Boeing and the STEM Hiring Gap

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Executive Summary

As one of the largest aerospace firms in the world, The Boeing Company (Boeing) operates three main business units: Commercial, Space and Defense, and Global Services. This report will heretofore focus on the Space and Defense part of the company.

Boeing has a strong market position and industry presence within each sector that it operates in, owning approximately 10.7% of the market share for the space sector. However, new companies such as SpaceX and Blue Origin are developing new technologies and methods which put an ever-increasing pressure on companies like Boeing to adopt innovative new practices to maintain its competitive edge.

One factor which limits Boeing's long-term ability to remain competitive is it's perceived "STEM Hiring Gap," which can be described as a deficit of STEM educated workers in Boeing's talent pool to recruit from as replacements for the company's aging workforce. Roughly 10% of this workforce is expected to retire within the next few years.

There is a body of evidence which suggests, however, that the problem may not be an issue of a STEM talent shortage, but a misidentification of the problem. There might not be so much a shortage of STEM talent, but a shortage of interest in the aerospace profession. Or else, there may be a miscommunication of what it necessary for potential recruits to enter the aerospace profession.

It is time for Boeing to make a strategic investment and reevaluate its traditional hiring practices and consider alternative options to replace and revitalize its workforce, preparing to way for the company's continued long-term success.

Situation Analysis

Boeing is one of the world's largest aerospace firms and has three main business units, each with its own strategy and mission: Commercial, Space and Defense, and Global Services. For the sake of this report the focus will be the Space and Defense portion of the company. The mission statement is as follows:

Throughout the last 50 years, Boeing and its heritage companies have been integral in every major endeavor to escape Earth's gravity. From the first Mercury capsule, to the current International Space Station, and beyond to the Space Launch System, Boeing has and will take humans and technology farther than they've ever been.

This mission statement contains elements of vision, while suggesting the company's values. But neither the vision nor the values are plainly outlined. Boeing Space's primary stakeholders are US government agencies such as NASA, the military branches (particularly the Air force), and commercial satellite companies.

Internal Performance. According to Business Insights: Global, Boeing has a strong market position as a leading provider of commercial airplanes, a high performing research and development program, and significant accomplishments in the space and defense segments of the company. The company's weakness is its financial performance, which is down from previous years. The SWOT analysis (see **Appendix A**) also lists the order backlog as a weakness, but since the time of the report Boeing has grown its backlog significantly through commercial plane sales including a $294 million contract for the new 737 MAX at the Paris Air Show (Nasdaq).

Based on Boeing's annual 10K reports from 2012 through 2016 and a Reuters Investment Report (see **Figure 1** and **Table 1** from the 10K Report) the company had a decline in net earnings in 2016 from the previous two years but also a substantial increase in R&D spending and a more than one-percent increase in its return on investment.

Figure 1: Excerpt of Boeing's 10K, Revenue Per Business Segment

Five-Year Summary (Unaudited)

(Dollars in millions, except per share data)	**2016**	2015	2014	2013
Operations				
Revenues:				
Commercial Airplanes	**$65,069**	$66,048	$59,990	$52,981
Defense, Space & Security: [1]				
Boeing Military Aircraft	**12,515**	13,424	13,410	15,161
Network & Space Systems	**7,046**	7,751	8,003	8,512
Global Services & Support	**9,937**	9,213	9,468	9,524
Total Defense, Space & Security	**29,498**	30,388	30,881	33,197
Boeing Capital	**298**	413	416	408
Unallocated items, eliminations, and other	**(294)**	(735)	(525)	37
Total revenues	**$94,571**	$96,114	$90,762	$86,623

The Boeing Company has a very positive outlook, with a recommendation for investors to "Buy". Boeing shares since January 2017 have increased 37.33% in value from $190.00 to $261.19 each on October 10, 2017. When compared to its closest industry competitor, Lockheed Martin (from $279.54 in January to 317.71 each, or 13.65% growth), Boeing is growing rapidly and increasing its value at a pace that is atypical for such a long-established company.

Table 1: The Boeing Company's financial data from 2016 10-K

Year	**2016**	**2015**	**2014**	**2013**	**2012**
Total Revenues	$94,571,000	$96,114,000	$90,762,000	$86,623,000	$81,698,000
Net Earnings	$4,895,000	$5,176,000	$5,446,000	$4,586,000	$3,903,000
Earnings/share	$7.70	$7.52	$7.47	$6.03	$5.15
Total Debt	$9,952,000	$9,964,000	$9,070,000	$9,635,000	$10,409,000
R&D Spending	$4,627,000	$3,331,000	$3,047,000	$3, 071,000	$3,298,000
Return on Investment (%)	13.02	11.97	11.67	No data	No data

Industry Perspective. According to IBISWorld, the space vehicle industry has a positive outlook, with the research company going so far as to state that it will "slowly liftoff" as a result of improved government funding and technology advances which will drive competitive innovation.

