S. HRG. 112–331

THE AVIATION WORKFORCE: INDUSTRY AND LABOR PERSPECTIVES ON TRAINING NEEDS AND CHALLENGES

FIELD HEARING

BEFORE THE

SUBCOMMITTEE ON AVIATION OPERATIONS, SAFETY, AND SECURITY

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

OCTOBER 24, 2011

Printed for the use of the Committee on Commerce, Science, and Transportation

U.S. GOVERNMENT PRINTING OFFICE
73–541 PDF WASHINGTON : 2012

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

JOHN D. ROCKEFELLER IV, West Virginia, *Chairman*

DANIEL K. INOUYE, Hawaii	KAY BAILEY HUTCHISON, Texas, *Ranking*
JOHN F. KERRY, Massachusetts	OLYMPIA J. SNOWE, Maine
BARBARA BOXER, California	JIM DEMINT, South Carolina
BILL NELSON, Florida	JOHN THUNE, South Dakota
MARIA CANTWELL, Washington	ROGER F. WICKER, Mississippi
FRANK R. LAUTENBERG, New Jersey	JOHNNY ISAKSON, Georgia
MARK PRYOR, Arkansas	ROY BLUNT, Missouri
CLAIRE MCCASKILL, Missouri	JOHN BOOZMAN, Arkansas
AMY KLOBUCHAR, Minnesota	PATRICK J. TOOMEY, Pennsylvania
TOM UDALL, New Mexico	MARCO RUBIO, Florida
MARK WARNER, Virginia	KELLY AYOTTE, New Hampshire
MARK BEGICH, Alaska	DEAN HELLER, Nevada

ELLEN L. DONESKI, *Staff Director*
JAMES REID, *Deputy Staff Director*
BRUCE H. ANDREWS, *General Counsel*
TODD BERTOSON, *Republican Staff Director*
JARROD THOMPSON, *Republican Deputy Staff Director*
REBECCA SEIDEL, *Republican Chief Counsel and Chief Investigator*

SUBCOMMITTEE ON AVIATION OPERATIONS, SAFETY, AND SECURITY

MARIA CANTWELL, Washington, *Chairman*	JOHN THUNE, South Dakota, *Ranking Member*
DANIEL K. INOUYE, Hawaii	JIM DEMINT, South Carolina
BARBARA BOXER, California	ROGER F. WICKER, Mississippi
BILL NELSON, Florida	JOHNNY ISAKSON, Georgia
FRANK R. LAUTENBERG, New Jersey	ROY BLUNT, Missouri
AMY KLOBUCHAR, Minnesota	JOHN BOOZMAN, Arkansas
TOM UDALL, New Mexico	PATRICK J. TOOMEY, Pennsylvania
MARK WARNER, Virginia	DEAN HELLER, Nevada
MARK BEGICH, Alaska	

CONTENTS

THE AVIATION WORKFORCE: INDUSTRY AND LABOR PERSPECTIVES ON TRAINING NEEDS AND CHALLENGES

MONDAY, OCTOBER 24, 2011

U.S. SENATE,
SUBCOMMITTEE ON AVIATION OPERATIONS, SAFETY, AND SECURITY,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Seattle, WA.

The Subcommittee met, pursuant to notice, at 10:18 a.m., at William M. Allen Theater, Museum of Flight, 9404 East Marginal Way South, Seattle, Washington, Hon. Maria Cantwell, Chairman of the Subcommittee, presiding.

STATEMENT OF DOUGLAS R. KING, PRESIDENT, MUSEUM OF FLIGHT

Mr. KING. Good morning, ladies and gentlemen. Thank you so much for coming this morning.

My name is Doug King. I am the President of the Museum of Flight. And it really is an honor to welcome you to our building and to welcome our distinguished panelists, the Senator, and her staff from Washington, D.C., to look at the aerospace industry here in Washington State.

You know, the Museum of Flight is honored to host this particular hearing for a couple of reasons. But I guess the main one is that most people think of us as a place that tells the story of the first century of flight.

I hope you will get a chance while you are here to go out and look at some of the early ideas of flight and the gliders right outside the hall here and the aircraft that wrote that story so strongly here in the Northwest over the last 100 years, and literally changed the way people think about where they live and people that you relate to on a daily basis, the place you can take vacation, where you can do business, how you see your families, who you talk to, how small the world is. All of that is a result of progress here in aviation.

But just telling the history isn't nearly all that we do. We think it is equally important to be thinking about the next century of flight. We would like Seattle and the Washington area to play the same major role in the coming exciting things that we will see, as we have in the first 100 years.

And so, exciting young people, making sure that they have the opportunity and the skills, the support that they need to think about aviation careers, that is the second major mission of the Museum of Flight. The people who will write that story are in class-

rooms around our region today. They are eager to work in the industry if we can get them excited.

We look forward to partnering with those of you who are in the field of encouraging and educating, getting young people ready for industry and for all the kinds of jobs that are related to aviation. We hope that we will be able to tell their story as well in the coming years.

So we hope you enjoy being here today. Please don't hesitate to ask any of us any questions about the museum, and enjoy your time here.

Now it is my honor to introduce the panel or, excuse me, the hearing on "The Aviation Workforce: Training Needs and Challenges." Senator Maria Cantwell.

[Applause.]

OPENING STATEMENT OF HON. MARIA CANTWELL, U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. Thank you.

I want to call to order this field hearing of the Senate Commerce Committee's Subcommittee on Aviation Operations, Safety, and Security.

And Doug, thank you very much for allowing us to be here today and for your ongoing work and focus on aviation education and the workforce of tomorrow.

I want to thank our two panels of witnesses that are here today to talk about this very important subject, and I just want to thank Doug for being here and the museum for being so kind to host us. You know, this really is one of the finest museums in the country in its significant aircraft and spacecraft holdings. If you haven't had a chance to visit, please do so.

And some of the exhibits are located in the red barn. The reason I mention that is the red barn is where Bill Boeing started the company on the Duwamish River nearly 100 years ago today—100 years ago—to build seaplanes. And it is this kind of aerospace leadership that today's discussion is all about—how we continue that leadership.

Because, literally, we are at a crossroads. We face a perfect storm in the demand for a skilled aerospace workforce. We have three dominant forces coming together at once.

First, there is an increased demand for aerospace products. Boeing, obviously, over the next 20 years, will be producing more than 33,000 commercial aircraft at a market value of $4 trillion.

Second, we need to adapt to exciting new technologies that require workers to learn new skills, and these include things like composite manufacturing.

And three, we need to be prepared to face a wave of projected retirements over the next decade. Here, in Washington State, the International Association of Machinists projects that 10,000 of its members will retire over the next decade.

So this perfect storm means we need more skilled workers, and Washington needs to fill more than 21,000 new aerospace jobs over the next decade to meet employer demands. And this is according to the Washington State Council on Aerospace.

Nationally, the broader aerospace industry has to hire about 32,000 workers just this year and 22,000 next year, according to Aviation Week workforce study analysis that was done in 2011.

Today's Aviation Subcommittee hearing is about training our workforce and stepping up to that challenge, and it is about America's competitiveness in aviation manufacturing. This is a pivotal point for the competitiveness of America's aerospace industry.

We are facing increasing competition on the global stage from Europe and Canada, China, Brazil, Russia, and other countries. And over the past decade, other countries have increased their investment in domestic aircraft manufacturing. This direct government investment has helped companies like Airbus challenge, obviously, the hard work that men and women are doing right here in Puget Sound.

If the U.S. is going to remain the leader in global aviation markets, then we need to continue to close the skill gap. America needs thousands more skilled workers to fill aerospace opportunities. So we know that aerospace is a huge driver for our national economy, and it employs over 600,000 Americans and accounts for over $2 billion in revenue, and general aviation manufacturing accounts for over 120,000 of those jobs.

So we want to talk today about the aerospace industry from a perspective of our State and local community, with over 150 different firms that are here and 650 in total that are part of the supply chain reaching all 28 counties in our state. And we want to talk about the forecast for the future and how that demand will mean that we have to educate more individuals to take advantage of this unique opportunity.

Washingtonians want Boeing to build all of these planes—the tanker, the 787, the 777, the 747, the 737, the 737 MAX—right here in Washington State. But to do this, we need to continue to make sure this is the best place to build airplanes, and one aspect of that is to make sure that we have a workforce that is ready to perform.

High production rates mean that we also have to have a supply base that can continue to be effective at hiring the right people and getting the productivity that we need. There are a number of common workforce issues facing the aviation industry and aerospace cluster, and we are going to talk about some of those today—an aging workforce, a challenge of current job openings and the skill gap that exists, how to make current training programs more responsive to the employers and what industry needs, how to get more students interested and trained in the occupations and trades necessary to support aerospace industry in their future needs, and how to increase the participation of women and underrepresented minorities in the area of the industry.

So we are here today to lay out the successes that we have had in training and to highlight the strategies that we need to move forward. So I want to thank our panelists for being with us today. We will have two panels this morning.

The first one more of a broader perspective by industry and academics, and the second by those involved in training the workforce in specific skills through a variety of education and training pro-

grams and representation from the employee side of what they view as the work skills and critical issues of the future.

So I am going to turn to our first panel and again welcome them and thank them for participating in this. We are going to hear from Mr. Michael Green—let us see. Sorry. We are going to start with Mr. Hermanson, who is the Chair of the Department of Aeronautics and Astronautics at the University of Washington. He will be followed by Mr. Greenwood, who is the Aerospace Academic Alignment Team Senior Manager for the Boeing Company.

Then followed by him will be Mr. Sieber, who is with GE Aviation and the Plant Leader there. And last, Randall Julin, who is with Absolute Aviation Services and General Manager of that company.

So, again, thank you very much for being here, and Mr. Hermanson, we will start off with your testimony.

STATEMENT OF JAMES HERMANSON, PH.D., CHAIR, DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS, UNIVERSITY OF WASHINGTON

Dr. HERMANSON. Thank you very much.

Good morning. Thank you, Senator. It is a pleasure to be here.

I am Jim Hermanson from the University of Washington, and these are my remarks.

The American aerospace industry understands the highly competitive international aviation environment of today, and that might be Boeing versus Airbus, GE versus Rolls-Royce, represented in part by the panelists here. This Subcommittee also clearly does understand this, and I am very happy to be here to share my perspectives on one key issue aspect of meeting this challenge, our engineering workforce. In particular, how we might work together to better meet the workforce needs of the aerospace industry in the United States.

I would say that the issue of guaranteeing a strong force of skilled workers to fill the aerospace jobs of the future has at least two key aspects, quantity and quality. Let me address the issue of quantity first.

Speaking from the standpoint of the Department of Aeronautics and Astronautics at the University of Washington, we are facing substantial challenges in expanding the size of our programs to meet the increasing demand for graduates trained in aerospace engineering. This is partly an issue of the infrastructure needed to accommodate the number of students.

Many good students are being turned away from our program due to class size limits, which arise for that reason. Perhaps more critically, there is a need for more university faculty and staff if programs are to grow to meet the increasing demand for graduates.

We are being severely strained by the economic downturn and budget austerity that this is forcing on the State of Washington. Budget cutbacks have forced, for example, significant staff layoffs, the cancellation of laboratory and other courses, and have severely restricted our ability to hire new faculty.

Staffing issues directly impact program quality and, therefore, the quality of our graduates. We need to be able to hire and retain more top-quality faculty and support staff. Our graduate programs

depend directly on the expertise and research opportunities afforded by working with top-caliber aerospace experts on cutting-edge research projects.

Our undergraduate program also benefits from the teaching provided by world-class faculty experts in aerospace. To attract and retain these people, we need an environment that provides a solid research and educational infrastructure, as well as funding that supports their research and educational activities. The Federal Government has a clear ongoing role to play here through the funding of research, which is key to sustaining major universities, such as the UW, that seek to grow and graduate the necessary new aerospace engineers.

I have sometimes heard with dismay a comment to the effect that aerospace is a mature technology and, therefore, not in any great need of research. I would like to emphatically state that this is not true.

Although we can routinely and safely cross continents and oceans in high-capacity jetliners, carry out amazing and effective aviation military missions, there are serious challenges ahead for aerospace. These challenges include meeting increasingly stringent requirements for low noise and exhaust emissions, the extensive use of composites and other advanced materials, new strategies for aircraft controls to reduce critical airspace crowding and further increase fuel efficiency, and more.

That aviation will remain a critical technology for both the American economy as well as its military is without question. In any case, the future of aviation and the institutions of higher education, which are the source of new engineers for the aerospace workforce, depend on a strong level of Federal support. The direct Federal support for students, whether it is in the form of students' grants, fellowships, or loans, also remains vital.

Increasing the quality of aerospace graduates and their effectiveness in the workforce is not, however, simply an issue of State and Federal funding. To truly increase such quality, in my opinion, also calls for increasing collaboration between university and industry in the areas of education and research.

There is already a significant degree of interaction between the two entities. For example, many of our students undertake co-ops and internships in industry, a clearly beneficial experience for the students and the host company alike. From the university side, I think we need to increase the amount of business-related training we offer to students to increase their effectiveness as they begin their careers in aerospace.

I believe that Government can play a vital role in strengthening the connections between university and industry. As one example, some years ago, the National Science Foundation introduced the concept of broader impact into its engineering research proposal requirements. The expectation is that each product produce not only excellent science but contribute to society in other ways, such as by innovations in education, K through 12 outreach, or encouraging underrepresented minorities, which I would add is a major source of new talent for science and engineering.

In the same spirit, perhaps similar expectations for similar industry involvement could be implemented, where appropriate, as

part of federally sponsored research programs in science and engineering. One example of such a program is the NSF GOALI program, which directly promotes university-industry partnerships.

One challenge is that though a clear commitment to excellence in aerospace is common to both academia and industry, their missions are different. Fundamentally, the focus of an academic unit is on education, research, and training; that of industry on development, commercialization, and production. Forming effective partnerships, therefore, requires leadership and commitment from both industry and academia to work jointly to strengthen the education of our new aerospace professionals.

To summarize, I would say that what is needed to strengthen the quality and quantity of new engineers entering the aerospace workforce is not merely to increase State and Federal funding of universities, though that is clearly important, but develop and implement mechanisms for greatly increasing the degree of academic-industry partnering in the United States.

Thank you very much for giving me this opportunity to share my thoughts with all of you today.

[The prepared statement of Dr. Hermanson follows:]

PREPARED STATEMENT OF JAMES HERMANSON, PH.D., CHAIR, DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS, UNIVERSITY OF WASHINGTON

The U.S. competitiveness in Aerospace can no longer be taken for granted in the international aerospace market. There was a time, up to the early 1980s, when Boeing was widely recognized to be the world leader in commercial aviation, playing a dominant role in the aviation marketplace. By the 1990s it was clear that that picture had changed. Airbus was demonstrating that it could produce commercial airplanes which were extremely competitive in performance, quality, and cost-effectiveness. Although the American aerospace industry understands that, I am not so certain that American society as a whole appreciates the full scope of the highly technical challenges we face as a nation. This Committee clearly does, and I am very happy to be here to share my perspectives on one key aspect of meeting these challenges: our engineering workforce, in particular, how we might work together to better meet the workforce needs of the aerospace industry in the United States.

I would say that the issue of guaranteeing a strong force of skilled workers to fill the aerospace jobs of the future has at least two key aspects: quantity and quality. Let me address the issue of quantity first.

Speaking from the standpoint of the Department of Aeronautics and Astronautics at the University of Washington, we are facing substantial challenges on the issue of expanding the size of our programs to meet the increasing demand for graduates trained in aerospace engineering. To an extent, this is an issue of the infrastructure and facilities needed to accommodate the number of students. Many good students are being turned away from our program due to class size limits which arise for these reasons. Perhaps more critically, there is a need for more university personnel if programs are to grow to meet the increasing demand for engineering graduates, thus more professors, instructors, and more support staff are required. The University is being severely strained by the economic downturn and the budget austerity that it is forcing on the government of the State of Washington. Budget cutbacks have forced, for example, significant staff layoffs, the cancellation of laboratory and other courses, and have severely restricted our ability to hire new faculty.

