomers to the top ten were Hong Kong, Switzerland, Qatar, UAE, Luxembourg, and Ireland. Arabian countries UAE and Qatar are placing more emphasis on the aerospace industry and have very low operating costs and taxes as well as good infrastructure and education. Switzerland was #2 in terms of infrastructure, stability, and talent, including #1 in STEM education. Singapore ranked #3 in infrastructure, stability, and workforce.

Netherlands, Germany, Spain, Poland, France, and Belgium were countries that fell out of the top ten. These are generally higher cost countries that were impacted significantly by the proportionality modification to the industry rank.

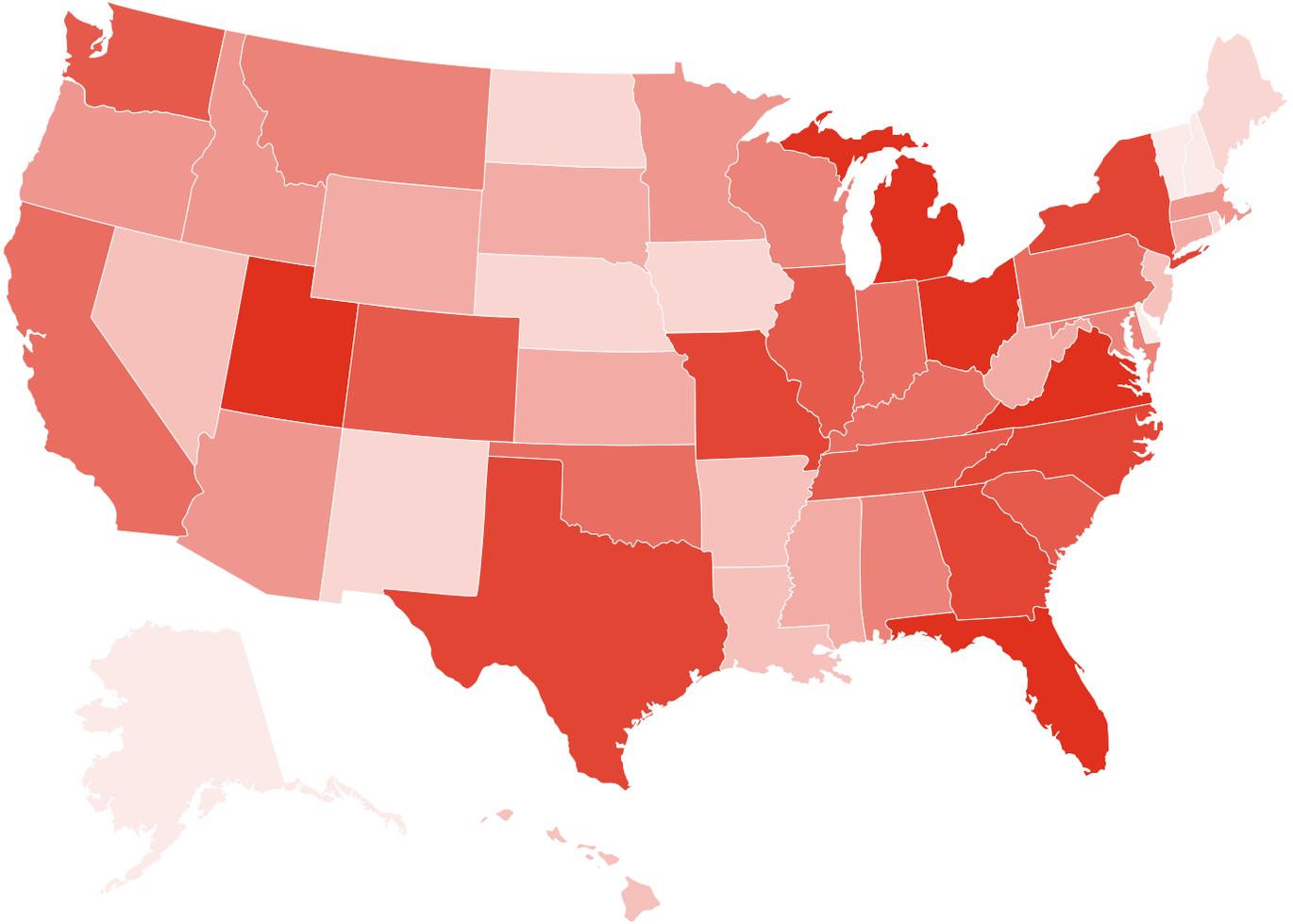
Considerations for your business

Expanding foreign markets, such as China, India, and Brazil, offer significant opportunities for US aircraft manufacturers, as demand for aircraft continues to swell in those regions. Such opportunities can drive both international and domestic expansion. Expansion in global markets also carries risks including intellectual property protection and human resources issues such as talent recruitment, training, and retention, an area that can be particularly difficult in some of these markets. Companies with supply chains expanding overseas (and in Mexico) also face new questions surrounding the soundness of offshoring; indeed, some companies are reconsidering re-shoring back to the US, as a supply chain strategy, for a host of reasons.

As demand for aircraft pivots to other parts of the world, questions arise as to how prepared is the US to enter a new era of competition. An important consideration for US companies, educators, and policy makers is promoting the skills and policies that will support investment in growth in the US.

State rankings and commentary

■ 1-5 ■ 6-10 ■ 11-15 ■ 16-20 ■ 21-25 ■ 26-30 ■ 31-35 ■ 36-40 ■ 41-45 ■ 46-50



Top ten US states by rank

State	Tax rank	Opex rank	Industry rank	Education rank	Overall rank
Florida	14	21	5	12	1
Michigan	10	25	3	18	2
Ohio	26	18	1	17	3
Utah	5	29	7	22	4
Virginia	6	34	19	5	5
Georgia	8	31	11	16	6
New York	20	28	17	1	7
Texas	39	16	4	9	8
Missouri	4	7	34	24	9
North Carolina	25	9	22	15	10

Source: Department of Labor; Tax Foundation; EIA, Census Bureau; PwC analysis

Note: Please find complete study results in appendix.