The Space Vehicle and Missile Manufacturing industry is rated as mature, meaning that growth of the industry tends to be slow but steady, at about 2% annually, roughly equivalent to the GDP growth rate. This rating is affected by a high level of technological change as we enter a new era of space exploration, a high concentration of industry within a few competing companies, and market saturation resulting from federal defense spending which acts as a barrier to entry and inherently reduces the number of competitors. The five-year growth rate however is forecasted to increase to 3.3%, with annual revenue climbing from $25.8 billion (as estimated for 2018) to $29.3 billion by 2022.

Here is a breakdown of Boeing's market share and performance data for 2017 as compared to its four biggest competitors in the Space Vehicle and Missile Manufacturing industry: Raytheon Company, Lockheed Martin, Orbital ATK, Inc, and Aerojet Rocketdyne.

Table 2: The Top 5 Space Vehicle Manufacturers

Company	Raytheon Company	Lockheed Martin	The Boeing Company	Orbital ATK, Inc	Aerojet Rocketdyne
Market Share (%)	29.7	28.6	10.7	8.2	7.3
Revenue ($ million)	7,407.0	7,126.8	2,671.8	2,041.9	1,826.3
% change (from previous year)	+ 5.1	+ 2.4	- 0.7	+ 8.5	+ 4.1
Operating Income ($ million)	1,034.2	1,023.7	240.5	220.2	123.5
% change (from previous year)	+ 2.6	- 0.6	27.8	- 6.8	+ 102.8

Environmental Factors. The aerospace industry is entering a volatile era thanks to the advent of private spaceflight companies such as SpaceX and Blue Origin. The advent of reusable rockets, coupled with a renewed public and government interest in space has at once revitalized the industry and placed an immense new pressure on the traditional titans of the industry to develop capabilities and services that are comparable to what the new entrants are offering.

Traditional aerospace companies get most of their funding from government and military contracts which, as previously mentioned, acts as a barrier to entry for new companies. There are also many national and international regulations and treaties, mostly holdovers from the cold-war era and designed to prevent space-based warfare. As of the reconvening of the U.S. National Space Council on Thursday, October 5th, 2017, several representatives of the commercial space industry met and suggested to Vice President Mike Pence and other government officials that such regulations are slowing progress and reducing profit. They were then promised that NASA and other U.S. regulatory agencies will review the rules with the goal of submitting actual changes within 40 days (the next convening of the council). Should the U.S. regulatory agencies follow through and update the regulations and licensing procedures for spacecraft, it may become much easier and faster for launch providers to provide quick service to their customers, falling in line with industry goals of a 24 hour or less turnaround for a rocket to land, refuel, and take off again.

Another major effect on the industry is the mass adoption of CubeSats, which is a small (10 cm by 10 cm by 10cm) standardized satellite form-factor which is substantially cheaper to build and much lighter in weight than traditional satellites. These small satellites have an advantage of providing quick turnaround for companies, which can take advantage of Moore's Law and produce a next generation with advanced capabilities in a time frame of a couple of years instead of decades. This presents a

challenge for launch providers, however, because it means that traditional revenue from launching large satellite payloads may be losing its validity as a business model.

This has prompted new companies to enter the scene with smaller rockets designed specifically to launch small satellites. This may satisfy the demand for smaller payloads, but the effect remains to be seen, with many critics saying that it is not a feasible business option in the near future.

One more factor to consider is the recent announcement by SpaceX founder and CEO, Elon Musk, of the Big Falcon Rocket (BFR) with its potential capabilities to not only provide cheaper launch services than any existing competitors (and even cheaper than the current SpaceX Falcon 9 rocket), but will also provide global travel services which can take passengers anywhere around the globe in only 30 minutes. It is possible that the SpaceX CEO and founder, Elon Musk, is only grandstanding, but even if he is, he has captured the American imagination and subsequently raised the stakes for his competitors.

A final factor to be considered is that individual workers in the space industry must be highly trained. IBISWorld states that 80.3% of Boeing employees have a bachelor's degree, 25% of whom hold a graduate level degree or higher. Wages in the space industry comprise 34.7% of total industry costs, only surpassed by purchasing costs (36.7%). The high cost of the workforce is due to a shortfall in skilled employees, especially engineers and other STEM trained workers.