These staffing challenges tie directly into the issue of program quality, which in turn directly impacts the quality of our graduates. The UW needs to be able to hire and retain top-quality faculty and support staff, given that the UW is a world-class, major research university. Our graduate programs, which produce master's and doctoral degrees in aerospace engineering, depend directly on the expertise and research opportunities afforded by working with top-caliber aerospace experts on cutting-edge aerospace research projects. Our undergraduate program in aeronautics and astronautics also benefits from the teaching provided by world-class faculty experts in aerospace. To attract, and retain, these experts we need an environment that provides a solid research and educational infrastructure, as well as funding possibilities that allow the faculty to successfully conduct their research and edu-

cational activities. The Federal Government has a clear, ongoing role to play here, through the funding of research. Ensuring robust Federal funding of research in engineering and science is key to sustaining major universities such as the UW. The success of universities is, in turn, essential for graduating the necessary new aerospace engineers.

Regarding support for research in aerospace, I have sometimes heard, with dismay, a comment to the effect that aerospace is a "mature" technology, and not in any great need of new research. I would like to emphatically state that this is not true. While it is true that we can routinely and safely cross continents and oceans in high-capacity jetliners, carry out amazing and effective aviation military missions, and successfully launch spacecraft into earth orbit and beyond, there are serious challenges ahead for aerospace in the coming decades. These include meeting increasingly stringent requirements for low noise and exhaust emissions, the extensive use of composites and other advanced materials, new strategies for aircraft controls to reduce critical airspace crowding and further increase fuel efficiency, and more. That aviation will remain a critical technology for both the American economy as well as its military is without question. In any case, the future of aviation, and of the institutions of higher education which are the source of new engineers for the aerospace workforce, depends on a strong level of Federal support. Furthermore, direct Federal support for students, whether it is in the form of student grants, fellowships, or loans, is also vitally important to this mission and must be continued, and strengthened.

Increasing the quality of our aerospace graduates and their effectiveness in the workforce is not, however, simply an issue of state and Federal funding. To truly increase the effectiveness of new graduates entering the engineering workforce, in my opinion, calls for increasing collaboration between university and industry in the areas of education and research. There is already a significant degree of connection between the two entities. For example, many of our students undertake co-ops and internships in industry, a clearly beneficial experience for the students and the host company alike. From the university side, I think we need to increase the amount of business-related training we offer to students to increase their effectiveness as they begin their careers in industry.

I believe government can play a vital role in further increasing and strengthening the connections between university and industry. As one example, some years ago the National Science Foundation introduced a concept of "broader impact" into its engineering research proposal requirements. The expectation is that the funded projects result not only in excellent science, but contribute meaningfully to other aspects of intellectual activity, such as innovations in education, K–12 outreach, and encouraging under-represented minorities (a major source of new talent for science and engineering)—all important and positive activities in aerospace engineering education. In the same spirit perhaps similar expectations for significant industry involvement could be implemented, where appropriate, as part of federally-sponsored research programs in science and engineering. One example of such a program is the NSF GOALI program, which directly promotes university-industry partnerships. This kind of program should be strengthened and expanded.

One challenge is that though a clear commitment to excellence in aerospace is common to both academia and industry, their missions are different. Fundamentally, the focus of an academic unit is on education, research, and training; that of industry, on development, commercialization, and production. Forming effective partnerships requires leadership and commitment from both industry and academia to work jointly to strengthen the education of our new aerospace professionals.

To briefly summarize, I would say that what is needed to strengthen the quantity and quality of new engineers entering the aerospace workforce is not merely to increase state and Federal funding of universities, though that is clearly important, but to develop and implement mechanisms for greatly increasing the degree of academic-industry partnering in the U.S.

Thank you very much for giving me the opportunity to share my thoughts with you today.

Senator CANTWELL. Thank you, Mr. Hermanson.

We will go now to Mr. Greenwood.

STATEMENT OF MICHAEL GREENWOOD, SENIOR MANAGER, AEROSPACE ACADEMIC ALIGNMENT TEAM, THE BOEING COMPANY

Mr. GREENWOOD. Thank you.

Good morning, Senator Cantwell. My name is Michael Greenwood. I am a Senior Manager with Boeing Company. I work within Boeing Commercial Airplanes Group, supporting training, integration, and workforce development.

Thank you very much for the opportunity today to share my thoughts about the training needs of the aviation workforce. Today, I would like to highlight the workforce growth that we are experiencing at the Boeing Company and the strategies that we are using, that we are developing a pipeline of skilled workers for the future.

This has been a tremendous year for the Boeing Company. In February, we won the intense competition to build the U.S. Air Force's next tanker. And just recently, we delivered two new airplane models, the 787 and the 747–8. None of this would have been possible without our talented workforce. It is clear that our people are our competitive advantage.

This year alone, Boeing added more than 5,000 people to its workforce in our State, bringing the total workforce in Washington to over 80,000 employees.

In order to continue to attract and retain the most talented and diverse workforce tomorrow, we need to inspire the next generation of youth today. Our mission is to excite today's youth about careers in aerospace and manufacturing well before they are ready to enter the workforce. We need to change the perception that aerospace and manufacturing jobs are dirty jobs or grimy jobs.

The reality is that these are high-tech, challenging, fulfilling jobs that pay a family wage. These careers include engineers, technical support, and our aircraft assembly workforce.

By engaging with students, teachers, guidance counselors, administrators, parents, and mentors, we are working to improve the perception of aerospace and manufacturing jobs here in Washington and across the Nation. To this end, we are working closely with our IAM labor partners at the IAM District 751 and also the Washington State Office of Superintendent for Public Instruction.

We are visiting the 13 high school skills centers located across our state. We want to have our passionate and knowledgeable Boeing workers visit students and teachers in their classrooms. By allowing them to inspire our children in the classroom with hands-on projects, videos, and be guest speakers, we hope to ignite the excitement in Washington State's youth to pursue meaningful careers that will provide them with living-wage jobs for years to come.

Partnerships with academia, labor, Government, and industry have been and will continue to be an integral piece in our strategy. I want to highlight some of our highly successful partnerships.

First, the Center of Excellence for Aerospace and Advanced Materials Manufacturing. The Center of Excellence serves as a focal point, bringing together our community and technical colleges and our industry partners. This effort brings all of the stakeholders together in one place to define curriculum aligned to industry needs. This collaborative approach is critical to our continued success.

Another example of our academic collaboration can be seen at the Washington Aerospace Training and Research Center. Just completing its first year, this industry-driven training program has quite an impact thus far. To date, the center has graduated over

400 students with certificates in aerospace disciplines. Almost 300 of those students have received job offers or are working for the Boeing Company or other suppliers today.

The curriculum developed at the WATR Center is now being deployed at Renton Technical College, who just started their aerospace assembly mechanic certificate program in September. I personally visited the campus last Friday and met the students in the hands-on lab area. They were so excited about learning new skills that would prepare them for jobs in our industry.

Multiple training programs at other colleges are underway, from Vancouver to Bellingham, across the state to Spokane and Yakima, providing students with the necessary skills to enter our workforce. Other benchmark programs that are making a difference, too, include AJAC, the Aerospace Joint Apprenticeship Committee, which provides our State citizens an opportunity to learn new skills through apprenticeship.

As a graduate of a machining apprenticeship program, I can personally endorse the value these programs provide not only to the students, but to our industry's suppliers as well.

Senator Cantwell, I want to make special note here of the unprecedented support we have received from the U.S. Department of Labor. Thank you, Senator Cantwell, for your help in securing the generous $20 million grant that will benefit aerospace training across our state.

This grant will provide training to thousands of workers over the next 3 years. To support this investment, Boeing has partnered with our state's colleges to define critical skill areas that will be required in the next several years. These include advanced manufacturing and machining, aircraft assembly, airframe and power plant, composites, and electronics.

Each of these focus areas will receive support from Boeing subject matter experts who will advise on the necessary skills for entry-level workers in those jobs. The schools will translate those skills into common curriculum that will be deployed across the state. This collaboration amongst colleges is unprecedented and ensures that the funding helps as many students as possible.

In closing, as an industry, we have a lot of work ahead of us to develop the workforce that will sustain our growth into the future. The investments that we make today need to be the right investments that align the needs of the workers and the industry. With your continued support, we will work together to narrow the skills gap and put people to work.

With that, I look forward to hearing the testimony from the rest of the panel, and I am happy to answer any questions that the committee may have.

[The prepared statement of Mr. Greenwood follows:]

PREPARED STATEMENT OF MICHAEL GREENWOOD, SENIOR MANAGER, AEROSPACE ACADEMIC ALIGNMENT TEAM, THE BOEING COMPANY

Good morning, Senator Cantwell, and members of the Subcommittee. My name is Michael Greenwood, Senior Manager for Boeing Commercial Aircraft Manufacturing and Quality supporting Training Integration and Workforce Development. Thank you very much for the opportunity today to share my thoughts about the training needs of the aviation workforce.

We are all acutely aware of the state of the economy and unemployment in the United States and here in Washington State. Today I would like to highlight opportunities for workforce growth and sustainable job creation across the aviation industry and improvements that we at the Boeing Company are making in the education and training sectors to ensure that we have skilled people to fill future aviation jobs. Through collaborative partnerships with Federal, state and local governments; academia; labor and industry, The Boeing Company is focusing its efforts in developing a qualified and skilled workforce to ensure we remain the world leader in the aviation market—a market that is growing and becoming increasingly more competitive. I want to make special note here of the unprecedented support we have received from the U.S. Department of Labor through the grant it recently awarded to the Air Washington consortium in support of Aerospace workforce development in Washington State. Thank you, madam chair, for your assistance in securing this critical investment in our collective future. Our collaboration across sectors will ensure that these valuable resources are focused on the most efficient and sustainable programs supporting workforce development for the industry.

I would like to focus on a few main actions that are vital to the continued success of the aviation workforce in the coming years. Collectively, we must:

- Continue to invest in education and training programs to support the technical skill set required for the aerospace industry.
- Connect academia with industry to define skills needed for the jobs of tomorrow and develop short-term training programs to ensure job seekers get into the workforce quickly.
- Encourage and invest in experiential learning through shop classes, vocational education, internships and apprenticeships.
- Engage all demographics including students in our K–12 system, unemployed workers and veterans.

These actions are imperative to our joint success in supporting a vibrant and well-prepared workforce for the aerospace and manufacturing industries in the United States.

Boeing is Growing and Creating Jobs

As a company, Boeing is growing and hiring skilled talent. We will require knowledgeable workers from many trades to fill our workforce in the years to come. In Washington, Boeing jobs equate to jobs throughout the region; for every job that Boeing creates, it supports 3 additional jobs in the community.

This year has marked many tremendous milestones for Boeing: in February we won the intense competition to build the KC–46—the U.S. Air Force's next tanker, in September we delivered the first 787 to Al Nippon Airways, and this month marked the first delivery of the new 747–8 to Cargolux. These milestones alone do not ensure our success. If we cannot provide airplanes in the time frames required by our customers it is likely they will look to other manufacturers to satisfy their fleet needs So as the business grows, we must also increase our capacity by growing our workforce to create the products our customers demand.

To keep up with market demand for single-aisle airplanes, the 737 program will increase production to 42 airplanes per month by mid–2014. A 33 percent increase from the current rate of 31.5 airplanes per month. Over the next 2 years, Boeing will increase the production rate for each of its other commercial aircraft including the 747, 767, 777 and 787.

Boeing's highly skilled workforce is a key asset to developing and delivering the world's greatest aerospace products. Boeing employment levels continue to increase, fueled largely by the earlier mentioned strong demand for commercial airplanes. Boeing added more than 7,000 people to its workforce in Washington State since the beginning of year. This brings our total workforce in Washington to over 80,000 workers! It is clear that our people are our strategic advantage.

The Workforce of Tomorrow

To attract and retain the most talented and diverse workforce of tomorrow, we need to inspire the next generation of youth today. Just as the race to the moon inspired the youth of generations past, our mission is to excite today's youth about careers in aerospace and manufacturing well before they are ready to enter the workforce. By engaging with students, teachers, guidance counselors, administrators, parents and mentors we are working to improve the perception of aerospace and manufacturing jobs in the United States.

We need to change the perception that these are "dirty jobs" into one that reflects reality: that these are high-tech, challenging, fulfilling jobs that pay a family wage. We want to demonstrate that the aerospace industry is a place where students can

apply their math and science skills in new ways that are fun and innovative, where veterans can apply the skills they learned in the field, and where people can make a meaningful career for themselves.

In Washington State, we are engaging with Career Technical Educators responsible for vocational education in K–12 to build manufacturing career path programs which will provide students a defined course of study to prepare them for careers in Aerospace and Manufacturing. This year, we partnered with Yakima Valley Technical Skills Center to deploy a new aviation and manufacturing curriculum for 11th and 12th grade students. The purpose of the YV Tech curriculum pilot is to develop the foundation for a long-term, sustainable aerospace and manufacturing curriculum and associated career pathways that meet the needs of students, industry, labor, and Washington State. This pilot will serve as the model for future skill center initiatives in Washington State. We plan to launch a similar program with the Sno-Isle Tech Skills Center in Everett, Washington early next year.

Partnering with the IAM and the Washington State Office of the Superintendent for Public Instruction, we are scheduling visits to K–12 classrooms, shop classes, skill centers and career guidance counselors. We want to get our passionate and knowledgeable workers into the classroom to show young people the benefits of an aerospace and manufacturing career. With hands-on projects, videos and guest speakers we hope to ignite the excitement and unleash the passion in Washington State's youth to pursue exciting careers that will provide them with living wage jobs for years to come and become the aerospace and manufacturing workforce for our future as a nation.

Collaborative Partnerships

Partnerships with K–12 education, higher education institutions, labor unions, government and industry have been, and will continue to be, an integral piece in our strategy for developing a strong pipeline of workers for aerospace and manufacturing jobs.

Workforce development, in support of a growing aerospace workforce, is one area where Boeing and our labor partners are clearly aligned. Boeing and the International Association of Machinists and Aerospace Workers (IAM) District Lodge 751 are working jointly on workforce development in Washington State. Together we are partnering in the public sector, concentrating on outreach activities geared toward the K–12 classroom. By sharing our passion for our industry with the youth of the region, our goal is to ignite excitement about manufacturing and aerospace, and to encourage our young people to consider careers in these fields.

We have a strong alliance with the Washington State Board for Community and Technical Colleges, both collectively and with individual colleges. Two examples of industry collaboration are worth mentioning.

First, the Washington Aerospace Training and Research Center, or WATR Center. At the WATR Center, industry and academia are collaborating to provide students with the skills our industry demands. Just completing its first year of operation, this industry-driven training program has developed an impressive track record. To date the WATR Center has graduated 442 students with certificates in aerospace related disciplines. Of those graduates, 414 have applied to Boeing, 371 have received interviews and 258 have offers or have already started. This is a hugely successful program that demonstrates a direct benefit to the students as well as to Boeing.

Second, the Center of Excellence (CoE) for Aerospace and Advanced Materials Manufacturing. The CoE serves as a focal point, bringing together community and technical colleges, local business and industry partners in the fields of aerospace and advanced materials manufacturing. This effort ensures the efficient use of state resources for workforce development, bringing all of the stakeholders together at one table to identify curricula aligned to manufacturing job skills. This industry-driven approach to skills definition and training is imperative to our continued success.

In partnership with CoE, Boeing has conducted workshops targeting critical hourly job codes for Composites, Electrical, Machining and Assembly Mechanic. These workshops included Boeing subject matter experts that represented the skill needs for Boeing along with the participation of many local Community and Technical College. As a result, curriculum has been identified and developed to support the critical skill needs above with local Washington State Community and Technical Colleges.

Air Washington

Thank you Senator Cantwell for your help in supporting the generous $20 million dollar Department of Labor grant that will benefit aerospace training in the State of Washington. We support the grant proposal from Air Washington, a consortium

of community and technical colleges and aerospace training organizations across the state that will benefit from this grant. This funding is a catalyst for the creation of short-term training programs to support the training of 2,600 workers over a three year period. The training capacity that this grant will create will be a benefit for Boeing as well as for our suppliers and other industry partners in the region.

Boeing has partnered with Air Washington and our state's community colleges to define critical skills that will be required in the next 5–10 years. The consortium will be focusing its efforts in five skill areas critical to aerospace and manufacturing in Washington State: Advanced Manufacturing, Aircraft Assembly, Airframe and Powerplant (A&P), Composites and Electronics. Each of these focus areas will receive support from Boeing subject-matter experts who will advise on the required skills necessary for entry-level workers in those jobs. Leaders for each program will translate those skills into a common curriculum that will be deployed across the colleges for all aerospace and advanced manufacturing courses. In addition, Boeing, as an industry advisor, will continue to play a role to the consortium schools. We will continue to work internally with our employment teams to elevate awareness of these programs.