Among the state rankings, Florida maintained its #1 overall rank from the prior year. The state rankings were very close. Florida had balanced metrics. Its best score was industry rank #5, with competitive scores in taxes, operating cost, and education. Michigan, Ohio, Texas, Georgia, and Missouri remained in the top ten. Ohio reported the #1 industry rank. Newcomers to the top ten included Utah, Virginia, New York, and North Carolina. New York had moderate rankings but was helped by an overall #1 rank in education. Virginia was #6 in taxes and #5 in education, more than offsetting higher operating costs. Utah had a strong industry rank and low taxes. North Carolina ranked #9 in operating cost and overall competitive in other metrics.

California fell out of our top ten list. California ranks #1 in industry employment and aerospace suppliers and #4 in education but its overall rank was dragged down because it was #43 in industry growth and #46 in operating cost. Washington State fell from #3 to #12. Washington was #7

in industry rank and #10 in education, but in the bottom half in terms of operating cost and taxes. Pennsylvania and Arizona also fell out of the top ten. Both states rank well in industry and education, but have higher operating and tax costs, particularly Pennsylvania which ranked #46 in tax cost.

Considerations for your business

While this ranking by no means suggests the ‘best places’ for aerospace manufacturing, given that companies’ individual criteria for locating in a geographical area vary so widely—it does, however, provide an interesting view on the wide diversity of options to locate sites and/or R&D facilities—most especially for those suppliers which do not need to be based near OEMs.

Thriving in the new competitive landscape means nurturing today’s workforce to satisfy backlog demand for aircraft and to meet demand for the next generation of more efficient, sustainable aircraft. Growing

and diversifying this workforce is fundamental to securing the competitiveness of US commercial aviation manufacturing in a globalized market. Some companies have taken innovative steps to recruit, train and retain talent. For example, South Carolina has been working closely with Boeing, who recently located a 787 final assembly plant there, to create a state-sponsored training program and facility that can keep supplying qualified, interested employees as the site grows. Effective talent recruitment strategies involve collaboration among private sector, government, and educational institutions that target numerous talent issues including STEM education, relevant job skills training, and the recruitment of new talent needed to spark innovations that will produce the next generation of aircraft.