Because STEM positions are in high demand, the wages for these employees are well above the national average. The 2016 National Aerospace & Defense Workforce Summit held by the Aerospace Industries Association (AIA) and American Institute of Aeronautics and Astronautics (AIAA) discussed strategies to address the shortfall through education initiatives. Recommendations from this summit include increased recruiting efforts of minorities and women, and for industry players to

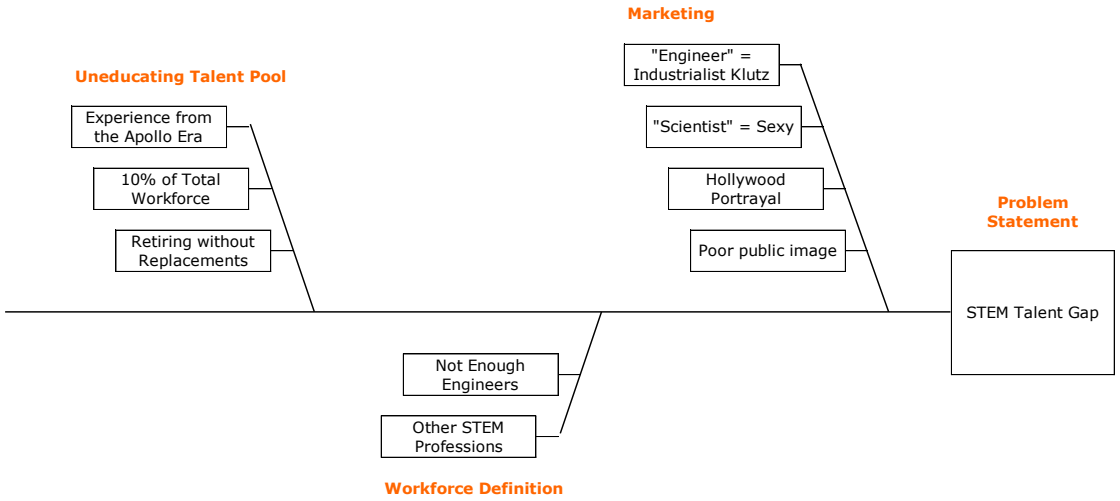
collaborate with the goal of enhancing STEM education programs throughout the U.S. to prepare youth for careers in aerospace.

Problem Analysis & Description

A problem facing Boeing is the STEM talent gap, a problem which grows as more and more baby-boomers enter retirement. Of over 145,000 Boeing employees, 9.7% are expected to retire in the next five years. Yet an Aviation Week study claims fewer than 1.5% of Americans between the ages of 25-34 have a science degree. Furthermore, "Although 85 percent of these students enroll in four-year colleges, fewer than 40 percent of students who declare a STEM major go on to earn a STEM degree."

It is clear from this study that Boeing has a considerable problem in terms of maintaining its workforce. But then one must ask the question, why is there such a STEM skills gap in the first place?

Figure 2: Cause-And-Effect Analysis



In its May 2015 *Monthly Labor Review*, the US Bureau of Labor and Statistics (see **Appendix B**) suggests that the problem is not so much that there is a lack of interest in STEM overall, just within certain industry sectors. As the article states, "Opposing sides paint a polarizing picture: Is there a

‘STEM crisis’ or a ‘STEM surplus’? Our answer is that there are both.” The article goes on to use a taxicab queuing model to describe the discrepancies between the STEM workforce and the available jobs: “If the number of employers searching for employees is greater than the number of STEM workers, we have a queue of taxis, which manifests itself in the real world as a STEM shortage.” The opposite is true if there is a STEM surplus.

The study concludes that some STEM job types have a surplus of workers, not a shortage. Using the taxi-cab metaphor, for example, there are more computer and data scientists than there are taxi-cabs, similarly for biology and medicine related workers. Yet within the aerospace industry there truly are more taxi-cabs waiting for scientists and engineers of an aerospace related discipline.

It would seem then that there is not so much a problem of a lack of STEM workers, but that the problem has been too broadly defined to begin with. Aerospace companies such as Boeing have been spending a lot of money on STEM initiatives ($17 million across 508 education institutions worldwide, according to The Boeing Company 2017 Global Engagement Portfolio), and studies to try and solve the STEM dilemma, but may have instead been inadvertently helping to foster surpluses in other unrelated STEM fields by not specifying what they truly needed to fill their talent needs.

In the 2016 Sci Tech Forum held by the American Institute of Aeronautics and Astronautics, in a session titled *Focus on the “E” in STEM*, industry experts spoke about the hiring gap in more detail, suggesting several potential root causes. One major discussion point was that engineering is not seen as a glamorous or “sexy” discipline anymore. They describe how engineers have been portrayed by Hollywood as the industrialist fools who design things wrong and cause pollution, while scientists and computer programmers get all the glory.

To summarize: The Boeing Company has two identifiable underlying factors to the STEM talent gap that need to be addressed. First is that the problem has been too broadly defined, resulting in spending on STEM initiatives that have benefited other sectors more than Boeing itself. Second is the industry may have a negative public image thanks to negative portrayals of heavy manufacturing and industrialist companies, which results in decreased interest from students as they decide which career path to prepare for.

Solutions, Evaluation & Recommendation

Potential Solutions. The Boeing Company faces a STEM hiring gap which has steadily grown worse in recent years. The company faces a loss of roughly 10% of its workforce to retirement, yet has a shortage of qualified professionals to replace the retirees. Three potential solutions will be outlined and evaluated using a Weighted-Criteria Decision Making Matrix and a Cost Benefit Analysis (see **Appendix C)** to determine which alternative solution will best solve the problem.