Closing

As a company and as an industry we have a lot of work ahead of us to develop the workforce that will sustain our growth into the future. Boeing will continue to work collaboratively across institutional boundaries to encourage people of all backgrounds, ages and demographics to join us in an exciting career in aerospace and manufacturing. I see a bright future for the aviation industry in the United States, and with your continued support we will work together to narrow the skills gap and put people to work.

Thank you for your interest in securing the future of the aerospace workforce. I look forward to hearing the testimony from the rest of the panel and I am happy to answer any questions that the Committee may have.

Senator CANTWELL. Thank you, Mr. Greenwood.

And now we will go to Mr. Sieber, correct? And thank you for being here.

STATEMENT OF MARK SIEBER, PLANT LEADER, GE AVIATION—YAKIMA

Mr. SIEBER. Senator Cantwell, my name is Mark Sieber, and I am the Plant Leader for GE Aviation's Yakima, Washington, site.

Thank you for inviting me to speak about the growing need to develop a well-trained aviation workforce.

GE's history of powering the world's aircraft features more than 90 years of innovation. Not just limited to aircraft engines, GE Aviation Systems business is a leading global provider of electrical power systems, avionics, actuation and landing gear, aerostructures, and propeller systems.

The Yakima plant was founded in 1921 by two brothers making irrigation and coal furnace equipment. Our transition to aerospace started in 1941, when Boeing recognized that our manufacturing capabilities could be used to produce parts for the B–17. In the decades that followed, the aerospace industry grew, and the Yakima facility expanded.

By the late 1960s, the facility had its own design engineering capability, and we started developing our niche in locking actuators. In 2007, the Yakima plant became part of the GE Aviation family and part of GE Aviation Systems business unit. Products currently manufactured at Yakima include hold-back bars used to launch aircraft like F–18 from aircraft carriers, hydraulic fuses used to protect aircraft control systems, and actuators used for landing gear.

Our Yakima plant provides 270 high-tech aerospace manufacturing and engineering jobs, with a payroll in excess of $14 million.

We are also proud to serve in our community. Last year, our employees logged more than 1,600 hours in community events.

We are fortunate to have technology, products, and services that are in demand. Contracts on new programs are helping us grow, and having access to a well-trained, educated workforce is critical to our continued growth.

The work we do in Yakima is specialized and technical. It can be difficult finding the expertise we need. So we invest heavily in training our employees. An incoming employee's background can vary anywhere from zero to hundreds of hours of actual experience. The amount of training required varies by position and level of skill.

Most of our engineers join us right out of college or from other aerospace companies. The majority of our manufacturing employees come to us from our local community. The Yakima site has historically struggled to fill positions for aerospace engineers and technicians, which are skill sets not common to central Washington. So we incur higher costs for recruiting outside the region and outside of the State.

We have found that using a teaming approach helps increase worker productivity. Teaming is one of GE Aviation's key initiatives to drive increased involvement, development, and empowerment of employees. We experience greater creativity, improved work processes, and increased plant performance when we maximize the diverse talents of our employees and increase their involvement in problem-solving and decisionmaking.

We are fortunate to have a great educational institution nearby, such as Perry Technical Institute and Yakima Valley Community College. Perry Tech is a 2-year machine technology program that prepares students for entry-level positions making machine products.

We participate in their program advisory committee by providing feedback on the skills we need, and this feedback provides guidance on the program's curriculum. Summer interns and students in our leadership programs provide an excellent pipeline for talent, and this is an area where we rely heavily on our partnerships with colleges and universities. We anticipate having 15 interns in Yakima this summer, and 6 additional students in our operations management leadership program.

We are proud to be a part of the GE Aviation family, which believes strongly in science, technology, engineering, and mathematics education; training employees; and developing a strong workforce. As a leader in technology and innovation, we strongly value the need for tomorrow's leaders to be equipped with skills for the 21st century, such as an ability to think critically and solve complex problems. These skills are predominantly developed in the mathematics and science disciplines.

GE invests more than $1 billion annually in training and development programs, helping our employees have a greater impact in our business and community.

In closing, aviation continues to be a growth industry. But in order to remain competitive and strong, we need a well-trained workforce. Continued investment for STEM education and employee training is necessary to help us fill the gap.

I thank the Committee for its time and would be happy to answer any questions later.

[The prepared statement of Mr. Sieber follows:]

PREPARED STATEMENT OF MARK SIEBER, PLANT LEADER, GE AVIATION—YAKIMA

Closing the Gap: The Need for Worker Training and Education

Chairman Cantwell, Ranking Member Thune, and members of the Committee, my name is Mark Sieber, and I am the Plant Leader for GE Aviation's Yakima, Washington site. Thank you for inviting me to speak about the growing need to develop a well-trained aviation workforce.

GE's history of powering the world's aircraft features more than 90 years of innovation, from the turbo supercharger to the world's most powerful commercial jet engine. Our innovation is not limited to aircraft engines; GE Aviation's Systems business is a leading global provider of electrical power systems, avionics, actuation and landing gear, aerostructures and propeller systems. GE Aviation's technological excellence, supported by continuing substantial investments in research and development, has been the foundation for growth, and helps to ensure quality products for customers.

Yakima's Proud History

The Yakima plant was founded in 1921 by two brothers making irrigation and coal furnace equipment, products that served needs of the region's agriculture industry. Our transition to aerospace started in 1941 when Boeing recognized that our manufacturing capabilities could be used to produce valves and mechanisms for the B–17. In the decades that followed, the aerospace industry grew and the Yakima facility expanded manufacturing capacity. By the late 60s, the facility had its own design engineering capability and we started developing our niche in locking actuators. Yakima-based engineers developed locking actuator technology that provided the right solutions to our customer's needs, and we continue to evolve those solutions to use in today's applications. In 2007, the Yakima plant became part of the GE Aviation family, and currently part of GE Aviation's Systems business unit, which designs and sells avionics, electrical power, and mechanical systems for commercial and military aircraft. Products currently manufactured at Yakima include holdback bars used to launch aircraft like F18 from aircraft carriers; hydraulic fuses used to protect aircraft control systems on the Boeing 737, 747, and 777; and actuators used for landing gear on the V22, A380 and 787.

Our Yakima plant currently provides 270 high tech aerospace manufacturing and engineering jobs, with payroll in excess of $14 million to central Washington economy. High tech manufacturing is not common for this region of the state, and we take pride in what we've built in this community. We are also proud to serve in our community. Last year, our employees logged more than 1,600 hours in events such as United Way's Day of Caring, Operation Harvest community food drive, March for Babies, Yakima Greenway beautification activities, and construction of a new playground at Kiwanis Park.

We are fortunate to have technology, products, and services that are in demand. Contracts on new programs like the 787 are helping us grow. Having access to a well-trained, educated workforce is critical to our continued growth.

Training is Essential for Our Employees

The work we do in Yakima is specialized and technical. It can be difficult finding someone who arrives with the expertise we need, so we must invest heavily in training our employees. An incoming employee's background can vary anywhere from 0 to more than 100 hours of actual experience, so the amount of training that is required varies by position and level of skill coming in the door.

Most of our engineers join us right out of college or from other aerospace companies. The majority of our manufacturing employees come to us from our local community population, where some of our hiring decision is based on their mechanical aptitude and if they are trainable for machinist and assembly positions.

Finding Qualified Workers Can Be Difficult

The Yakima site has historically struggled to fill positions for qualified, experienced aerospace engineers and technicians, which are skillsets that are not common to central Washington. Winning the contracts for A380 in 2002, and 787 in 2004, drove requirement to expand our engineering and manufacturing capacity . . . more than the handful we could recruit locally. We incur a higher cost for recruiting outside the region, and outside the state.

Teaming Increases Productivity

We have found that using a teaming approach helps to increase worker productivity. Teaming is one of GE Aviation's key initiatives to drive increased involvement, development and empowerment of employees. Within our teams, we experience greater creativity, improved work processes and increased plant performance when we maximize the diverse talents of our employees and increase their involvement in problem solving and decision-making. Yakima currently has nearly 40 percent of our workforce organized in high-performance teams and we continue to move in this direction with all employees.

As a global company, our talent must reflect the communities we serve and with whom we do business. We are actively engaged in various outreach efforts, some of which include the City of Yakima's Worksource job fair, South East Community Center's 100 jobs for 100 kids' summer program, and the New Vision Yakima county development association.

Our diversity within GE is about the power of the mix—the strength that results from an internal and external team with varied experiences, backgrounds and styles.

University Partnerships Are Key

We are fortunate to have great educational institutions nearby, such as Perry Technical Institute and Yakima Valley Community College.

Perry Technical Institute has a two-year Machine Technology program that prepares students for entry-level positions making machined products. We participate in their Program Advisory Committee by providing feedback on the skills we need and this feedback provides guidance on the program's curriculum.

Summer interns and students in our leadership programs provide an excellent pipeline for talent and this is an area where we rely heavily on our partnerships with colleges and universities. We anticipate having 15 interns in Yakima this summer and six additional students in our Operations Management Leadership Program (OMLP's).

Central Washington University, Washington State University and Montana State University are also strong proponents of ours who help provide talented interns and engineering candidates.

GE Aviation's Commitment to STEM Education and Workforce Training

We are proud to be a part of the GE Aviation family, which believes strongly in Science, Technology, Engineering, and Mathematics (STEM) education, training its employees, and developing a strong workforce. As a leader in technology and innovation, we strongly value the need for tomorrow's leaders to be equipped with skills for the 21st century, such as an ability to think critically and solve complex problems creatively and collaboratively. These skills are predominately developed in the mathematics and science disciplines.

Regarding training, GE is investing more than $1 billion annually in our training and development programs, helping our employees to have a greater impact in our businesses and community.

In closing, aviation continues to be a growth industry, but in order to remain competitive and strong we need a well trained workforce. Continued investment for STEM education and employee training is necessary to help us fill the gap.

I thank the Committee for its time and would be happy to answer any questions.

Senator CANTWELL. Thank you, Mr. Sieber, and we will get to that in a minute.

But, Mr. Julin, you are our last speaker on this panel. Thank you for being here. We appreciate it. Look forward to your testimony.

STATEMENT OF RANDALL JULIN, GENERAL MANAGER, ABSOLUTE AVIATION SERVICES, INC.

Mr. JULIN. Thank you for inviting us.

Senator CANTWELL. You may need to pull that microphone a little closer, too.

Mr. JULIN. Thank you, Senator Cantwell. Is it——

My message is similar to what we have heard across the panel——

Senator CANTWELL. Why don't you just try to pull it a little bit closer, or maybe it is the next microphone?

Mr. JULIN. Maybe it is not on.

Senator CANTWELL. Next to you.

Mr. JULIN. Hello?

Senator CANTWELL. Yes.

Mr. JULIN. Yes. My message is very similar to what we have already heard. I am the General Manager of Absolute Aviation Services. We are a small veteran-owned business on the east side of the state.

I represent also not just myself, but probably 60-plus companies on the east side of the State that are in the aerospace business. Yes, there is aerospace in eastern Washington.

It has been stated, but just to reiterate, the significant shortfall of trained aerospace workers that is projected over the next decade, the shortfall has already begun. An example is the recent hiring of almost 6,000 workers at Boeing, creating a domino effect in the industry. These workers, in many instances, are hired from other aerospace companies in the area, who must then backfill those positions.

This is in addition to those workers needed to support the aerospace companies to accommodate the increased production rates. Being able to fill these positions with trained workers is not only important to Washington State, but also to our national interests.

Although the shortage of engineers is well documented, as Mr. Hermanson has indicated, my personal experience at Absolute Aviation and also input from other Washington-based companies indicate that the workforce requirements ratio for technicians, mechanics, machinists—2-year program students—to engineers, basically a 4-year degree, is roughly 7 to 1, respectively, and sometimes higher, depending on the industry.

More than 60 percent of the high school students currently do not go on to college directly from high school. We need to focus our recruiting efforts on this group.

Although these students may not be immediate candidates for a 4-year engineering degree, they are prime candidates for 2-year associate degrees or certificate programs. We cannot afford to marginalize or discount the innate talents and potential of this group of students.

So, what do we need to do? We need to motivate and inspire these students early on, at the junior high and high school level, to pursue careers in aerospace. But how do we do that? I mean, one important way to do that is to show the relevancy of science, technology, engineering, and math, a STEM education, with practical, real world examples of its application.

One of the programs that I have seen successful on the east side is Teach the Teachers program, where we bring teachers into the business, maybe 20, 25 teachers at a time. And we actually let them do hands on so that they can connect and understand what we are doing in industry.

They take that message back to the classroom. That provides some inspiration. I have seen that program work.

High school job fairs, where we are actually out there interfacing, talking to the students. High school skills centers. We have lost, it

seems like, in high school—I grew up with shop classes. You don't see that much anymore. But the skills centers is one avenue, and I think a cost-effective one, to connect high school students to those jobs and skills that would be more associated with the community college system.

Aviation High School, which we are going to hear about a little bit later. I think it is great. I am not sure we have the number of students on the east side to do something like that now, but that is a great program.

It is important that it be industry driven, that the education—and it is up to us as industry leaders to ensure that what is being taught is what we need. I am seeing a lot of enthusiasm and efforts from the educators and academia to engage with industry, I think, and that is absolutely critical.

You have got the Washington Aerospace Training and Research Center; Inland Northwest Aerospace Technology Center, which is being built; aerospace program equipment grants; and also the community college centers of excellence. And the next panel, I think, will talk some more on that.

Industry must be actively engaged in the design of aerospace training facilities, equipment purchases, and curriculum development and implementation. I have got a list of things that are—where industry can get involved. Community college advisory boards, involved in the technology centers and their curriculum, as Mr. Greenwood has indicated with Boeing actively involved in that.

Apprenticeship programs, which will be discussed by Laura Hopkins a little bit later. The FAA Centers of Excellence. One thing that I would like to see is that I would like to see industry connect with academia, with the educational system to be able to offer some of the state-of-the-art equipment, access to state-of-the-art equipment maybe on a second or third shift. I haven't seen really that initiative at this point, but I think that that is a way that—a very cost-effective way, maybe on a third shift where it is not being utilized, that we get students in to train on the equipment that is absolutely state-of-the-art.

In conclusion, I think that, you know, as I indicated, although it would be wonderful if all of our high school students were bound for a 4-year college to become engineers and scientists, that is not reality. We need to convince students, teachers, and parents that a 2-year degree is respectable and can lead to family wage jobs and a fulfilling career, as Mr. Greenwood has indicated.

Through industry and Government partnerships, we need to recruit and train our next generation of aerospace workers. To do that, we must increase support for aerospace and aviation-related education programs and institutions by providing coordination at the local, State, and Federal level; funding current programs; and finding and implementing best practices. We need to go across the State and the country to find out what is working.

We can develop State-wide and national synergies to meet our current and future aerospace workforce needs.

Thank you.

[The prepared statement of Mr. Julin follows:]

PREPARED STATEMENT OF RANDALL JULIN, GENERAL MANAGER,
ABSOLUTE AVIATION SERVICES, INC.

Challenges

A significant shortfall of trained aerospace workers is projected over the next decade, both in Washington State and nationally. This shortfall has already begun. As an example, the recent hiring of 6,000 workers at Boeing creates a domino effect on the industry. These workers, in many instances, are hired from other aerospace companies in the area, who must then backfill those positions. This is in addition to those workers needed by the supporting aerospace companies to accommodate the increased production rates. Being able to fill these positions with trained workers is not only important to Washington State, but is also in our national interests.

Although the shortage of engineers is well documented, my personal experience at Absolute Aviation Services and also input from other Washington-based companies indicates that the workforce requirements ratio for technicians/mechanics/machinists (2 year degrees) to engineers (4 year degrees) is roughly 7 to 1 (respectively) or higher depending on the industry.

More than 60 percent of High School students currently do not go on to college directly from High School. We need to focus our recruiting efforts on this group. Although these students may not be immediate candidates for a 4 year engineering degree, they are prime candidates for 2 year Associate Degrees or certificate programs. We cannot afford to marginalize or discount the innate talents and potential of this group of students.