The industry should also take measures to lift its reputation and allure, as other industries, over the years, have pulled talent that might once have been drawn to aviation.

What this means for your business

Top industry issues and what companies are doing (or can do)

Issues, implications, actions

PwC's *Aerospace Manufacturing Attractiveness Rankings* are a quantitative framework for assessing many pressing issues facing industry leaders as they consider how (and where) to optimize their supply chain, control costs, and plan for future growth. Of course, a qualitative assessment of the trends affecting each region is needed to more fully understand the current operating environment and understand the potential challenges and hurdles in a highly dynamic global economy.

Our team at PwC is actively monitoring these factors as well as a host of other issues that cannot be fully captured in our framework such as IP protection, cybersecurity, innovation, geopolitical developments and, perhaps most importantly, technological disruption trends.

Based on our paper *Aviation's Second Golden Age: Can the US Aircraft Industry Maintain Leadership?*, issued in December 2013, the following list were top issues that resonated with leaders—as well as implications of these issues and, most important, what companies can do to tackle them. We encourage you to reach out to PwC's highly experienced Aerospace & Defense team for an in-depth conversation on these or other topics that are top-of-mind.

Issues	Implications for US competitiveness	What companies are doing (or can do)
Talent	Companies are under pressure as they seek to secure the workforce they need to achieve increased production rates and continue to innovate. Talent—both the skilled technician and engineer ends—is hard to secure as the industry faces stiff competition from other industries.	Companies are being more proactive in forging ties with government and academia to attract, educate, and train the next generation of manufacturers and to capture and pass on the knowledge of veteran specialists nearing retirement.
Innovation	Demand for 'greener, smarter' aircraft and greater automation in manufacturing and inspection are exerting more pressure on US aviation OEMs and suppliers to boost innovation and productivity while containing costs to maintain technological leads.	Aviation manufacturing companies can consider co-opting automation practices from other industries (e.g., automotive) and collaborate with emerging developers of technology (carbon composites, bio-fuels) and manufacturing processes to maintain a leading edge as innovators and to diversify their businesses.
Globalization pressures/opportunities	Mushrooming demand for commercial fleets outside the US, especially in Asia, leaves US manufacturers eager to sell to and expand in these markets through partnerships. Yet they need to build a strategy that prevents new partners from turning into new competitors.	To thrive globally, US companies need to invest in securing and nurturing local talent and be vigilant when partnering with local firms, employing strict IP protection measures and careful technology transfer strategies.

<i>Issues</i>	<i>Implications for US competitiveness</i>	<i>What companies are doing (or can do)</i>
Availability of capital	Financing by export credit agencies (such as Ex-Im Bank) and private sector lenders clearly drives not only OEM deliveries but also has a ripple effect throughout the aviation industry ecosystem.	Work collaboratively with lenders and promote the importance of export credit agencies, which is a critical backstop to commercial capital in order to keep the industry healthy.
Cost of labor	As manufacturing spreads throughout the US—and suppliers are more able to geographically decouple from customers—companies find greater leeway with fixed costs, including wages.	Companies are making long-term strategic relocations to take advantage of wage arbitrage within the US, particularly in the Southwest.
Cost management	Pressures to manage costs prompt suppliers to look on multiple fronts—from wages to health-care costs, automation, commodities, energy, transportation and maintenance, etc.	Companies that are innovative in managing costs—from the supply chain to operations—will be more competitive as customers weigh pros and cons of offshoring and on-shoring to the US. Suppliers need to find ways to compete in a world where many orders are global and require quick, cost-competitive fulfillment.
Energy costs	Volatile energy prices impact demand for aviation and leave energy-intensive sectors, including airplane parts and component manufacturing, vulnerable to energy cost pressures.	Companies are adopting energy management systems and processes to contain costs. Meanwhile, the sharp rise in shale gas and oil production in the US bodes well in stabilizing energy and feedstock costs for manufacturers across the vast and diverse aircraft manufacturing supply chain.
Tax policy	US federal tax rates are among the highest in the world and the tax code is extremely complex. Depending on the state, corporate tax rates can exert considerable pressure on aircraft manufacturers' bottom line and can place US suppliers at a competitive disadvantage. Companies also note the importance of a permanent federal R&D tax credit.	Companies can lobby their federal and state legislators for tax reform to promote an overhaul of the current tax code to be less complex and more competitive with global tax rates as well as make R&D tax credits permanent and to even increase the amount of the credit—such as the case in New Hampshire in early 2013.