Solution 1: Education Outreach. This solution is the most straight-forward, it being what Boeing and other aerospace industries have already been doing. In the causal analysis, this approach is identified as having unintended outcomes: there is an actual STEM surplus, but with skills that do not benefit the aerospace industry. However, following this model does not exclude experimentation with new methods of education, which will be discussed as part of the implementation plan.

Solution 2: Targeted Marketing. Begin a marketing campaign to educate the public about the overall benefits of a thriving aerospace industry, and clearly outline the skills and knowledge that are necessary to enter aerospace career fields.

Solution 3: Redefine Workforce Requirements. Define new jobs that will embrace the skills that are available in the STEM talent pool, specifically the computer programming and data analytics skillsets, and explore how those skills can be applied to Boeing's aerospace engineering requirements.

Solution 4: A Combined Approach. Combine aspects of these three approaches into one super solution. The STEM education initiatives have been working, but there needs to be more of an emphasis on the specific needs of the aerospace industry. By redefining what it means to be an aerospace professional, and then better marketing the industry, a more substantial solution may be possible. This option will be further explored after Solutions 1-3 have been examined in the following sections.

Table 3: Weighted-Criteria Decision Making Matrix

Factors:	**Quality of Hire**	**Time to Hire**	**Revenue Loss Per Vacant Day**	**Stakeholder Engagement**	**Competition Across Sectors**	**Total/ Score:**
Weight:	50.1%	15.5%	19.5%	10.8%	3.9%	100.0%
Solution 1	80	50	40	60	30	
S1 Score	40.1	7.8	7.8	6.5	1.2	63.4
Solution 2	40	30	30	90	50	
S2 Score	20.0	4.7	5.9	9.8	2.0	42.3
Solution 3	60	80	60	50	70	
S3 Score	30.1	12.4	11.7	5.4	2.8	62.4

Explanation of Factors. These factors are taken from the 2016 Aerospace and Defense Workforce Summit Proceedings Report & Recommendations. Weights were determined by using an Analytical Hierarchy Process calculator tool (found at BPMSG.com). The stated weights add up to 99.8% due to rounding. Each solution is then given a score from 1-100 based on how well it satisfies that factor. The factor scores are multiplied by their corresponding weight, and each solution's factor scores are added up to get a total with the highest total being the preferred solution according to this analysis.

Quality of Hire. This is the highest weighted factor (50.1%) due to its immediate relevance to the question at hand: how will Boeing fill the STEM hiring gap? This factor takes into consideration the education and skills necessary for aerospace jobs. While this really includes a range from engineering talent, manufacturing knowledge and skills, and qualified pilots, for the sake of this report we will focus on engineering talent specifically. A high score on this factor means that most candidates for hire are ready to go straight into work with little additional training.

Time to Hire. The nature of this problem is such that no solution will produce immediate results, even with immediate implementation of that solution. This presents a challenge, however, because the generation that Boeing needs to replace has already begun to retire. Because an increased time to hire can have difficult to quantify negative effects, it is weighted moderately high, at 15.5%. A high score on this factor reflects the time that a job vacancy will remain unfilled.

Revenue Loss Per Vacant Day. Because this factor is easier to quantify, it is given a higher weight than time to hire, at 19.5%. While the time to hire will not be immediate, the industry will lose revenue from reduced productivity in engineering man hours. This factor is directly tied into the previous factor in that a high score on this factor reflects the cost for Boeing to wait for a qualified candidate.

Engagement with Stakeholders. In the Workforce Summit, this criterion, weighted at 10.8% in my analysis, is discussed in some detail with a focus on building strategic partnerships with stakeholders. These benefits are more qualitative than quantitative, resulting in a lower weighted score, but could have far reaching effects if done properly. No matter which solution Boeing, or the wider aerospace industry, takes, they will need to find new and creative ways to engage with the broader society outside of the industry. A high score on this factor means that Boeing would be fostering

positive relationships with its stakeholders, with a focus on relationships educational institutions, non-aerospace government entities, other industry sectors, and especially communities.

Competition with Other Sectors. As identified in the report from the Bureau of Labor and Statistics, there is not so much a "STEM" talent gap, as there is a somewhat more specific "aerospace-related" talent gap. As such, other sectors may be outcompeting the aerospace industry for such talent. There is substantial evidence, however, that much of this talent pool is trained in STEM fields that may not directly correlate to the outgoing aerospace workers, thus giving this criterion a lower weight of 3.9%. A high score on this factor reflects how much Boeing draws its talent from the same pool as other unrelated industries such as computer programmers and data scientists.

Recommendation. Based on the weighted criteria matrix, the best option is Solution 1: to maintain current education initiatives. However, Solution 3 rates very close: Looking at the cost benefit analyses, Solution 3 has the strongest tangible benefit, having the potential to significantly reduce the time to hire and to regain at least some of the productivity lost as the aging workforce enters retirement.