Student Outreach

Motivate and inspire students in Junior High and High School to pursue a career in Aerospace.

Show relevancy of Science, Technology, Engineering, and Math (STEM) education with practical real world examples of its application

Examples in Washington State:

Teach the Teachers

High School Job Fairs

High School Skills Centers focusing on aerospace manufacturing technologies, *e.g.,* machining, welding, plating, non-destructive testing (NDT), computer programming, electronics, etc.

Aviation High School—Des Moines, WA

Technical Training Facilities

Industry driven state-of-the-art Technical Training facilities are required to prepare students for Aerospace employment.

Examples in Washington State:

Washington Aerospace Training and Research Center—Everett, WA

Inland Northwest Aerospace Technology Center (in work)—Spokane, WA

Aerospace Program Equipment Grants to Community Colleges

Community College Centers of Excellence for Aerospace, Technology, and Manufacturing—Edmonds and Everett Community Colleges

Industry/Government Partnerships

Industry must be actively engaged in the design of aerospace training facilities, equipment purchases, and curriculum development and implementation:

Community College Advisory Boards

Aerospace Technology Centers and their curriculum

Apprenticeship Programs—Mobile Training Center

Government/Educational System partnerships for Research and Development—University of Washington (Washington Technology Center) and Washington State University (Applied Sciences Lab)

FAA Centers of Excellence—Joint Center for Advanced Material Research at the University of Washington (UW)

Department of Agriculture grants to the University of Washington and Washington State University for aviation bio-fuel research

Need to develop new programs in which modern/state-of-the-art equipment currently being used by industry is made accessible for hands-on training to Community Colleges and Technical Centers

Conclusions

Future aerospace workforce shortfalls are well documented. In order to meet those needs, we must not miss an opportunity to connect with the majority of High School students who will not continue their education after High School unless we intercede to raise the visibility of and actively promote aerospace careers. By connecting with these students early, we can motivate them to continue their education, whether it is a 2 year technical degree or a 4 year engineering degree. Although it would be wonderful if all of our High School students were bound to attend a 4 year college and become engineers and scientists, that is not reality. We must convince students, teachers, and parents that a 2 year degree is respectable and can lead to a family wage job and a fulfilling career.

Through Industry and Government partnerships, we need to recruit and train our next generation of aerospace workers. To do that we must increase support for aerospace and aviation related education programs and institutions. By providing coordination at the local, state, and Federal level, funding current programs, and finding and implementing best practices, we can develop statewide and national synergies to meet our current and future aerospace workforce needs.

Senator CANTWELL. Well, thank you, Mr. Julin.

And again, we are here today, obviously, to talk about how the United States keeps its competitive edge in aerospace manufacturing. And there is no better place to come to, to talk about that than right here in Seattle because we are a leader in aerospace manufacturing.

I think the panelists have outlined some of the challenges that we face, the fact that we are facing a shortage of the skill level that we need to continue to meet the demand. And obviously, we are going to hear from the second panel about how we have a great number of employees who are going to be retiring in the next 10 years that is going to make this challenging for us.

So I wanted to start with you, Mr. Greenwood. You mentioned in your testimony that the workforce or you said people are really one of our competitive advantages. I wonder if you could expound on that because I think a lot of people in this room think that the workforce is our competitive advantage, and obviously, that we have seen competition come from lots of different places.

Could you describe what you mean by that and how we could continue to use that as a way to keep manufacturing jobs not just here, but in the United States in general?

Mr. GREENWOOD. Sure.

Senator CANTWELL. And you might have to pull that microphone closer to you.

Mr. GREENWOOD. Yes. Thank you.

A couple of comments. One is that here in the State of Washington, we have 80,000 employees or more that work for the Boeing Company, and they certainly come to work every day with the technical skills needed to design, engineer, and build the world's greatest aircraft. And those technical skills are certainly important as we move into the future, continuing to build the workforce for tomorrow.

I did want to just touch a little bit on one point, and that is, is that while those technical skills are certainly important—and we heard that here from the panel this morning—so are the interpersonal skills, the ability to work collaboratively in a teaming environment. And I think we heard a couple of panelists talk about the ability to solve complex problems in the work area. That hap-

pens today with our workforce here in Washington at our Boeing facilities and across the Nation and around the world.

So as we move forward and build that workforce for tomorrow, it is important to continue that and that when we build those technical capabilities, we also remember that the interpersonal skills of the workforce, the ability to work in a very complex environment is just as important.

Senator CANTWELL. Do you think we have a competitive advantage today on the skill level of our workforce in the U.S. over other countries?

Mr. GREENWOOD. I would say yes, and I would say the challenge is, as we have all talked this morning, to continue that. There are some challenges that need to be addressed.

Senator CANTWELL. One of the things, Mr. Hermanson, you talked about is how industry and academia have to work closer together on solving some of those challenges or issues. And you mentioned NSF GOALI program. Could you elaborate on what kind of collaboration would help us?

Dr. HERMANSON. Well, I think there are a number of things. And first, if I might digress a minute and follow up on Michael's comment? Strengthening the students' perceptions and their experiences in teamwork and people skills is absolutely vital, and we stress that throughout our program.

We have a very intensive project-based component where the students learn early on in their junior year and again in their senior year to conduct projects, many of these in direct collaboration with Boeing and other industries, to form that teaming environment, to do their project reporting, to meet their objectives, to meet their schedule. And the key importance of interacting with other professionals is emphasized.

The GOALI program is one program NSF has to encourage—from that program's standpoint, it is more directed at encouraging academicians to spend some time in industry, as part of that program, which I think is valuable. What I am saying is I think beyond that, it would be good to more broadly encourage industry to engage with universities in research programs, in education programs, along the lines that we have heard here.

How can we get more students out into industry as part of their education, as part of internships? If it is something after hours or whatever, get them exposed to the equipment and technology. How can we get more industrial experience and exposure to our projects and more involvement from local companies in working with the students as part of their formal projects?

And then, beyond that, what can we do to strengthen the connection between industry and academia in the area of research? Can we carry out more joint programs? How can that be encouraged so we can formulate a research portfolio at the university, for example, that connects strongly with Boeing and GE and other aerospace leading companies to conduct research that advances the state-of-the-art, gives our students the cutting-edge experience, and also addresses practical industrial problems?

As I said in my statement, the challenge there is sometimes industry wants different things. Their focus is more on development and product and having prototypes and deliverables. Our focus is

more on education. But there are ways that both can be worked in the context of trying new programs so we get the basic research and an exploratory development and also get real connection with industrial problems.

Senator CANTWELL. Are not composites a clear example of this? Where the AMTAS Center worked with industry on what needed to be done—the research behind composites?

Dr. HERMANSON. I think that is a stellar example. And the FAA is involved, of course. So you have a triangle between Federal agencies, you know, through the Department of Transportation, FAA, helping guide the overall scope of the program; extensive industrial involvement; and then university involvement for the research end. So those sorts of programs, I think they are terrific and absolutely should be encouraged.

Senator CANTWELL. Mr. Julin, you mentioned the ability to have young people actually take advantage of some of the equipment, state-of-the-art machines. You are part of our larger supply chain and serve a variety of end customers.

I am assuming that as Boeing continues to hire out, part of your challenge and Mr. Sieber's challenge is maintaining the workforce that you have, that they are an attractive source of employees. As Boeing hires to fill their needs, oftentimes, you might be left with having to then fill the new vacancies created. Is that true? Is that a challenge?

Mr. JULIN. Certainly, that is a challenge. And I think it all goes back to where we get our students from and getting students into aerospace and aviation at an early point in their time. An early time meaning junior high and high school, and that is the inspiration that we need to foster at that early age.

And because, basically, in the supply chain, we end up doing a lot of the training for the Boeing Company. And that is understandable. We know how the process works. On the eastern side of the State, we are not as dependent on the Boeing Company, but there is a lot of aerospace that is going on on the eastern side.

It was mentioned that the partnership between the universities and business, and I think that there are a couple examples. The Washington Technology Center is one. I personally have been able to use what they call the "Applied Sciences Lab" at Washington State University. So that a small business can access what the universities have in terms of equipment. They have got the scientists and the engineers there. And we are able to tap into that from a small business standpoint, very reasonably priced, and we need to foster more of those kinds of relationships.

But some of it is just industry knowing that it is available. I think that is a lot of the problem. It is a matter of publicizing and making it known to industry that these resources are out there and they can be accessed.

Senator CANTWELL. Mr. Sieber, did you want to comment on that, on how the production rates at Boeing sometimes make it challenging for part of the supply chain to then keep a skilled workforce?

Mr. SIEBER. Definitely, as there is a rapid increase, it puts pressure on us to try to find qualified people quickly to fill the positions. I will say that I actually think some of the mix between our

company and Boeing, people moving back and forth, is actually healthy. That we have definitely seen people come to us from Boeing that have shared ideas, and I am certain that we have had people that have gone from GE to Boeing that have shared ideas.

And I actually think that adds to the strength of our U.S. aviation industry, the ability to have a certain amount of movement of people and the sharing of best practices within that.

The comment on the increased production rate, as I mentioned in my comments, the ability to find and hire people definitely puts pressure on us. And we reach out to pretty significant distances to find people and bring them into the region. Engineers certainly through the universities, but also skilled machinists and that type of trade.

So I think it is important to continue to encourage children, especially in the high school before they get into the thoughts of college. Not every high school student has the interest to become an engineer. But I think we do need to reinforce that some of the skilled trades offer a wonderful career with a lot of challenges and the abilities to collaborate together and contribute to our aerospace industry.

Senator CANTWELL. All of you mentioned the apprentice programs, in addition to engineering programs generally. I know that part of the Department of Labor grant was for, I think, five different certificates. Do we have an ongoing process of identifying or shifting the skills within various certificate areas? Or do we know what is going to be for the next 20 years, and we can really go to town on how to match up not just this certificate program, but at the K through 12 level of encouraging students to be interested?

I don't know who wants to talk about that.

Mr. SIEBER. I will jump in on it. I mean, the——

Senator CANTWELL. I mean, I heard a story as we were touring South Seattle Community College on this the other day, and someone mentioned that we might be falling behind as it relates to Europe on some of the qualifications standards for certificates just because the FAA needs to also modernize its requirements. That some of the manufacturing being taught was still done with wood when we need to move toward composites and that they have been able to streamline that a little faster in Europe.

So my question is, do we know what these certificate needs are for the future? Are they going to stay the same, or are they going to continue to change? And do we need to take that into account?

Mr. SIEBER. Well, I think it is actually a little bit of a mix because there are some very basic machining skills, inspection skills, assembly skills that require a person with the interest with a mathematics background to be able to adapt to. Certainly, the newer machine tools have higher levels of computer equipment to work with them. Certainly, the newer inspection equipment also offers a challenge.

With that said, there are skills like composites, and I have worked in composites a bit, and there is a learning involved with that technology that is different. And it is not something that is normally available to most high schools, being able to work with the autoclaves and the pressurized equipment, both from a temperature or pressure. There is a lot of cost involved with the equip-

ment. So it is very specialized, certainly not as available as a machine tool or a micrometer.

So I think we need to make sure that we have got the basics. Even with composites, you still need to know how to read a gauge, how to read a blueprint, how to do math. And then be able to build on that with some of the more specialized skills, but recognize it is not going to be something that every school can offer.

Dr. HERMANSON. If I could add to that from the university's point of view? Composite materials and structures is huge. It is a landmark area. It is truly changing aviation with the increased performance that you can get from these materials. We have a very active program in composite materials and structures and offer actually a master's degree in that, as well as a certificate program.

So for half of the answer, I would agree with Mr. Sieber, that composite materials and structures is going to remain an active topic probably for the next 20 years or so. But I think another one that is emerging and not necessarily the only one is, as a Nation, we need to again renew our focus on energy as a key topic.

And we have these energy crises periodically. We have been talking about energy as a nation for 30-plus years. But what is our energy strategy? Where are we going?

And we have seen with the recent boost in oil prices and fuel prices, again the discussion has increased on alternative fuels from an economic standpoint. But I think for the sustainability of aviation, alternative fuels is going to be a key area that in a sense that energy issues have been around for a long time. We have all grown up thinking and talking about energy.

Maybe, pun intended, we need to renew our discussion of energy and open this up to get the resources and start new programs in alternative fuels. Aviation being one example, but this spills over into transportation more broadly and into the national economy.

So my vision might be along that 10 years from now we have a dynamic composite materials and structures program. We have an equally dynamic energy and aviation—green aviation, sustainable aviation, alternative fuels program—with also clear benefits to the economy and to the Nation. So that is another area.

Mr. GREENWOOD. I would just add to Mr. Sieber's comments around your question around certificate training. Certainly, technology changes. Machine tool technology, the way we fabricate might change over time. But some of those core foundational skills that were good 80 years ago, were good 20 years ago, are still needed today.

The math skills, the ability to measure, the ability to be collaborative—all those foundational skills around manufacturing, we need to kind of revisit that, I think, across the State with young people. We often say this internally, and it is true, that young kids today don't spend time in the garage with their father or their uncle. And in some cases, they haven't even been to the garage.

So there is an opportunity to kind of revisit some of that core training for our kids.

Senator CANTWELL. I think a lot have been on flight simulator, though, haven't they?

[Laughter.]

Mr. GREENWOOD. That is true. True.

Senator CANTWELL. Mr. Greenwood, you mentioned yourself the apprentice program and that you were part of that. How do we encourage students to take an interest in aerospace? Do you think this is a chicken and an egg that if we create apprentice slots, the people will come? Or do you think this is an issue of we also have to attract people into these careers and reposition it? I think you mentioned some of that in your testimony.

Mr. GREENWOOD. Yes. I think we do need to create excitement with our kids today about what is manufacturing and assembly, how do those airplanes get built, how do we manufacture products of all kinds. And I think our efforts to get back into the classroom, have our Boeing employees and other suppliers visit the classroom and inspire young kids into this career is step one.

And I think that there are some really great examples of things we can share with kids. We can show videos. We can conduct tours. We can really excite today's youth about the opportunity to get into manufacturing.

Senator CANTWELL. Any of the other panelists on that point, on the apprentice program and what we need to do? Obviously, the Department of Labor grant will create some capacity to do more education. But if you look at these numbers, at least of what Mr. Greenwood and Mr. Hermanson are saying about the future demand, I mean, we are talking thousands of job slots here that we are going to have to fill and a retirement of machinists that are going to accentuate that.

Mr. JULIN. And I think the problem is really twofold. One, you have got education in the basic skills, and we all know that that is important. But how do you get the more advanced skills also? And I think we also have to look at whether we are training in the right things?

Well, it is really a moving target. It is very dynamic. And the only way that we are going to ensure that we are training in the right things is to make sure that we have that industry-academia-education system link, and we can't calibrate today and say, OK, we have got everything in place, and we are going to meet all the needs of industry, and then just forget about it and move on. Because it has to be an ongoing process.

We do have some systems now where industry is talking to the educators. There are systems set up. But we have to keep an emphasis on that. We can't just go back to old ways of just educating the way we always have been.

And that, really, I think comes down to equipment. I was involved on an advisory panel where we allocated some funds for equipment, and that is great. But that equipment is probably going to be there for decades.

It is going to go out of date. The only way to stay up with it is to have the education system have access to industry's latest and greatest technology, and we have to figure that one out.

Senator CANTWELL. How about that, Mr. Greenwood? Is that something possible, the kind of third shift access to technology for training purposes or inspirational purposes?

Mr. GREENWOOD. I think it is a really great point. We have certainly talked about the possibility of internships not only for students, but for teachers and members of academia. I don't think we

are at a place now where we are ready to commit to that, but I think the idea is excellent, a very good idea.

Senator CANTWELL. Because, Mr. Julin, you have quite a few internship programs, right, and leadership programs at your facility? Or Mr. Sieber, is that you, that you do quite a bit of that?

Mr. SIEBER. We have internships, not so much on the apprenticeships. And for us, that is a win-win because we embed our interns right into the job, working with our engineers, working with our shop. They are part of our team, and we see a lot of excitement because we share quite a bit with them. They are there to learn. They are there to contribute.

But then we also tie them into other parts of the business so that they can see the higher picture. As an example for myself, on a weekly basis, we will meet with all the other plants within the aviation system. And my interns will come in and sit as part of that panel with me on the videoconference and be able to hear what is going on in other parts of the industry as well.