Issues	Implications for US competitiveness	What companies are doing (or can do)
Regulations	Many companies cite the high cost of regulation as a competitive disadvantage, from environmental regulations to Dodd-Frank. The cost of non-compliance can be considerable.	Companies can lobby their federal and state representatives regarding the cost of regulation and regulation reform. Companies need to build more effective and efficient processes for compliance.
Infrastructure	An acute need exists to expand and modernize US critical infrastructure, including the network of airports, multi-modal connections, and air traffic control infrastructure. The success—or lack thereof—in developing air transport infrastructure will have important implications for the potential growth for aviation, and commercial aircraft, demand in the US.	The commercial aviation industry and the FAA will need to make greater strides in ‘taking ownership’ of the successful development of NextGen air traffic initiatives as well as making efforts to support the development of a 21st-century airport network in the US.
Supply-chain innovation	The pressure OEMs face to increase production rates is trickling down through their supply chain, raising expectations for quicker and more cost-effective production, while ensuring world-class quality.	Manufacturers and suppliers that can adopt innovations that lead to quicker production lead times, improve quality and contain costs (e.g., through automation, robotics, additive manufacturing) will likely sharpen their competitive edge, not only among US competitors but also those emerging in foreign markets.
IP protection	As US aviation companies expand into new markets through partnerships and business combinations with local firms abroad, they seek opportunities to expand in growing markets yet simultaneously run risks of losing valuable IP to those very partners.	Companies must put into place the right controls and protections to reduce risks of IP rights infringement. This includes acquisitions of US aviation companies by foreign firms which may result in threats to US leadership in aviation technology.
Cybersecurity	The rising concern surrounding cyber attacks on US critical infrastructure as well as hacking into companies’ systems highlight the realities of a new era of corporate and national espionage and, worse, terrorism.	As aviation companies wade into new realms of ‘compufacturing’ and relying on big data for both manufacturing and R&D, they must invest in proper cyber protections to prevent potentially damaging consequences of cyber attacks.

Appendices

PwC 2015 global aerospace manufacturing attractiveness index

Methodology

PwC's analysis compared countries in terms of their attractiveness as locales for commercial aircraft manufacturing. Our study created an 'attractiveness ranking index' which primarily used a weighted average of three major elements: **costs** (taxes, manufacturing wages, productivity), **industry size** (number of existing suppliers), and **infrastructure/stability/talent** (including quality of electrical and transportation infrastructure, regulatory/legal/corruption rankings and enrollments in, and quality of, engineering programs).

Changes from prior year

Major enhancements from last year include the addition of infrastructure and stability metrics to the workforce element. These additions help provide a more robust assessment of the manufacturing environment in which the aerospace companies are (or will be) operating. Refinements from last year's rankings methodology include the addition of new tax variables and the use of proportionality in our industry rankings. The latter adjustment better reflects the difference in magnitude of suppliers between countries (e.g., the US has seven times the number of suppliers as the next largest country).