Therefore, it is recommended that Boeing use Solution 4, which would be to combine elements of each solution into a grander plan. While an improved marketing plan scored lower in the weighted criteria matrix, it does have a critical benefit of increasing public buy-in and public support of Boeing and the aerospace industry, if done right. A well-planned marketing strategy could also be used to recruit a more diverse work force which can improve productivity and innovation in the long run.

The goal of a well thought out education initiative should be to attract interest from students at a young age. This could mean appealing to children as early on in their education as primary school. If a marketing plan were to more clearly outline Boeing's specific skill and knowledge needs, combined

with education funding to reduce financial barriers to entry, and research more effective teaching methods, then Boeing will greatly increase interest and grow its talent pool in the long term.

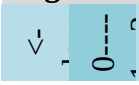
This still leaves a gap in the short term, which there may be a partial answer for: Solution 3. One criticism of all the media about there being a STEM hiring gap is that companies like Boeing are too traditional in their approach, and so it may need to be willing to redefine some of its expectations for potential talent. For example, computer scientists and programmers already have some of the skills necessary to be effective engineers. What if Boeing brought some level of training in house, and created opportunities for computer scientists to cross-train and help fill the gap? This could also result in bringing in a more diverse workforce with different viewpoints and biases than the traditional aerospace engineer, potentially fostering innovation.

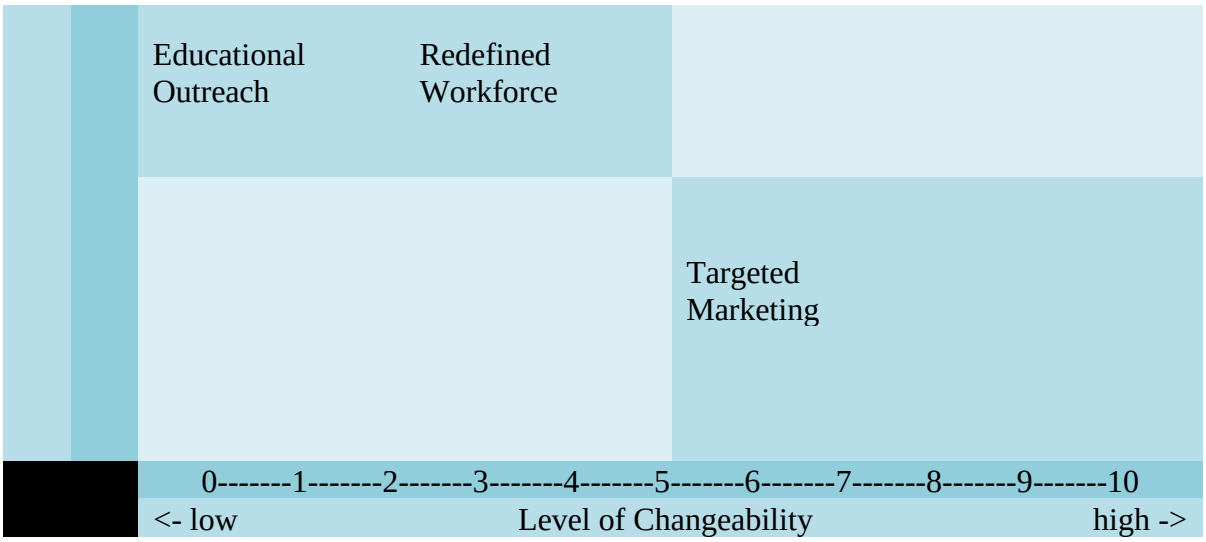
The problem at hand has multiple root causes, and each cause will need to be specifically addressed to rectify the problem. But this doesn't mean that a single coherent plan cannot be used to tackle the larger issue of the aerospace-talent gap. Therefore, the official recommendation of this report is to take a combined approach, but which will take into consideration the weight and relevance of the alternative options as previously discussed.

Implementation Plan

The plan will be implemented in phases based on changeability to maximize overall impact. The most changeable elements will be included in the first phase, with low changeability items (see **Figure 3**). The plan will be implemented over the course of four years, as shown in **Appendix D.**

Figure 3: Impact and Changeability Analysis





Phase 1: Marketing and Research. The Impact and Changeability Analysis shows that targeted marketing has a high level of changeability, yet only a moderate level of impact. Yet if properly done in conjunction with the other two options, which are each rated at a high impact level, it can substantially boost each of those efforts. Because of this, the first phase will be for Boeing to research how to better market itself and the aerospace industry to the modern American culture. The marketing campaign will need to be either sustained, or revisited at each new phase implementation to ensure that the public is aware of the changes taking place.

In conjunction with the marketing campaign, Boeing will also need to begin researching its own workforce and outlining which job elements are crucial so that it can determine to what extent those roles can either be filled directly by talent in non-aerospace engineering fields, and to what extent they might need to cross-train potential applicants. Other factors to be considered here are how software can be better integrated into the design process (potentially reducing the need for as many specialists). This research will be actively synthesized into the implementation plans for phases two and three.