So I think a key to keep that excitement is to not pigeonhole them too much, to really let them see that there is a number of opportunities that the experience will contribute to.

Dr. HERMANSON. If I could add onto that? You know, going back to the educational point of view, I think another thing, another condition we should acknowledge is that education has changed a lot in the last 20 years. And the biggest single thing I would point to is the emergence of the Internet and rapid exchange of information and the computer skills.

One result is the incoming students, the undergraduates that we get, generally are extremely familiar with computers. They are very comfortable with computing. They can run their own codes. They can run multiple programs that is simply not an issue. Their computational skills are very strong.

But at the same time, I think there has been a certain erosion of the emphasis of fundamentals in the sense that we emphasize the fundamentals in our program, but you can do so much with high-speed computing now, the nature of how students' thinking is changed to an extent. And in conversations I have had with my counterparts in industry, a theme that has come up again and again is those computer skills and those capabilities are good, but we need fundamentals.

In the industry, we need a solid understanding of the fundamentals, which is one thing that we stress, on top of more hands-on experience that we have also heard from this panel. More opportunities to get involved, to take apart that car engine and reinstall it, and that sort of thing.

And then the third category, of course, that we have already talked about is the increasing emphasis on people skills that we already do through the projects we run. So my comment to my industrial counterparts would be that anything we can do in developing these kinds of joint programs that impresses upon students the need for fundamental understanding, hands-on experience, and then building their people skills are important. And we appreciate your computer skills. You know, young people, they are terrific, but these other skills have to backbone all of those.

Mr. GREENWOOD. If I could just add one more comment on your mentioned apprenticeship, and there is absolutely a place for 6,000, 8,000, and 10,000-hour apprenticeship programs in the trades. I think, and I know we are going to hear from in the second panel talk about short-term certificate training. Absolutely vital method for getting entry-level workers into our industry.

And that could be as short as 12 weeks or 2 quarters or even a year or 2, but certainly around apprenticeship, there is value in the traditional 4- and 5-year apprenticeship programs.

Senator CANTWELL. And we have a gap there is what you are saying?

Mr. GREENWOOD. I am not necessarily saying we have a gap there. I am saying that the value those programs bring to our industry is immense.

Senator CANTWELL. OK. We are going to turn to our second panel in a minute, but I thought maybe I could close with this question to you all. Since you have all chosen this area of expertise, something lit the lamp for you. If you had 30 seconds to say why young people should be interested in this career or why we should—why they should pursue this.

I feel like we are, again, at this incredible moment where we have now seen the production schedule that Boeing is going to pursue and won some victories, as the tanker and composites. And yet we need to instill in the next generation how critically important, even in this near term, it is going to be get a skilled workforce.

And so, I just wonder if you, from you have said, don't forget the basic training, don't forget the fundamentals, don't forget that you have to start that at the K through 12 level and then take some of those students and put them into the apprentice and the certificate programs. You are reminding us that we have to start early at this, but how do we do this every day.

I don't know. Maybe you should put a little sign outside. "Interested in a future job in aerospace? Come find out more." Because, obviously, Mr. King is funneling a lot of enthusiasm through the doors here of the museum every day.

But what would you say to Washingtonians, to Americans, about the critical importance of this sector, which is really one of the leading manufacturing sectors the United States has, and we want to retain it. So what would you say? You can take a minute. You don't have to limit yourself to 30 seconds.

What would your message be to encourage young people to consider this career and to the existing workforce that maybe is unemployed right now, to get down to one of these community colleges, to get involved in one of these certificate programs?

Dr. HERMANSON. Well, I think two parts. First, I think the challenge is that the aerospace environment has changed in a sense. I grew up during the Apollo era, and my colleagues have had similar experiences. So the 1970s, it was a time of great transformation. We were going to the Moon. We were doing entirely new things.

I am emphasizing space a little bit here, there was a clear excitement there as a nation, you know, that we rallied around that, and the entire country could focus on aerospace as a wonderful, exciting field.

We may have lost that a little bit in that we are not going to the Moon. The Space Shuttle has just been retired. We seem to be on a little bit of a plateau. So I think the challenge is to energize the generation now to recognize aviation is still exciting. There are still major transformations coming.

Perhaps focuses there might be globalization, to get America, you know, get our State and our Nation to focus on the global world we are in. The world is really shrinking. We need transportation. We need communication. Aviation is a key player in that and that there are more transformations coming to generate excitement.

And then the other area, of course, is energy, its clear dependence. Aviation plays a role in that as well. So if we focus on those challenges as new generations of aircraft continue to emerge, perhaps we can help regenerate that expectation. And at the same time again, NASA eventually will be going back to the Moon, asteroids, and Mars, hopefully, and that will also help.

A final one is, of course, the Cold War, which at least underscored the critical need for aviation technology. Not that we would welcome another cold war, but that was a factor in increasing level of aerospace awareness.

Senator CANTWELL. Mr. Greenwood?

Mr. GREENWOOD. Yes, I would just say, to reiterate what I said in my opening statement is that aerospace and manufacturing, these are challenging, high-tech, enjoyable jobs and career choices for our young people. And we talk about aerospace here today, of course, but a lot of the skills that students can learn will transfer to other industries, to other manufacturing sectors, and that really it is a wonderful career choice for our young people to consider.

And again, I would say that you mentioned Washingtonians, and we often talk about this is that we think the messaging needs to be from border to border, from north, south, east, and west is that the messaging about the opportunities in aerospace and manufacturing needs to be clearly communicated and understood by everyone in our State. And so, manufacturing is alive and well. We build the world's greatest aerospace products right here and that opportunity abounds.

Senator CANTWELL. Great. Mr. Sieber?

Mr. SIEBER. I will just share something shared with me many, many years ago was find something that you love and make a career out of it. So I think, Jim, with the museum here, as people come in, they are coming here to see planes. And so, maybe give them a pamphlet that says if you like planes, these are some of the careers that could exist in your future. It is not just designing them. It is being the machinist, being the assembler, being the inspector, being the technicians, working in aviation whether it is in the shop or whether it is in the office with jobs like material management or sourcing.

The one thing I find, and I have been to a ton of aerospace firms over my 31-year aviation career, you walk through the shops, you walk through the offices, and people in aerospace love planes. They have planes on their desks. They have planes on their workboxes. They have the stickers. They are very proud of what they do.

And for me, the passion was very early on. I just fell in love with planes. I went to an airport when I was a young kid and fell in

love with aviation and knew I wanted to get into it in some manner. So I think just trying to build on that love of airplanes.

We have one heck of an opportunity because we have a growth industry. We are having a hard time filling jobs. We have a country that has people that want to work—that need to be employed, and we just have to marry up the people, the education, the industry. So I think we have that passion.

Senator CANTWELL. Mr. Julin, any final comments?

Mr. JULIN. It was exactly the same way with me, and it is about airplanes. I have been in the business for 40 years. My father was a pilot in the Air Force for 28 years. So I grew up going to air shows, and I was always around airplanes. It was a passion.

Especially when I got my pilot's license, I knew that aviation was what I wanted to make a career out in. I didn't make a career out of flying, but I made a career out of aviation and aerospace.

And I think between museums, air shows, and businesses inviting students in to see what they do, we provide the needed inspiration. Boeing is a great example of being able to "touch and feel" airplanes. Absolute Aviation is in a hangar with Empire Airlines. So I always bring the kids over to make sure that they see airplanes, too. They see what the end product is.

Bottom line, I think it is about the passion for airplanes. There is a certain appeal, and it is an exotic and exciting industry. The people that are in it are not here for the money. We are here because it is about airplanes.

Senator CANTWELL. Great. Thank you, gentlemen, very much, and we will look forward to working with you. And again, thank you for your testimony today.

This information that is gathered here goes to our full Committee back in Washington, D.C., and we leave the record open in case any of my colleagues also want to chime in and pose questions to you through writing.

So thank you for being here today, and we will look forward to talk to you more about some of the solutions and possibilities.

So we are going to move to the second panel now, and if they would come up to the stage and join us? That is Tom McCarty, who is the President of the Society of Professional Engineering Employees in Aerospace; Mr. Jim Bearden, Administrative Assistant, District Lodge 751 for the Machinists; Ms. Laura Hopkins, who is the Executive Director of the Aerospace Joint Apprenticeship Committee; Ms. Cyndi Schaeffer, Executive Director of Edmonds Community College Business and Training Center; Mr. Joe Dunlap, President of Spokane Community College; and Ms. Reba Gilman, Principal and Chief Executive Officer of the Aviation High School.

So welcome to the second panel. That is definitely a quicker shift than what we are able to do in Washington, D.C., changing. So we are already ahead of the game. We know how to move in and out.

OK. We are going to start with you, Mr. Bearden. Thank you.

Welcome to all the panelists. Thank you for spending time here this morning to talk about this important issue. And many of you are obviously involved in many of the aspects we discussed on the first panel. But thank you for your leadership in this important area.

And Mr. Bearden, we will start with you.

STATEMENT OF JIM BEARDEN, ADMINISTRATIVE ASSISTANT TO THE PRESIDENT, AEROSPACE MACHINISTS INDUSTRIAL DISTRICT LODGE 751, INTERNATIONAL ASSOCIATION OF MACHINISTS AND AEROSPACE WORKERS

Mr. BEARDEN. Well, good morning, Senator Cantwell.

Senator CANTWELL. And again, just you might have to pull those microphones. They are a little sensitive. You might have to pull them closer to you.

Mr. BEARDEN. How is that?

Senator CANTWELL. Yes.

Mr. BEARDEN. I can taste it.

Senator CANTWELL. Perfect.

[Laughter.]

Senator CANTWELL. Perfect.

Mr. BEARDEN. Well, good morning. I am here today to talk about opportunities that I had as a young person that truly, in most cases, don't exist today and to encourage you, as leaders in Congress, to take steps to reenergize the teaching of vocational skills in our Nation's schools.

Starting in the seventh grade, I had the option of taking a variety of vocational classes. I took metal shop, auto shop, wood shop. By the time I reached high school, I already knew that I enjoyed working with my hands and that I was good at it.

As a result, I focused on learning a skilled trade. After I graduated, I worked in several union shops and eventually came to work at Boeing and later became a union officer. It has been a rewarding career. I have been able to buy a home and raise a family. I pay my taxes and support numerous charities.

But as I have raised my family, I have seen changes in educational philosophy. Our schools have promoted the idea that everybody needs to go to college, get a 4-year degree, and become a software engineer or a banker. Most of our local schools don't offer classes in shop anymore. When these shop courses are offered, they are offered at vocational skills centers.

Now the instruction at those places may be good, but it is only offered to high school juniors and seniors. I would argue that by the time a teenage boy or girl is a junior in high school, it may be too late. If our young people aren't exposed to careers in the trades at an early age, they will never have the chance to consider whether a manufacturing job could be their life's work.

That is a shame. It is possible to make a good living as a manufacturing worker in aerospace without going to college. That is particularly true if you are working in a union job. Our union members at Boeing earn on average more than $58,000 a year, and they have good benefits, too.

Now while you don't have to hold a college degree to become an aerospace machinist, you do need to have a high-quality education. There are a lot of vocational skills to be learned and physical skills to master. Young people must learn how to use complex tools like computerized numerical control machines or the digital displays that have replaced blueprints.

They will also need classroom learning. Our machinist union members have to have good skills in math, geometry, trigonometry, and beginning calculus. They need to understand principles of

physics, metallurgy, and electricity, and the new composite technologies.

Sadly, one of the biggest problems we have finding candidates for our joint IAM-Boeing apprenticeship program is that many of the people who apply lack these basic academic skills. To fix this, we need to start making serious investment in our schools and in other workforce training programs like apprenticeships.

But we need to start immediately. Our union has 30,000 members across Washington State, and about a third of them will retire in the next 5 to 7 years. It is a big challenge. Even if every community college in Washington and every regional high school vocational center graduated 100 aerospace workers a year, that still would only equal about half of the workers Boeing needs.

And that is not taking into account the needs of more than 600 aerospace suppliers around Washington State—companies like Triumph Composites in Spokane, Pexco in Union Gap, and Hytek Finishes in Kent. Having this kind of workforce is essential to our Nation's future. Aerospace, we know, is a key part of our national security. Aerospace is also essential to the economic security of the United States. It is well known that Boeing is America's number-one exporter.

But the industry's biggest impact is on local economies. The money our union members earn gets spent at local car dealerships, stores, and restaurants. Their insurance benefits support local clinics and hospitals, and their pensions allow them to retire with dignity in their local communities.

If we don't have enough trained workers to meet the demand, America will lose its position as the world's leader in aerospace, and we will lose all those economic advantages. I urge the Senate to take action quickly. We, as a nation, need more investment in vocational education in our local schools and in our community and technical colleges. We, as a nation, need to encourage a rebirth of manufacturing apprenticeships, and we need to improve the quality of math and science education in our Nation's public schools.

Ninety-nine percent of our children will never become investment bankers or Wall Street financiers. Not everyone is interested in or can afford college. I couldn't. But because I had opportunities to explore vocational education options in the K through 12 system, I was able to find a career in manufacturing that allowed me to buy a home, raise a family, and contribute to my community.

It is my duty as a union officer to make sure that the young people who come after me have that same opportunity, and it is my goal as an American citizen to see Government, business, and labor come together to support our Nation's aerospace industry. Because when we do that and work together, we can't be stopped.

Thank you.

[The prepared statement of Mr. Bearden follows:]

PREPARED STATEMENT OF JIM BEARDEN, ADMINISTRATIVE ASSISTANT TO THE PRESIDENT, AEROSPACE MACHINISTS INDUSTRIAL DISTRICT LODGE 751, INTERNATIONAL ASSOCIATION OF MACHINISTS AND AEROSPACE WORKERS

Good morning, Senator Cantwell and members of the Subcommittee. My name is Jim Bearden, Administrative Assistant to the President for Aerospace Machinists District Lodge 751, which represents 45,000 active and retired aerospace workers. Thank you for the opportunity to address the Subcommittee.

I'm here today to talk about opportunities that I got as a young person that don't exist today in America, and to encourage you, as leaders in Congress, to take steps to re-energize the teaching of vocational skills in our Nation's schools.

Without a strong commitment to this, America will lose its position as the global leader in aerospace manufacturing, which will lead to further declines to our Nation's economy in general, and lost jobs for our middle class in particular.

When I was a teenager—back in the Seventies—I had the option of taking a variety of vocational classes. I took metal shop. I took auto shop. I took wood shop. By the time I reached my junior year of high school, I already knew that I enjoyed working with my hands, and that I was good at it. As a result, I focused on preparing to learn a skilled trade.

That led me to union jobs in Everett, at the Hanford Nuclear Reservation in the Tri-Cities, and eventually at Boeing, where I became an Aerospace Machinists Union officer.

It's been a rewarding career. I've been able to buy a home and raise a family. I pay my taxes and I contribute to charities.

But as I've raised my family here in Washington State, I've seen changes in educational philosophy that aren't changes for the good. Over the past 15 years or so, our schools have promoted the idea that everyone needs to go to college, to get a four-year degree and become a software engineer or a banker.

Most of our local schools don't offer metal shop anymore. Many don't offer wood shop. Auto shops are few and far between.

When these shop courses are offered, they're offered at vocational skills centers. The instruction at those places may be good, but it's only offered to high school juniors and seniors.

I'd argue that by the time a teen-aged boy or girl is a junior in high school, it's too late. If our young people aren't exposed to possible careers in manufacturing and other trades at an early age, they'll never have the chance to consider whether a manufacturing job could be their calling, and their life's work.

That's a shame. It's possible to make a good living as a manufacturing worker in America, without going having a bachelor's degree. That's particularly true if you're working in a union job. Our union members at Boeing earn, on average, more than $58,000 a year. They have good benefits too, the kind of health insurance that means they don't have to fear bankruptcy should someone in their family be struck with a serious health problem.

But while you don't have to hold a college degree to become an aerospace Machinist, you do have need to have a high-quality education.

There are a lot of physical skills to be learned, and manual dexterity to master. I recently visited a vocational skills center in Yakima where high school students are training for potential careers in aerospace manufacturing. The instructor there has his students practice for 15 minutes every day the technique for drilling holes, so that at the end of their 2 years of study, they can be confident in their ability to drill a hole straight and clean—and accurate to within a few thousands of an inch.