Complete raw data

Country	Cost rank	Industry rank	Infrastructure/stability/talent rank	Overall rank	Country	Cost rank	Industry rank	Infrastructure/stability/talent rank	Overall rank
Albania	28	142	100	59	Burkina Faso	126	142	106	126
Algeria	134	142	114	134	Burundi	134	142	136	138
Angola	136	142	142	140	Cambodia	15	142	124	73
Argentina	142	142	102	133	Cameroon	123	142	103	123
Armenia	54	142	85	73	Canada	11	134	10	6
Australia	129	140	24	82	Chad	139	142	140	141
Austria	107	141	13	53	Chile	19	142	44	22
Azerbaijan	48	142	92	76	China	70	134	50	49
Bahrain	5	142	42	16	Colombia	130	142	88	119
Bangladesh	87	142	127	115	Costa Rica	90	142	45	67
Barbados	104	142	26	64	Côte d'Ivoire	84	142	87	93
Belgium	125	141	6	63	Croatia	31	142	46	28
Bhutan	56	142	72	59	Cyprus	26	142	33	19
Bolivia	122	142	108	125	Czech Republic	61	141	32	36
Botswana	44	142	82	57	Denmark	36	142	7	13
Brazil	133	141	84	118	Dominican Republic	94	142	125	120
Bulgaria	31	142	69	41	Egypt, Arab Rep.	123	142	126	136

Complete raw data (continued)

Country	Cost rank	Industry rank	Infrastructure/ stability/ talent rank	Overall rank
El Salvador	94	142	73	90
Estonia	54	142	29	33
Ethiopia	74	142	120	107
Finland	71	142	1	24
France	112	134	14	52
Gabon	116	142	116	126
Gambia, The	101	142	105	111
Georgia	17	142	63	29
Germany	76	135	12	31
Ghana	28	142	71	39
Greece	119	142	53	94
Guatemala	57	142	91	78
Guinea	141	142	139	142
Guyana	62	142	101	87
Haiti	110	142	138	134
Honduras	82	142	112	107
Hong Kong SAR, China	4	142	5	3
Hungary	94	142	40	65
Iceland	36	142	18	18
India	106	139	68	92
Indonesia	21	142	59	29
Iran, Islamic Rep.	127	142	79	111
Ireland	12	142	22	10
Israel	48	141	35	32
Italy	138	140	37	95
Jamaica	118	142	83	109
Japan	58	137	9	21
Jordan	23	142	49	25
Kazakhstan	13	142	86	39
Kenya	80	142	89	91
Korea, Rep.	16	140	30	14

Country	Cost rank	Industry rank	Infrastructure/ stability/ talent rank	Overall rank
Kuwait	47	142	75	54
Kyrgyz Republic	26	142	122	78
Lao PDR	9	142	94	44
Latvia	24	142	36	20
Lebanon	43	142	115	84
Lesotho	39	142	96	67
Libya	98	142	137	131
Lithuania	44	142	28	25
Luxembourg	14	142	8	9
Macedonia, FYR	3	142	65	23
Madagascar	63	142	121	103
Malawi	52	142	111	87
Malaysia	20	141	27	15
Mali	119	142	109	124
Malta	68	142	41	46
Mauritania	140	142	123	137
Mauritius	30	142	43	27
Mexico	112	142	80	105
Moldova	50	142	99	81
Mongolia	7	142	95	42
Montenegro	34	142	60	37
Morocco	92	142	57	80
Mozambique	115	142	119	129
Myanmar	100	142	132	126
Namibia	52	142	64	50
Nepal	90	142	130	121
Netherlands	89	140	4	35
New Zealand	24	142	17	12
Nicaragua	108	142	117	122
Nigeria	42	142	131	96
Norway	94	142	16	47

Complete raw data (continued)