It is important to note that there are already university models that can be studied to learn effective methodologies to improve both the hiring and education initiatives, and they should be identified in this phase, with the partnerships sustained through the remaining phases. Two examples would be The Catalyst Project and the Portland State Aerospace Society, which will be explored further in Phase 3.

Phase 2: Redefining the Workforce. The research conducted in Phase 1 will be used to refine Boeing's current hiring practices. It should begin by running trial programs to determine which research recommendations are effective before being integrated into the larger recruiting platform. It will be important for the human resource department to keep detailed records and collect data to identify patterns of difficulty and establish best practices for training new recruits. This will set the framework for a sustainable workforce reassessment model which Boeing can use periodically to update its recruiting practices based on real-time market needs as they change an ever-expanding offering of new technological capabilities.

Another method that Boeing can take is to place candidates from partner universities selected in Phase 1 and evaluate them as part of the pilot program. This will enable Boeing to collect data and provide direct feedback to the schools so that the program can be refined on both ends of the partnership.

As data is collected on current aerospace engineering job requirements, it will be compiled along with other industry data to be used in the Phase 2 part of the marketing campaign: Boeing will advertise its changing workforce and what that means to the company, and to the larger aerospace industry. Doing so will establish Boeing as a leader in innovative employment practices within the industry.

Phase 3: Education Outreach. The model for education outreach will be tested ad refined based on the results from phase 2, preferably even as phase 2 is underway. Education reform is a long process because schools typically are quite limited in what they can teach and what resources can be used to teach it.

Once a good working model is identified and proven effective through pilot programs, Boeing will advertise the work being done in these studies, defining its updated workforce expectations and putting together an outline of what colleges and universities can do to improve their graduate's chances of being hired. Two examples of unorthodox but demonstrably sustainable approaches that could be examined and studied are:

The Catalyst Project. The Catalyst Project was presented at the AIAA NW 2017 Technical Symposium by Dr Dan Tappan, who described it as a public/private/academic partnership between Eastern Washington University (EWU) and Spokane, Washington industrial companies. Dr Tappan, a Systems Engineer and Computer Scientist, has a rich history of modeling and simulating aerospace weapons systems for the Department of Defense and uses that background to teach engineering students about the aerospace industry. In his EWU biography, he lists the main tools that he teaches his student to be:

- Modeling
- Simulation
- Visualization
- Analysis

Dr Tappan is a prime example of a person with a computer science background who was able to take that area of expertise and use it to not only establish a career in the aerospace sector, but then

reapply it to an education setting to prepare the next generation of aerospace engineers. His students include mechanical, electrical and computer engineers both on the graduate and undergraduate levels.

The Portland State Aerospace Society. The Portland State Aerospace Society (PSAS) was founded in 1998 by electrical engineering students, and continues at Portland State University 19 years later thanks to the continued dedication of its founders and the unique approach that it takes in aerospace education.

The success and longevity of PSAS has much to do with its approach: it provides students with the resources to pursue projects within their major and based on their own interests. PSAS is not an ABET accredited Aerospace Engineering program, yet through this approach it has produced some of the world's most highly sophisticated, yet original, open-source amateur level rocket technologies. Portland State University students who have had PSAS involvement regularly obtain internships and research fellowships from NASA, and graduates who have PSAS projects in their portfolios have successfully begun aerospace engineering careers at companies such as Boeing, Blue Origin and Garmin.

Additionally, Boeing will actively inform colleges of which job skills are CURRENTLY most important, what is lacking from current college graduates and other pertinent information uncovered from the workforce analyses. By studying and partnering with proven successful programs such as these, on top of the Phase 1 and 2 reforms outlined above, Boeing can close the STEM Hiring Gap while also increasing its own flexibility and innovation as a company to keep it competitive far into the future.

Success Metrics

Phase 1. It will be important for Boeing to consult the public to learn their perception of and concerns about the company. An important factor in this will be outreach to women and marginalized communities, which are still underrepresented in the industry.

Phase 2. As mentioned in the implementation plan, Phase 2 will require data collection from human resources and trainers as Boeing goes through the difficult but necessary process of redefining its workforce. Traditional HR metrics will be used, including Quality of Hire and Retention rate. This will be a test program, so data collection throughout implementation will be necessary to ensure that recruiting and training methods are optimized for employee success within the company.

Phase 3. As Boeing works with partner schools to develop its education outreach initiative, it will need to track the performance of the programs that those schools use, including retention and job placement rates. One key qualifier would be for Boeing to directly place promising candidates from these programs into its Phase 2 hiring process as a pilot program, and rate their performance compared to traditional candidates. Data collected from this program can be fed back to the partner schools to give them opportunities to develop any exposed weaknesses in the school programs while also shoring up their strengths.

If the initiatives through all phases of this plan prove successful, Boeing can use the developed partnerships and methodologies to broaden its impact by researching effective ways to educate younger students, enabling the preparation of an even stronger workforce in longer term.