That's a skill they must have to succeed. Failure to do that in the workplace can mean an aircraft part worth tens of thousands of dollars is ruined.

The young people also will need to learn how to use tools far more complex than drills. They'll need to learn how to program computerized numerical control machines. They'll need to know how to read the digital displays that have replaced blueprints.

And while these vocational skills are essential, they'll also need classroom learning. Our Machinists Union members have to have good skills in math—geometry and trigonometry in particular, but also beginning calculus. They need to understand principals of physics, metallurgy and electricity and the new composite technologies. And they need to have the soft skills that all businesses require: the ability to read and write, to work in groups yet be individually accountable.

Sadly, one of the biggest problems we have finding candidates for our joint IAM/Boeing apprenticeship program is that many of the people who apply lack these basic academic skills—particularly in math. As a result, they don't get the chance to train for the top-level, highest-skill jobs that command the biggest paychecks.

To fix this, we need to start making serious investments in our schools, and in other workforce training programs, like apprenticeships, which for centuries have offered young people a path toward meaningful careers in skilled trades.

But we need to start immediately. Our union has 30,000 members across Washington State, and we estimate about a third of them will retire in the next five to 7 years. Meanwhile, a full-fledged aerospace manufacturing apprenticeship can take 4 years to complete. This means we only have a short window of time to help our

members pass on their skills and experience to the next generation, and to get our new people trained to the highest level.

It's going to be a tremendous challenge. The administrator in charge of that Yakima skills center told me that if every community college in Washington, and every high school vocational center, graduated 100 workers from aerospace training programs a year, that still would only equal half of the workers Boeing needs, to replace workers who are retiring, and to ramp up to meet the production goals the company has set for itself.

And that's not taking into account the needs of the aerospace suppliers around Washington State. We've got more than 600 of them here, companies like Triumph Composites in Spokane, Pexco in Union Gap and Hytek Finishes in Kent. Each of them does complex work that requires a highly trained, highly skilled workforce.

Having this kind of workforce is essential to these companies' futures—and to our Nation's future.

Aerospace, as we all know, is a key part of our national security. We have to maintain a deep and broad pool of skilled aerospace workers if we are to continue to build and maintain the military aircraft that defend our borders.

Aerospace is also essential to economic security of the United States. It's well known that Boeing is America's No. 1 exporter, which helps us maintain our position as a leading world economy. In addition, aerospace exports have a positive impact on our Nation's balance of trade.

But industry's impact on local economies is even greater—here and in places like Wichita and Portland and Long Beach, California, and everywhere else that aerospace workers spend their union paychecks. The money they earn building airplanes and airplane parts gets spent at local car dealerships and restaurants, shopping malls and convenience stores. Their insurance benefits support local clinics and hospitals, and their pensions allow them to retire with dignity, without being a burden on their families or communities.

If we don't have enough trained workers to meet the demand, American will lose our position as the world's leader in aerospace, and we'll lose all the global and local economic advantages that go along with that.

To keep that from happening, I'd urge the Senate to take action quickly, to spur improvements in all forms of workforce training. We, as a nation, need more investment in vocational education in our local schools and in our community and technical colleges. We, as a nation, need to encourage a rebirth of manufacturing apprenticeships, which we in the labor movement like to call the original four-year degree. And we need to improve the quality of math and science education in our Nation's public schools, so that our high school graduates are able to perform the high-skill manufacturing work that will earn them the best standard of living.

Ninety-nine percent of our children will never become investment bankers or Wall Street financiers. Not everyone is cut out for college—I wasn't.

But because I had opportunities to explore career choices as a skilled tradesman, I was able to find a career in manufacturing that allowed me to buy a home, raise a family and contribute to my community. It's my duty as a union officer to make sure that the young people who come after me have that same opportunity, and it's my goal as an American citizen to see government, business and labor come together to support our Nation's aerospace industry and the economic benefits it creates.

A perfect example is the recently awarded U.S. Department of Labor $20 million grant to the Air Washington consortium in support of aerospace workforce development in our state. I want to take this opportunity to express our sincere gratitude to Senator Cantwell for her assistance in securing that grant.

Machinists Union District Lodge 751 is committed to keeping our Nation the world's leader in aerospace, with Washington State at its center. We work daily with Boeing, other aerospace companies, elected officials, the educational institutions and workforce development councils to maintain this highly-skilled workforce, which is our major competitive advantage. Along with my testimony, I've submitted a power point that outlines some of the IAM's collaborative efforts with Boeing in this area.

I would encourage you as leaders in the U.S. Senate to continue and redouble your efforts to ensure we have the most highly-trained aerospace workers in the world for decades to come.

Plan for Boeing / IAM Collaboration on Workforce Development

September 20, 2011

Workforce Development Collaboration Priorities

Situation: Boeing and IAM 751 have agreed to work jointly on workforce development at the Washington state level. A joint IAM and Boeing Steering Committee met on September 20th to identify specific collaborative workforce development opportunities and accelerate progress on those priorities.

Proposal: We have agreed to significant partnering in public sector where it has not been present in the past, with a focus on joint advisory board membership and partnership in outreach activities focused towards the K-12 arena.

Move Discussion To Real Collaboration

Workforce Development Collaboration Priorities

Joint Advisory Roles

- Our first step is to Identify roles in the community currently held by Boeing and IAM representatives. We have agreed to leverage our joint participation to enhance our shared workforce development goals.

Engagement Opportunities

- Boeing will join the Aerospace Joint Apprenticeship Council (AJAC). Initial involvement will include Boeing joining the Board of AJAC and sponsoring their mobile training lab which the IAM also sponsors.
- Working to have the IAM added to the advisory board of Washington Aerospace Training and Research Center (WATR). Bill McSherry will work this with Linda Lanham of AFA which will represent a significant breakthrough in collaboration.
- The IAM has expressed interest in having a seat on State Board for Community and Technical Colleges. Michael Greenwood and Bill McSherry are investigating this opportunity.

Work Together To Move The Needle

Workforce Development Collaboration Priorities

Leadership & Partnership in Outreach Activities

- The IAM and Boeing teams have agreed to focus their initial engagement in the K-12 arena. More specifically, the IAM has agreed to lead the effort to create excitement about the career potential in manufacturing and aerospace in this State through several tactics including:
  - Promotional visits to K-12 classrooms, shop classes, Skill Centers and career guidance counselors
  - Preparation and distribution of promotional materials
  - Career fair participation
  - Utilize subject matter experts to support development of teaching staff
- IAM/Boeing Joint Programs will coordinate this effort in collaboration with the Aerospace Academic Alignment Team (AAAT).

Sharing The Passion

Senator CANTWELL. Thank you.

[Applause.]

Senator CANTWELL. We don't usually clap at field hearings either, but that was a very poignant and precise statement. So thank you, Mr. Bearden.

Ms. Gilman, thank you for being here.

Ms. GILMAN. Thank you.

Senator CANTWELL. We look forward to hearing about all the successes of Aviation High School and how we can expand on it.

Thank you.

STATEMENT OF REBA GILMAN, CHIEF EXECUTIVE OFFICER AND PRINCIPAL, AVIATION HIGH SCHOOL

Ms. GILMAN. Well, thank you for inviting me to testify.

I am Reba Gilman. I am the Principal and Chief Executive Officer of Aviation High School.

I have had the honor of leading the high school since its inception. I have also been an administrator of a comprehensive high school and a State skills center, and I have worked for a large aerospace firm and owned my own business. These experiences have impressed upon me the critical need to prepare young Americans to innovate and lead in science, technology, and engineering.

Partnering with the Museum of Flight, and as a result of a public-private partnership that raised $43.5 million, Aviation High will occupy a new school in 2013, right here on museum property in close proximity to more than 200 aerospace-related companies and industry professionals who are essential in mentoring and preparing our students for further education and careers.

We are a college prep high school for students who have a passion for aviation and aerospace. It was conceived in response to the critical need to improve student achievement in math and science and to prepare students for the demands of a high-tech global workforce.

Our school plays an important role in the U.S. effort to stay competitive in global air and space innovation and fill our region's need for a STEM-proficient workforce. Seventy-seven percent of our students are pursuing STEM education and career pathways. Forty-eight percent pursue engineering pathways, and that is more than four times that of other high schools in our State.

Our model is project-based learning, deep scientific inquiry, and high-stakes performance assessment in which students present and defend their learning to industry experts—engineers, technicians, and aerospace leaders who can provide real world feedback.

Seven years after its founding, Aviation High School has developed from an experiment in public education to a proven model of success. Students consistently score in the top 5 percent of Washington high schools in science, math, reading, and writing, with a significantly higher population of students coming from low-income families and ethnic minority groups.

Out of nearly 22,000 schools surveyed by U.S. News and World Report, our school was rated one of the top 6 schools in Washington State and the top 500 nationally for preparing all students for college. Average daily attendance is 96 percent, with some students commuting 120 miles or more a day to attend school.

Our graduation rate is 98 percent, and our graduates are being recruited to and accepted at places like MIT, Berkeley, and military academies. Successful sports of the mind teams, such as First Robotics and Science Olympiad, dominate the culture of our school.

We opened our doors in 2004 with a freshman class of 100 students and now are over capacity with 420 students in grades 9 through 12. Our success has resulted in nearly three times the number of students applying for admission than we can accept.

Our model is research based and small by design. Our goal is not to become larger, but replicable to other parts of the State and the country. We have discussed this goal with the Federal Government during trips to D.C., and also we hosted a visit to Secretary of Education Arne Duncan to our school. And while there is a good deal of interest, there has been little agency follow up.

I would respectfully ask that this committee to help turn the rhetoric from Federal agencies into action. I would like to thank you, Senator, along with your colleagues Congressmen Smith and McDermott, for securing close to $600,000 for laboratory equipment at the new school. I also want to applaud local employees of the FAA, who serve as mentors to our students and staff.

I offer two recommendations for your consideration. First, help us formalize a relationship with the FAA by having the agency provide a full-time staff person to the school, offer paid internships to students, and help expose and familiarize our staff with cutting-edge technologies, such as UAVs, next-gen standards, et cetera.

Second, I ask the Committee to consider working with industry, Federal agencies, and with us to help replicate schools like ours in other parts of Washington State and the country. Our students want to follow in the footsteps of Washingtonians who have created innovations that have been adopted worldwide.

People like James Raisbeck, whose name we will place on our new school, a world-renowned aerodynamicist and entrepreneur who, among his many innovations, has created secured cockpit doors after the 9/11 attacks. And Joe Clark with the winglet, which has saved millions in fuel costs. Captain Steve Fulton, who created extraordinary aircraft navigation performance systems.

And of course, Bonnie Dunbar, former Astronaut and CEO of the Museum of Flight, and Doug King, current CEO, President of the museum, who believe that a premier high school and a premier education museum ought to partner to inspire and prepare students to pursue STEM careers.

Our first Aviation High School alumni are graduating from college this spring. Already some are being recruited by major commercial jet engine manufacturers and other critical players in this Nation's air and space industry. We can provide more innovators if we replicate our model in other areas.

Thank you for the opportunity to testify today. Our school stands ready to assist you in filling the STEM pipeline with the intellectual and technical capital that ensures the prominence of aerospace innovation in the Washington State and national economies.

[The prepared statement of Ms. Gilman follows:]

PREPARED STATEMENT OF REBA GILMAN, CHIEF EXECUTIVE OFFICER AND PRINCIPAL, AVIATION HIGH SCHOOL

Good morning. I am Reba Gilman, Chief Executive Officer and Principal of Aviation High School.

Thank you for holding this hearing today and inviting me to testify.

I am a veteran educator, whose career has included teaching business and marketing, serving as an administrator of a large, comprehensive high school and as a Director of one of our state's skills centers. These experiences, combined with working in the private sector for a major aerospace company and owning my own business, have led to a deep understanding of the critical needs in education and the workforce . . . and to the founding of Aviation High School, which l have led since its inception and development over the past decade.

At Aviation High, we have hosted hundreds of visitors from different parts of the United States and even different countries since opening our doors in 2004. Most of those visitors are interested in replicating our teaching, learning, and partnership model. It would be an honor to host you and your committee members at our current interim site and then again when we move to our new state-of-the-art school that is being constructed just across the street from here and that will be ready to occupy in 2013.

It is important to note that we just completed a $43.5 million capital campaign to construct this new school. Partnering with the Museum of Flight, the school embarked upon a public/private capital campaign that successfully culminated this past summer. Located on the Museum's West-Side Campus, with the new Space Gallery and a future Air Transport Gallery, the school will have the best location imaginable. We believe that the creative, cutting edge educational programming that can be crafted through collaboration of our two institutions and the 200 aerospace-related entities that surround Boeing Field, including Boeing's R&D facility, will be of unparalleled benefit to education and the workforce.

We believe it is critical for theme-based, industry responsive schools to reside where they are closest to the resources that will help students get ready for further education and careers.

Aviation High is a college prep high school where students have an affinity for aviation and aerospace, and it is a critical part of the U.S. effort to stay competitive in global air and space innovation. Aviation High students are pursuing STEM education and career pathways at nearly double the rate (77 percent) of their peers in other Washington State high schools . . . with 48 percent pursuing engineering pathways—which is about five times that of other high schools in the state.

As I mentioned earlier, Aviation High School was conceived in 2000 in response to the critical need to improve student achievement in math and science to ensure that our graduates were prepared for the rigors of college and the demands of a high-tech, global workplace. A Strategic Planning team of educators, business, labor, and government leaders came together to address these critical needs. We were intent on creating a teaching and learning model that required students to use their minds well, be passionate about the work in which they were engaging, and solve authentic and complex problems occurring in the work place. We landed on creating an aviation/aerospace-themed school because Seattle, being the birthplace of modern aviation with a huge reliance on a STEM-proficient workforce, was the right model for our region.

When our grassroots planning team proposed our model to The Superintendent and Board of Highline Public Schools, they embraced the concept of blending the best practices in career and technical education with high academic demand . . . and gave us a green light to move forward if we could find initial funding. We found it from the *Bill & Melinda Gates Foundation and Sea-Tac Airport*.

We opened our doors in 2004 in rented space on the Duwamish campus of South Seattle Community College, just up the street from the Museum. Since our first year, we have been intent on perfecting our model of project-based learning, deep scientific inquiry, and high-stakes performance assessment in which students present and defend their learning to industry experts—engineers, technicians, and aerospace leaders who can provide the kind of feedback that is needed to inspire further learning and pursuit of a STEM education and career pathway.

Aviation High currently has an enrollment of 420 students with approximately 100 students in each grade level, 9–12. Each student is immersed in a college prep curriculum that makes them attractive and eligible candidates to any college of their choice.

Extensive research shows that small learning communities with a focused curriculum and effective instructional practices are more likely to achieve higher results in student learning than large, comprehensive schools. Our school model is de-

signed to be personalized, rigorous, and relevant. Our goal, therefore, is not to become larger but rather, replicable to other parts of the state and country that have similar needs.

Aviation High teachers are a huge part of our formula for success, with 60 percent having experience outside of education, including engineering, computer science, research, and general aviation.

Seven years after its founding, Aviation High School has developed from an experiment in public education to a proven model of extraordinary success:

- Students in all four graduating classes have consistently scored in the top 5 percent of Washington high schools in science, math, reading, and writing. AHS serves a significantly larger population of low-income and ethnic minority students than any other school in this category.
- Out of nearly 22,000 schools analyzed by *U.S. News & World Report* in 2010, AHS was rated one of the top six high schools in Washington State and among the top 500 in the nation, for preparing all students for college.
- Our average daily attendance rate is between 95–99 percent, which is remarkable given that some students commute 120 miles or more per day to attend school. AHS is a regional school that attracts students from 22 school districts.
- Our graduation rate is 98 percent.
- AHS ranks 8th in the State of Washington for percentage of students taking Advanced Placement exams.
- Disciplinary issues are almost nonexistent—the lowest number of sanctions in a district of 17,000+ students.
- 94 percent of AHS students meet or exceed the requirements for college admission as set forth by the Higher Education Coordinating Board. Students take 4 years of math and science, 3 years of English and Social Studies/History, and 2 years of a world language, all which include an aviation context where appropriate.
- Graduates are being accepted to top-level colleges and post-secondary institutions in the country, including MIT, Berkeley, and military academies. Each graduating class has collectively earned between $1–$1.7 million in scholarship awards, some on full rides from organizations such as FIRST Robotics or "golden tickets" to university engineering programs.
- The Washington State Legislature designated Aviation High School as a Lighthouse Model of STEM Excellence in recognition of its best practices in teaching and learning and stellar results in student achievement.
- "'Sports of the mind" teams dominate the culture of our school as opposed to athletic teams. Our FIRST Robotics, Science Olympiad, and Speech and Debate teams successfully compete at regional, state, and national levels. They are Ambassadors of STEM education who mentor elementary and middle school students to inspire learning and consideration of a STEM pathway.