Country	Cost rank	Industry rank	Infrastructure/ stability/ talent rank	Overall rank	Country	Cost rank	Industry rank	Infrastructure/ stability/ talent rank	Overall rank
Oman	38	142	48	34	Timor-Leste	40	142	133	96
Pakistan	65	142	118	102	Trinidad and Tobago	81	142	54	67
Panama	101	142	56	83	Tunisia	127	142	66	106
Paraguay	87	142	129	116	Turkey	85	141	55	75
Peru	65	142	98	87	Uganda	109	142	107	116
Philippines	58	142	77	67	Ukraine	72	142	74	77
Poland	69	141	39	45	United Arab Emirates	2	142	20	8
Portugal	112	142	25	72	United Kingdom	21	122	11	5
Qatar	1	142	19	7	United States	51	1	21	1
Romania	78	141	52	62	Uruguay	131	142	58	104
Russian Federation	64	136	70	61	Venezuela, RB	137	142	135	139
Rwanda	41	142	77	51	Vietnam	31	142	96	58
Saudi Arabia	6	142	47	17	Yemen, Rep.	72	142	141	114
Senegal	105	142	76	101	Zambia	46	142	90	71
Serbia	101	142	80	100	Zimbabwe	116	142	128	132
Seychelles	58	142	67	56					
Sierra Leone	76	142	134	113					
Singapore	7	140	3	2					
Slovak Republic	65	142	38	43					
Slovenia	78	142	34	48					
South Africa	99	142	62	85					
Spain	132	140	31	86					
Sri Lanka	83	142	51	66					
Suriname	74	142	104	98					
Swaziland	86	142	93	99					
Sweden	111	140	15	55					
Switzerland	10	141	2	4					
Taiwan, China	18	141	23	11					
Tajikistan	92	142	110	110					
Tanzania	121	142	113	129					
Thailand	35	142	61	38					

PwC 2015 US aerospace manufacturing attractiveness index

Methodology

PwC analyzed the relative ‘aerospace industry attractiveness’ of the US in a state-by-state comparison. Our study produced an overall ‘attractiveness ranking index’ using a weighted average of the following major elements: **taxes**, **operating costs** (industry and overall wage rates, business climate, energy costs), **industry size** (existing suppliers and supply/growth of workforce including available aerospace technicians, engineers, mechanics), and **educational attainment**.

Changes from prior year

Enhancements from last year’s index include the creation of a separate category for tax and the use of effective tax rates instead of statutory rates. Operating costs now reflect both industry wage rates and overall employee wages which provides a better gauge of wage dynamics in the state and a more appropriate weighting to labor (relative to other expenses) in the operating costs category. Finally, the industry ranking now includes employment growth rates (in addition to number of employees) and is based on aerospace companies as well as metal fabricators as opposed to broader manufacturing talent.

Complete raw data

State	Tax rank	Opex rank	Industry rank	Education rank	Overall rank	State	Tax rank	Opex rank	Industry rank	Education rank	Overall rank
Alabama	27	15	18	34	22	Montana	18	1	39	38	25
Alaska	30	49	42	44	50	Nebraska	31	29	49	28	43
Arizona	24	35	23	20	28	Nevada	1	31	48	42	40
Arkansas	40	9	24	47	39	New Hampshire	48	41	38	25	48
California	34	46	6	4	20	New Jersey	41	48	27	3	37
Colorado	12	47	12	8	13	New Mexico	35	21	50	40	46
Connecticut	32	50	19	14	33	New York	20	28	17	1	6
Delaware	50	43	26	41	49	North Carolina	25	9	22	15	10
Florida	14	21	5	12	1	North Dakota	19	38	41	44	44
Georgia	8	31	11	16	6	Ohio	26	18	1	17	3
Hawaii	9	44	39	27	37	Oklahoma	7	9	32	37	16
Idaho	21	6	29	43	27	Oregon	36	21	21	19	26
Illinois	47	12	7	6	11	Pennsylvania	46	27	2	12	18
Indiana	22	18	15	32	18	Rhode Island	43	40	31	29	45
Iowa	49	4	46	33	41	South Carolina	13	2	36	29	14
Kansas	38	37	15	23	32	South Dakota	1	13	47	46	31
Kentucky	29	3	14	39	16	Tennessee	15	7	34	26	15
Louisiana	23	18	42	35	36	Texas	39	16	4	9	8
Maine	45	25	30	35	42	Utah	5	29	7	22	4
Maryland	16	44	28	7	23	Vermont	42	38	37	29	46
Massachusetts	37	42	10	2	21	Virginia	6	34	19	5	5
Michigan	10	25	3	18	2	Washington	28	31	7	10	12
Minnesota	44	36	13	11	29	West Virginia	17	4	44	50	33
Mississippi	11	13	33	48	30	Wisconsin	33	17	25	20	23
Missouri	4	7	34	24	9	Wyoming	1	21	45	49	35

To have a deeper conversation about the aerospace manufacturing industry and the issues discussed in this paper, please contact:

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