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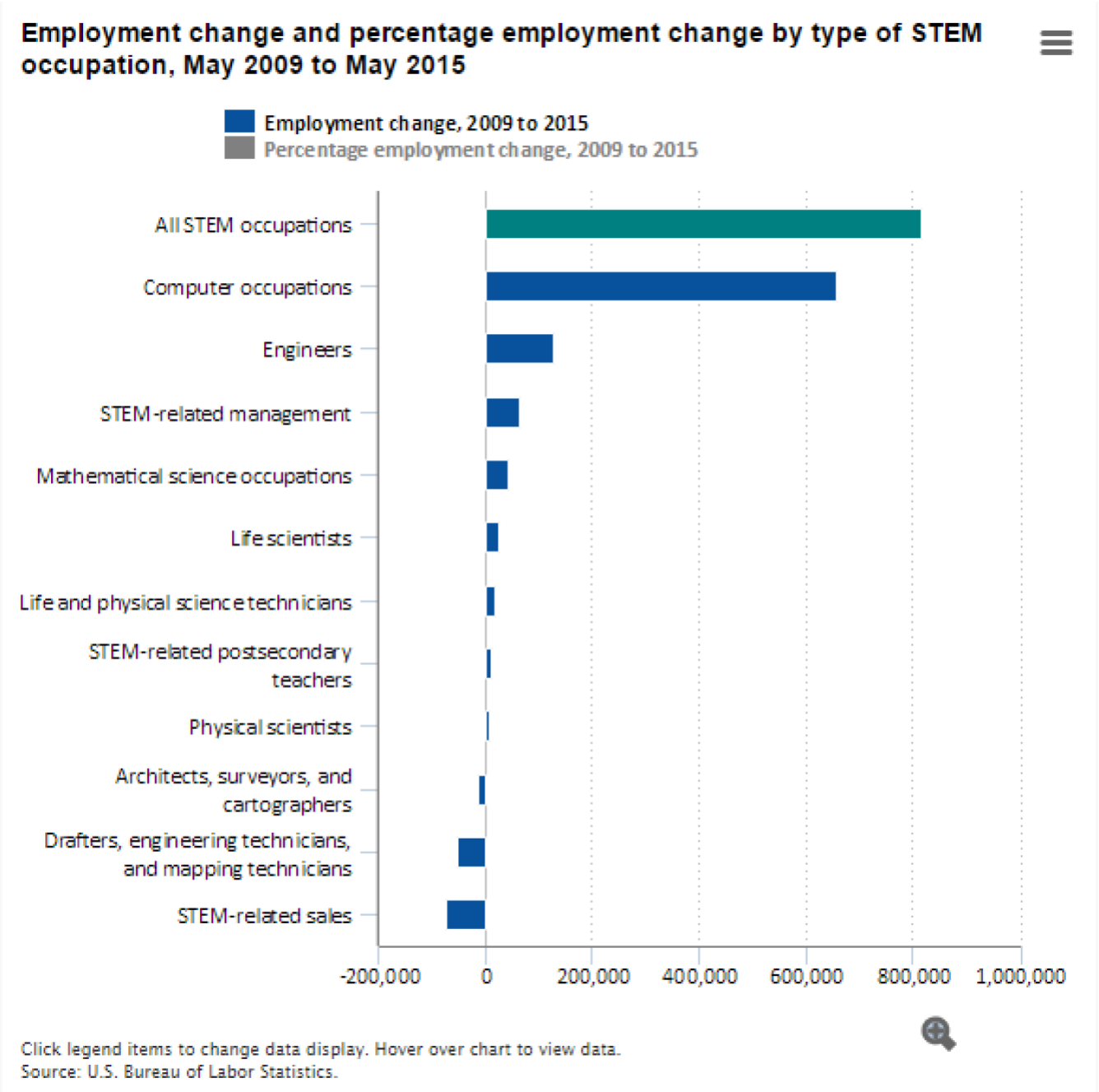
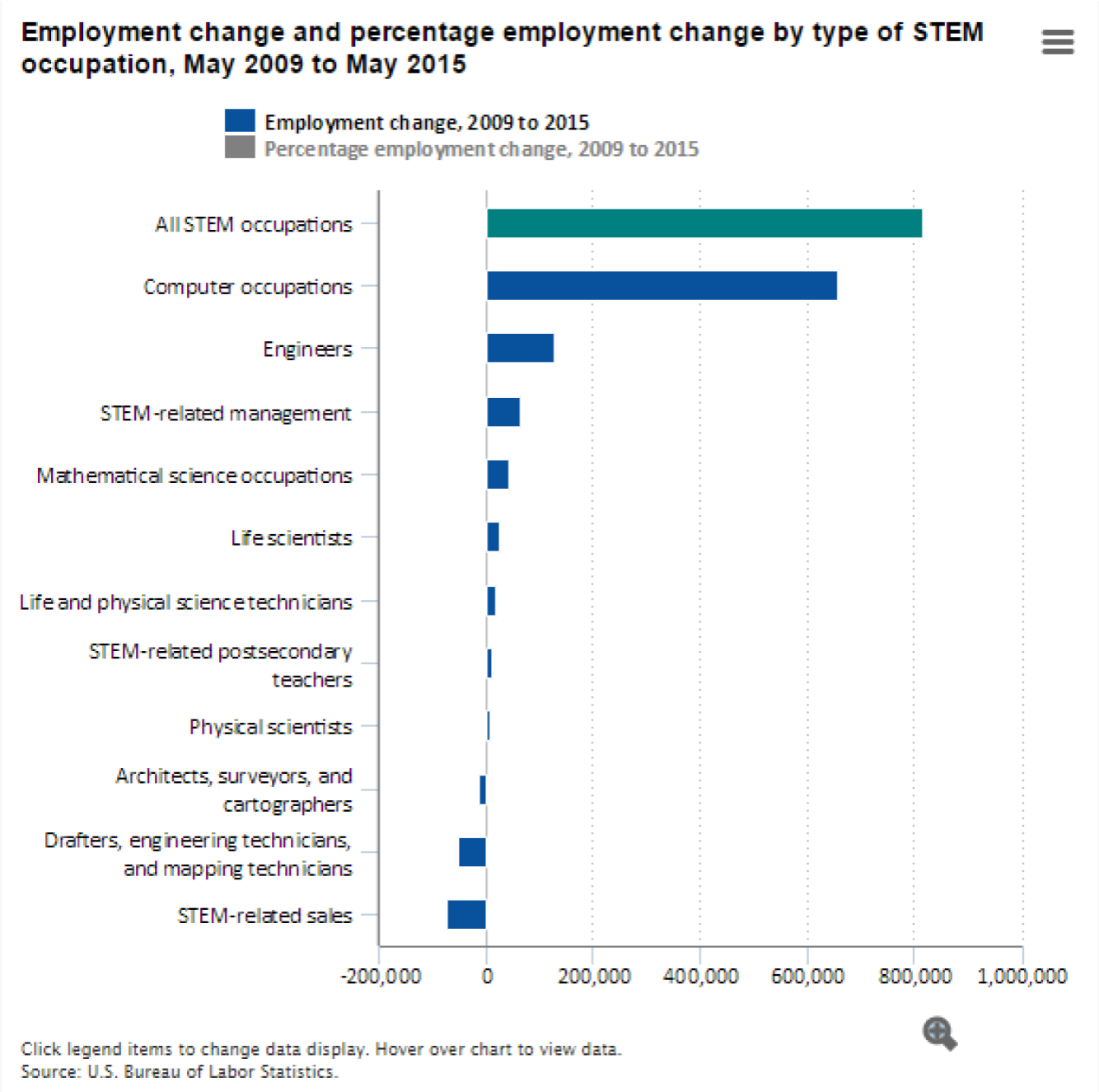
Appendix A: SWOT Analysis (From Business Insights:Global)