The successes that we have experienced over the years have resulted in nearly three times the number of students applying for admission than we can accept. It is reaffirming to know that so many young people are inspired by aviation and aerospace and want to be part of the solution in filling the critical gaps in the STEM workforce; at the same time, this incredible demand reinforces the need to replicate our model if we are intent on having the quality and quantity of students in the STEM pipeline.

In preparing for my testimony I read the Labor and Workforce recommendations of the "Future of Aviation Advisory Committee" and wholeheartedly agree with them. I understand there has been an MOU signed between the Departments of Education and Transportation which may mean more assistance for schools like ours. I have been to Washington, D.C. on occasion to discuss Aviation High; and we have also hosted a visit to our school for Secretary of Education Arne Duncan. In being completely transparent, there seems to be a good deal of interest in our school from DOE officials, and we have been told at the highest levels that the Department wants to create "more schools like AHS," but there has not been much follow-up.

Thanks to Congressmen Smith and McDermott, who represent parts of our district, we will use about $600,000 in Federal money for lab equipment in our new $43.5 million school. We hoped for more support from the Federal Government for construction and are pleased to see construction-related recommendations in the report.

At this point, Aviation High School could use assistance creating relevant and innovative programs with Federal aviation and aerospace agency help. The biggest

challenge faced by this committee and industries that rely on STEM innovators, is turning the rhetoric from Federal agencies into action. I do want to applaud the work of the men and women of the FAA locally. They are dedicated professionals who want to share their passion and knowledge with our students. We appreciate their serving as mentors and subject matter experts.

Aviation High School is completely committed to helping fill the stem pipeline. We are working with other STEM schools in the state to do just that. We are very willing to work closely with you to fill that pipeline as well, and here are three recommendations that will help us all:

First, we ask that you help us formalize a relationship with the FAA by having the agency provide a full-time staff person at the school, offer paid internships to students and help expose and familiarize our students with cutting edge technologies in which it is currently engaged—Next Gen, UAVs, commercial space, systems safety, etc.

Secondly, the Committee should consider working with industry, Federal agencies and Aviation High to help replicate schools like ours in other parts of Washington State and the country;

And third, we recommend, even in this austere time, that you find ways to provide funding. We recognize that due to budget deficits, it is oftentimes necessary to cut programs; however, money should be spent on creating and expanding the STEM pipeline to keep this Nation's aviation and aerospace industry competitive in the midst of growing threats from elsewhere in the world.

I want to leave you with a few examples of the sort of innovation we want our students to emulate—innovation that has made this Nation the premier aviation and aerospace leader in the world. The first three innovations were created by Washingtonians and have been adopted worldwide.

Mr. Joe Clark, owner of Aviation Partners located just across the field from the Museum, along with his colleague Bernie Gratzer invented blended winglet technology, which saves hundreds of millions of dollars in fuel costs, protects the environment, modernizes aircraft, and makes them perform better. The winglet is now the standard on all commercial jets . . . and as their website states, "The future is on the wing."

Steve Fulton was recently selected as a Pathfinder in Aviation by The Museum of Flight. As a former Alaska Airlines technical pilot, Captain Fulton knew firsthand how important it was to improve aircraft departure and arrival operations in Alaska. He led the development of what is now known as Required Navigation Performance (RNP) and now provides RNP solutions for airlines and air navigation providers around the world.

When completed, our new school will be named Raisbeck Aviation High School after James Raisbeck, a world-renowned aerodynamicist and entrepreneur who owns and operates Raisbeck Engineering, located just a couple of miles from here—a firm that is dedicated to conceiving, engineering, designing, flight-testing, certifying and manufacturing performance improvement systems for the world's business and commercial jet-powered aircraft. James has an uncanny ability to see a need and innovate a solution. For example, after what we now refer to as 9/11, Raisbeck created secured cockpit doors that are now standard equipment on new and existing commercial aircraft worldwide. This innovation by our local icon has raised safety and security for flight crews to a new level.

I cannot talk about local innovation without mentioning Bonnie Dunbar, former Astronaut and CEO of the Museum of Flight, Doug King, current CEO/President of the Museum, and all of the trustees and stakeholders of the Museum who believed that a premier high school and a premier education museum ought to partner for the benefit of students and their future contributions to the economy and to humanity. They are the ultimate innovators in creating a positive future for our youth and the air and space industry.

The innovations that I have cited are of the same nature as students at Aviation High School want to create in the future. Our first crop of students graduating from college will enter the workforce next year. Already, some are being recruited by major commercial jet engine manufacturers and other critical players in this Nation's air and space industry.

With your help, Aviation High can increase the number of innovators it is producing, both through offering better opportunities at our school and helping to replicate the Aviation High model in other places.

Thank you for giving me the opportunity to testify today. Our school stands ready to assist you in filling the STEM pipeline with the intellectual and technical capital that ensures the prominence of aerospace innovation in the Washington State and national economies.

Senator CANTWELL. Thank you, Ms. Gilman. Thank you for those specific recommendations.

Next, Ms. Schaeffer, welcome. Thank you for being here.

STATEMENT OF CYNDI SCHAEFFER, EXECUTIVE DIRECTOR, BUSINESS TRAINING CENTER, EDMONDS COMMUNITY COLLEGE

Ms. SCHAEFFER. Good morning, Senator Cantwell. Can you hear?

Senator CANTWELL. You might pull it up a little closer.

Ms. SCHAEFFER. Great. I am Cyndi Schaeffer, Executive Director of the Business Training Center with Edmonds Community College. I will be talking about the Washington Aerospace Training and Research Center, referred to as WATR, a little bit of its history, as well as the programs and challenges that we face.

The WATR Center is operated through Edmonds Community College with an operating agreement through the Aerospace Futures Alliance, AFA. Before I describe the WATR Center, I want to take the opportunity to explain what happened before the center opened.

Approximately 6 years ago, Senator, as you know, you were instrumental in the creation and development of the Center of Excellence, the Advanced Materials and Transport Aircraft Structures, AMTAS, where Edmonds Community College, University of Washington, the FAA, and others were members. Your office continued to support the college in accessing grants, to support composite training tools, equipment, as well as Senator Murray, Congressman Inslee, and the AFA.

Briefly, there is two centers, as you know, in the State. The WATR Center serves the west side, and I know that Dr. Dunlap will be talking about his center in a moment. The intent and the mission of these centers is to provide Statewide training through collaborating with local community colleges and delivering training out of the centers themselves.

The training delivered out of the centers has to be industry driven with a rapid response. If industry identifies a new need, we are expected to develop that training and deliver it immediately. WATR has recently developed a partnership and agreement with Renton Technical College to deliver the WATR trainings in King County as well.

Just a little bit of a description, WATR opened in June 2010, and it is because of our successful partnerships with the Boeing Company and suppliers, the Center of Excellence, Snohomish, WDC, AFA, and of course, our legislative support and your support. The industry-driven center is operated, again, through the AFA and consults with an AFA industry advisory board.

Some of the challenges that we see, there are a lot of industry representatives telling us there is a lot of people out of work, yet not enough job candidates with entry-level skills needed to pursue even entry-level manufacturing jobs. And while engineering and other long-term skills are needed, a large number of the demand jobs can be taught in relatively a short timeframe. People can continue their education once they are employed.

The second challenge we are hearing is the average age of aerospace workers, approximately 48 years old, and this aging work-

force will result in skilled aerospace workers leaving the industry without skilled workers to replace them. And although the aerospace manufacturing industry has many career opportunities and ladders, today's youth appear to be unaware or disinterested in pursuing aerospace careers, and there needs to be more recruitment in middle school, high school, and young adults to the industry.

Also, a challenge to the aerospace industry we are hearing is that the training content and delivery needs to be quick, fast, relevant, and industry driven. Training must be delivered using state-of-the-art methods to increase capacity that also increases students' capacity and learning.

Training must be executed intensely, quickly, with a high level of retention. Our training content cannot be static, but it has to be continually reviewed, modified to ensure it is cutting edge.

So how is WATR addressing the challenge? WATR Center has developed over 20 aerospace courses and a number of certificates requested by industry, including core aerospace, assembly aerospace, certificate FAA requirements, quality control, lean for aerospace, nondestructive testing for composite, among others.

We not only teach the technical skills at the WATR Center, but we teach the soft skills or the global professional standards, such as interpersonal skills, teaming, conflict resolution. Those soft skills are so important that many aerospace companies are telling us they are not seeing in their new recruits and their new employees.

WATR has delivered these courses and certificates to meet industry demands containing cutting-edge content, promoting fast and intense learning, serving a large number of students. Since the opening on June 2010, WATR has been offering core and assembly certificates on first and second shift. These certificates prepare students for jobs such as aerospace assemblers and aerospace manufacturers.

These courses were developed to be delivered through online and very innovative technology that has been welcomed by younger and older students alike. Through an intense online course of study, students are able to move through the material. When they have demonstrated their knowledge and can repeat the content that is challenging, following demonstrated knowledge competency, the students participate in a month-long, intensive hands-on student learning experience 8 hours a day to help them apply their skills.

Students successfully navigate through the 12 weeks of program, earning them 29 college credits. Using this innovative online hybrid model, the center has the capacity to graduate 180 students per month. With the center's upcoming renovation, expansion to third shift and weekend courses, the center will have the capacity to graduate over 350 students per month, earning two certificates.

To expand capacity and better meet industry needs, the WATR Center is partnering with the Renton Technical College and other colleges to train more students State wide. And in addition, the center is also offering aerospace electronic assembly mechanic certificate, and of course, other offerings include composite certificate, Six Sigma, quality control, quality inspection.

As one of our graduates, Michael Greenwood, had mentioned earlier, we have over 400 graduates, 442, with a placement of 85 to 90 percent within about 3 months. The 3 months is due to the time that aerospace needs to screen people properly to make sure they are not using drugs and have a clear record.

Boeing has hired the majority of those graduates, but many supplier aerospace companies, such as TECT Aerospace, Flight Structures, Norfolk Shipyard, Bridgeways Manufacturing, Terry's Machine, Giddens, Crane Aerospace, Primus International, have also taken our graduates and hired them.

The demographics of our students—16 percent of the students were female, 33 percent are nonwhite, and 24 percent were under the age of 25. Although the demographics are encouraging with respect to women and nonwhite populations, the numbers do raise concern regarding the low enrollment of younger students and that aging workforce issue. So we have implemented several strategies to increase the number of young students coming through the center.

The first one is a project that we are launching in collaboration with the Boys and Girls Club, Senator, your office, the AFA. It is called the Cool Girls for Aerospace Project. It is being implemented in November. The club will require 13- to 15-year-old girls to make composite trinket trays, design personalized key chains using CAD and CATIA with prototype machines, and make paperweights using welding equipment.

Throughout the training, the girls will view aerospace and manufacturing videos, introducing aerospace concepts. We plan to expand that program for boys, too.

In addition, we have a huge marketing campaign. We are doing an aggressive advertising blitz in the Alderwood Mall. We are going to be using Generation Y themes and motivational concepts, based on academic studies and research. All the research suggests that the way we recruit young people, we would think, us baby boomers, to recruit people in the industry probably won't work.

During September and late October, WATR will be mailing out 44,000 postcards to residents, advertising WATR certificate geared to younger adults using those generation marketing strategies. We are also developing marketing videos and working with skills centers to offer scholarship programs for our certificates. Thus far, WATR has met with Sno-Isle Skills Center, Yakima Skills Center to develop agreements.

So how are we reaching out to industry? AFA is leading an advisory board on our behalf. That is industry represented. WATR staff meets with the Boeing Company weekly, as well as suppliers. Our curriculum and training is developed by subject matter experts.

Some of our challenges are the cost of running the program, the actual lab program. The Boeing Company was so generous to donate over $2.5 million of equipment and tools, but the materials needed to instruct those courses, in particular composites, is very expensive.

[The prepared statement of Ms. Schaeffer follows:]

PREPARED STATEMENT OF CYNDI SCHAEFFER, EXECUTIVE DIRECTOR, BUSINESS TRAINING CENTER, EDMONDS COMMUNITY COLLEGE

Introduction

I'm Cyndi Schaeffer, Executive Director of the Business Training Center with Edmonds Community College. The Washington Aerospace Training and Research Center (WATR) is an aerospace training facility located at Paine Field, providing statewide training, by Edmonds Community College—Business and Training Department through an operating agreement with the Aerospace Futures Alliance (AFA).

History

Before I describe the WATR Center, I want to take this opportunity to explain what happened before the Center opened. Approximately 6 years ago, Senator Cantwell was instrumental in the creation and development of the Center of Excellence—Advanced Materials in Transport Aircraft Structures (AMTAS), where Edmonds Community College, University of Washington, the FAA, and others were members. Your (Senator Cantwell's) office continued to support the college in accessing grants and other funding to support composites training, tools, and equipment. Senator Murray and Congressman Inslee's offices, as well as the AFA, assisted the college in accessing grants and allocations to begin WATR.

Statewide Aerospace Centers

Statewide Aerospace Centers are located on the East and West side of Washington to provide statewide training for aerospace companies. Spokane Community College serves the East side, and the Washington Aerospace Training and Research Center (operated through the AFA and Edmonds Community College) serves the West side.

The intent and mission of these centers is to provide statewide aerospace training through collaborating with local community colleges and delivering training out of its centers. The training delivered out of the centers must be industry driven and have a rapid response. If industry identifies a new need, the centers are expected to develop that training. WATR has recently developed a partnership and agreement with Renton Technical College to deliver WATR trainings in King County.

WATR Center Description

WATR opened in June 2010 through a variety of successful partnerships with the aerospace industry, Snohomish County, Center of Excellence, WDC, AFA, local legislators, and state and Federal Government. This industry driven center is operated in partnership with the AFA and consults with an AFA industry advisory board.

Workforce Challenges

Increased number of trained entry level job applicants

There are many industry representatives telling us that there are a lot of people out of work, yet there are not enough job candidates with the entry level skills needed to pursue even entry level aerospace manufacturing jobs. While engineering and other long term skills are needed, a large number of in demand jobs can be taught in relatively short time frames. People can continue their education once they are employed, gaining experience, and ultimately filling higher skilled job positions.

Aging workforce

The average age of aerospace employees is approximately 48. The "aging" workforce will result in skilled aerospace workers leaving the industry without skilled workers to replace them. Although the aerospace manufacturing industry has many career opportunities and ladders, today's youth appear to be unaware of and/or disinterested in pursuing aerospace careers. There needs to be increased recruitment of middle school, high school, and young adults to the industry.

Delivery of training

Training content and delivery needs to be consistent with industry workforce demand, and the content must be industry driven and continually changing. Training must be delivered using state-of-the-art methods that increase student capacity and learning. Training must be executed quickly with a high level of retention. Training content cannot be static, but must be continually reviewed and modified, if necessary, to ensure it is cutting edge.

WATR Addresses the Challenges

Training developed conducive to industry needs

WATR developed over 20 aerospace courses and a number of certificates requested by industry, including: Core Aerospace Certificate FAA Requirements; Quality Control; Lean for Aerospace, and Non-destructive Testing for Composites, among others.

WATR has delivered these courses and certificates to meet industry demands: containing cutting edge and relevant content; promoting fast and intense learning; serving a larger number of students. Since opening in June 2010, WATR has been offering Core and Assembly aerospace certificates, on first and second shift. These certificates prepare students for jobs such as aerospace assemblers and aerospace manufacturers.