The Boeing Company, SWOT Analysis	
Strengths	**Weaknesses**
Market Position Research and Development Accomplishments of the Boeing Defense, Space & Security Business	Financial Performance Order Backlog
Opportunities	**Threats**
Positive Outlook for Global Airline Industry Growing Global Defense Spending Growing Global Military Satellite Market	Competitive Environment Fixed Price Contracts Business in Other Countries
Source: GlobalData	

Appendix B: Bureau of Labor and Statistics Employment Charts



Appendix B (cont.): Bureau of Labor and Statistics Employment Charts



Appendix C: Cost Benefit Analyses

Cost Benefit Analysis for Solution 1: Educational Outreach	
Tangible Benefit	**Tangible Cost**
• Promising educational programs can be continued.	• Time to hire retained as future talent is trained. • Only fills portion of the gap.
Intangible Benefit	**Intangible Cost**
• Boeing retains reputation as a STEM donor and participant in existing programs.	• Student beneficiaries are not guaranteed to go to work for Boeing. • Investments also benefit other industries and companies.

Cost Benefit Analysis for Solution 2: Targeted Marketing	
Tangible Benefit	**Tangible Cost**
• Greater public investment in success of Boeing	• Targeted campaigns to increase diversity are expensive.
Intangible Benefit	**Intangible Cost**
• Boeing's public image improved • May improve interest in more diverse talent pool	• No guarantee of success • May have unintended consequences if not done well.

Cost Benefit Analysis for Solution 3: Redefine Workforce Requirements	
Tangible Benefit	**Tangible Cost**
• Reduce time to hire and lost production revenue by broadening hiring standards to untapped workforce.	• Talent will require additional training investment to learn aerospace specific skills.
Intangible Benefit	**Intangible Cost**
• Boeing can fill vacant positions and regain some lost productivity.	• Some sacrifices to quality and lead time resulting from non-aerospace specialized workers.

Appendix D: Gantt Chart