The courses were developed to be delivered online through very innovative technology that has been welcomed by younger and older students alike. Through an intense online course of study, students are able to move through material when they have demonstrated their knowledge and they can repeat content that is challenging. Following demonstrated knowledge competency, the students participate in a month long hands on student learning experience to allow them to apply their skills. Students successfully navigate through the program in 12 weeks. Using this model, the Center has the capacity to graduate 180 students per month. With the Center's upcoming renovation and the expansion to third shift and weekend courses, the Center will have the capacity to graduate over 350 students per month, each earning two certificates and 19 credits. To expand capacity and better meet industry needs, the WATR Center is partnering with Renton Technical College and other colleges to train more students statewide. In addition, the Center is offering the Aerospace Electrical Assembly Mechanic Certificate. Other trainings WATR has offered include the Applied Technology Manufacturing Certificate, the Composite Certificate; CATIA, Lean and Six Sigma, Quality Control, ESL in Aerospace Manufacturing, and ISO 9000.

Graduates

As of August 31, 2011, 357 students have graduated with Core and Assembly Mechanic certificates. 347 of them have applied for jobs, 291 of them have been interviewed, and 240 of them have received job offers (206 of whom are now working with the remaining in the process of undergoing background checks and drug analysis). Boeing has hired 190 of the 206 employed graduates; other employers include TECT Aerospace, Flight Structures, Norfolk Naval Shipyard, Bridgeways Manufacturing, AMT, Terry's Machine Giddens Industries, Crane Aerospace, and Primus International. It takes approximately two to 3 months, once a person graduates to obtain employment in the aerospace field.

Demographics of WATR students

Sixteen percent of the students were female; 33 percent non-white; and 24 percent were under the age of 25. Although, the demographics are encouraging with respect to the number of women and non-white populations, the numbers raise concern regarding the low enrollment of younger students, and the "aging" aerospace workforce. WATR has implemented several strategies to increase younger students:

Cool Girls for Aerospace Project: In collaboration with the Boys and Girls Club, Senator Cantwell's staff, and the AFA, a "Girls for Aerospace Project" is being implemented in November 2011. The "club" will require the 13 to 15 year old girls to make a composite trinket tray, design and produce a personalized keychain using CAD and prototype machines, and make a paperweight using welding equipment. Throughout the training, the girls will view aerospace and manufacturing videos and be introduced to aerospace concepts.

Marketing Campaign: In October 2011, WATR will launch an aggressive advertising blitz in the Alderwood Mall. The campaign may include hanging banners, table top inserts, a T-stand, and a barricade wall. The advertisements will be in the mall for 8–10 weeks targeting younger adults by using Generation Y themes and motivational concepts based on academic studies. During September and late October, WATR will be mailing out 44,000 postcards to residents throughout Snohomish and King County, advertising the WATR Certificate geared to younger adults using Generation Y marketing strategies.

Marketing Videos: WATR has contracted with a video producer to develop several unique marketing videos—one designated to recruit high school students and young people and the other designed to recruit veterans.

Scholarships for High Schools and Skill Centers: WATR is working with skill centers and high schools statewide to recruit transitioning students into the aerospace

industry for employment. Thus far, WATR has met with Sno-Isle Skills Center and the Yakima Skills Center to develop agreements. WATR staff will meet with the City of Kent to replicate these agreements with the Renton Skills Center to offer aerospace certificate scholarships to high school students.

How the WATR Center is Reaching Out to Industry

AFA industry led advisory board: The Aerospace Futures Alliance leads an industry advisory board that provides direction. AFA initiates quick turnaround surveys to evaluate the training needs and existing skill gaps of 650 aerospace suppliers. WATR meets with the advisory board regularly.

WATR staff meets with the Boeing Company and other aerospace companies WATR *staff meet with Boeing* on a weekly basis to discuss training needs. (These meetings have been ongoing for 2 years.) Additionally, WATR *staff provides regular tours, meets with industry, and industry comes to the WATR site to recruit and interview students and graduates.* During all these interactions, companies are asked about their training needs and skill gaps.

Curriculum and training is developed quickly using industry subject matter experts and delivered in a rapid and sustainable manner. Training is developed and delivered to increase capacity to meet industry demand needs—that it is industry driven and can be modified quickly to match the ever changing needs of the aerospace industry.

Challenges to the WATR Center

Cost of program: The materials and supplies for students to participate in the lab portion of the certificates is extremely high because of the intense practice students are required to complete to gain the necessary competencies and skills. Because of the high costs and tuition, more funding is needed for the student loan program and student vouchers.

This short-term training model has proven to be effective for both students and employers. It is an excellent example of education, industry, and government partnering to develop a skilled workforce and an established career pathway. Continuing to fund this important training will help keep the aerospace industry alive and well in Washington State.

Senator CANTWELL. So thank you. Thank you very much, Ms. Schaeffer.

Ms. SCHAEFFER. Thank you.

Senator CANTWELL. Thank you for your testimony. And certainly, we will have questions.

Mr. Dunlap, thank you for being here. Thank you for your leadership on this Department of Labor grant and coordinating that with the many institutions that are going to be receiving funds.

STATEMENT OF JOE DUNLAP, ED.D., PRESIDENT, SPOKANE COMMUNITY COLLEGE

Dr. DUNLAP. Thank you for the invite, Senator Cantwell.

I am President of Spokane Community College, one of 34 community and technical colleges within the state of Washington. And those community colleges support the 600 aerospace manufacturers and suppliers. The community and technical college system is absolutely critical to that industry cluster for workforce development.

Last year, 161,000 full-time equivalent students were enrolled in the community and technical college system, which is 20,000 more than they were funded for. And that equates to 330,000 unduplicated head count students. Enrollment in science, technology, engineering, and math courses and programs over the past 4 years has increased by over 12 percent.

And in October 2009, Governor Gregoire allocated $1.5 million of her discretionary workforce investment funding to support the aerospace industry. In her directive, Governor Gregoire instructed the State Board for Community and Technical Colleges to dis-

tribute the funding for industry-driven training centers, new equipment, K–12 programs, curriculum alignment, and facilitation of transfer of research findings into training curricula.

Recognizing that workforce development for the aerospace industry is critical to Washington's economic future, the State Board for Community and Technical Colleges, with assistance from the legislature, began to organize around that appeal. Funding was appropriated to establish the Aerospace Joint Apprenticeship Committee, two aerospace technology centers at the WATR Center and the Inland Northwest Aerospace Technology Center in Spokane. A 10th Center of Excellence, the Aerospace and Advanced Materials Manufacturing at Everett Community College was also established.

With grant writing support from Everett Community College, Spokane Community College took the lead in organizing a consortium affectionately known as "Air Washington," which consists of 11 community and technical colleges, the aerospace technology center in Spokane, the Center of Excellence for Aerospace and Advanced Manufacturing, the Aerospace and Joint Apprenticeship Committee, and regional workforce development councils, as well as employer partners, such as Absolute Aviation and the Boeing Company, to submit a grant proposal to support that industry cluster.

The proposal was recently funded by the Department of Labor for $20 million for a 3-year period of time. And thank you, Senator Cantwell, for your support in that endeavor.

The purpose of this grant is to research, develop, design, and implement state-of-the-art education, training, and support services necessary to meet Washington State's growing workforce demands identified by employer partners in the aerospace industry sectors, as well as to develop sustainable infrastructure to increase capacity for training aerospace workers in Washington State.

Selected occupations that this grant will focus on include aircraft structure, surfaces, and rigging assemblers; machinists and computer numeric controlled machine tool operators; helpers for installation, maintenance, and repair workers; aircraft mechanics and service technicians; and electrical and electronic assemblers. More specifically, the Inland Northwest Aerospace Technology Center at Spokane Community College supports the aerospace industry in eastern Washington, which is expected to grow by 40 percent over the next several years.

Spokane Community College offers the following aerospace-related programs: aviation maintenance technology degree, which includes the FAA airframe and power plant certificates embedded into the curriculum, and there are five such programs in the State; electronics; hydraulics and pneumatics; machining and welding; and customized business and industry training.

The following curriculum was recently completed this summer: AS 9100, Quality Assurance I and II, Coordinate Measuring Machine, CATIA Levels I and II, TIG Welding, Avionics and Job Performance Skills, and we conducted an aerospace summer camp for high school students as well. And a two-quarter, short-term composite manufacturing certificate is under development.

The Center of Excellence, located at Everett Community College, for Aerospace and Advanced Materials Manufacturing, serves as

the State-wide liaison to business, industry, labor, and the State's educational systems for the purposes of creating a highly skilled and readily available workforce critical to the future of this economy.

Significantly, the Center of Excellence produced a cross-mapping of 22 community college and technical programs with the Boeing 32 job codes. And that will help create alignment with the curriculum based on industry needs. I have attached to my comments their most recent inventory of programs that are aerospace related at the community and technical college systems within the system, and this is available on the table outside.

Again, I would like to thank you for the invite, and we appreciate your leadership in helping create aerospace jobs.

[The prepared statement of Dr. Dunlap follows:]

PREPARED STATEMENT OF JOE DUNLAP, ED.D., PRESIDENT, SPOKANE COMMUNITY COLLEGE

For many decades, Washington State has been a center of the aerospace industry, focusing around The Boeing Company and over 600 aerospace and manufacturing industry supply companies statewide. The health of this critical industry is reflected in the economic health of Washington State and the ability of highly-skilled Washington workers to obtain high wage technical careers. Community and Technical College enrollment for 2010–2011 was 161,081 FTEs which is 20,000 FTEs over the funded target level; while headcount was 330,608 students served. Students enrolled in Science, Technology, Engineering, and Math (STEM) courses/programs have significantly increased over the past 5 years [see table below].

Year	STEM Enrollments	Increase from previous year
2006–07	4,049	N/A
2007–08	4,190	3.5%
2008–09	4,573	9.1%
2009–10	5,079	11.0%
2010–11	5,697	12.2%

On October 19, 2009, Governor Gregoire allocated $1.5 million of her discretionary Workforce Investment Act (WIA) funding in support of the aerospace industry. In her directive, the Governor instructed the State Board for Community and Technical Colleges (SBCTC) to distribute the funding for: (1) industry-driven training centers, (2) new equipment, (3) K–12 programs, (4) curriculum alignment, and (5) facilitation of the transfer of research findings into training curricula.

Recognizing that workforce development for the aerospace industry is critical to Washington's economic future, the State Board for Community and Technical Colleges, with assistance from the legislature, began to organize around the Governor's appeal. Funding was appropriated to establish: (1) the Aerospace Joint Apprenticeship Committee, (2) two aerospace technology centers; the Washington Aerospace Training and Research Center at Edmonds Community College, and the Inland Northwest Aerospace Technology Center at Spokane Community College, and (3) a tenth Center of Excellence [COE] for Aerospace and Advanced Materials Manufacturing at Everett Community College. An inventory of programs and courses taught at the 34 community and technical colleges was developed. In addition, industry helped to identify knowledge, skills and abilities needed by the 600 aerospace related manufacturers and suppliers.

With grant writing support from Everett CC, Spokane Community College took the lead in organizing a consortium known as "Air Washington," which consists of 12 community and technical colleges, the aerospace technology centers in Edmonds and Spokane, the COE for Aerospace and Advanced Manufacturing, the Aerospace Joint Apprenticeship Committee, and 14 regional Workforce Development Councils, to develop a comprehensive proposal supporting Washington State's aerospace industry. That proposal was recently funded by DOL for $20M over 3 years. The purpose of this grant is to research, develop, design and implement state-of-the-art education, training, and support service necessary to meet Washington State's growing workforce demands, identified by employer partners in the aerospace industry sectors; as well as to develop a sustainable infrastructure to increase capacity for train-

ing aerospace workers in Washington State. Selected occupations that this grant will focus on include: (1) aircraft structure, surfaces, and rigging assemblers, (2) machinists and computer numeric controlled machine tool operators, (3) helpers for installation, maintenance, and repair workers, (4) aircraft mechanics and service technicians, and (5) electrical and electronic assemblers.

More specifically, the Inland Northwest Aerospace Technology Center [INATC], at Spokane Community College supports the aerospace industry in Eastern Washington, which is expected to grow by 40 percent over the next several years. Spokane Community College offers the following aerospace related programs: (1) Aviation Maintenance Technician degree that includes FAA Airframe and Powerplant certificates embedded into the curriculum [*there are five such programs in the state*], (2) electronics, (3) hydraulics and pneumatics, (4) machining, (5) welding, and (6) customized business and industry training. Future plans call for the establishment of flight training, air traffic control, and dispatcher programs.

The following curriculum was recently completed this summer: (1) AS 9100, (2) Quality Assurance I & II, (3) Coordinate Measuring Machine, (4) CATIA Level I & II, (5) TIG welding, (5) Avionics and Job Performance Skills, and (6) an Aerospace Summer Camp for high school students was conducted. A two-quarter, short-term composite manufacturing certificate is under development.

Once 5.4 acres of land has been transferred from the Washington Military Department, INATC will relocate from Felts Field in Spokane to the Spokane International Airport to be more centrally located and better able to serve the emerging aerospace workforce in Eastern Washington.

The Center of Excellence [COE] for Aerospace and Advanced Materials Manufacturing, located at Everett Community College, serves as the statewide liaison to business, industry, labor and the state's educational systems for the purpose of creating a highly skilled and readily available workforce critical to the success of industries driving the state's economy and supporting Washington families. Significantly, the COE produced a cross mapping of all 22 Community and Technical College aviation, aerospace, and advanced manufacturing programs to the 32 Boeing Job Codes. This alignment is shared with the state high schools to facilitate their curriculum alignment with college curricula.

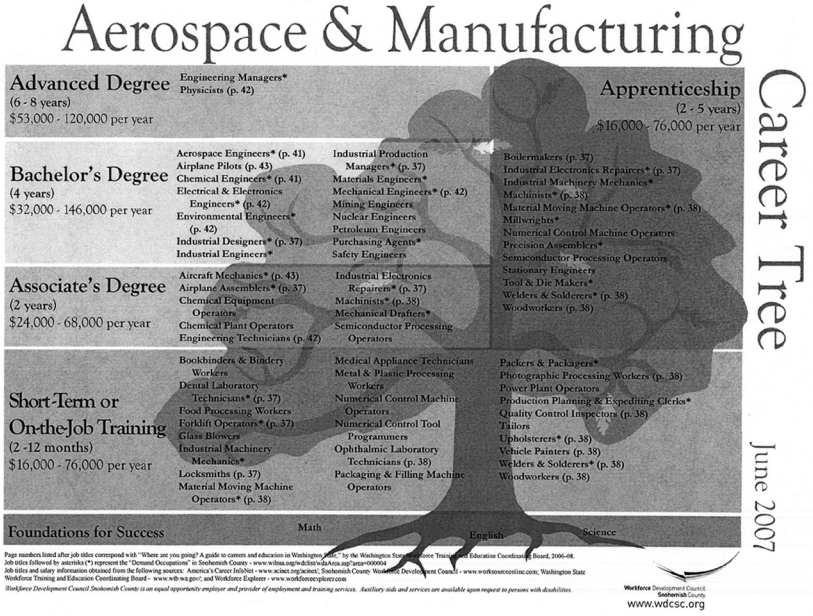
Attached is an inventory of community and technical college aerospace programs throughout the State, prepared by the COE, as well as an aerospace manufacturing career tree.

ATTACHMENTS: 2

Washington State's Aerospace and Advanced Manufacturing Education and Training Organizations*

Aerospace Manufacturing Career Tree

* This report can be found at *http://www.a2m2.net/resource-guide*.



Senator CANTWELL. Thank you, Mr. Dunlap.

Next, we will hear from Ms. Laura Hopkins, who is with the Aerospace Joint Apprenticeship Committee. Thank you.

STATEMENT OF LAURA HOPKINS, EXECUTIVE DIRECTOR, AEROSPACE JOINT APPRENTICESHIP COMMITTEE

Ms. HOPKINS. Thank you for the opportunity to speak with you today.

My name is Laura Hopkins, and I am the Executive Director of the Aerospace Joint Apprenticeship Committee, commonly known as AJAC. Our organization was created in 2008 with funding from the State of Washington to address the aerospace and manufacturing sectors workforce shortage issues.

In these industries, employers have been looking at the reality of over 50 percent of their workforce being eligible to retire and a lack of younger generations getting trained in the skilled trades. Examples of the occupations we are talking about are machinists, FAA-certified aircraft mechanics, composites technicians, and aircraft interiors technicians.

We currently have programs in King, Pierce, Snohomish, Spokane, and Franklin Counties and work with over 90 employers across Washington State.

One of the significant challenges brought on by these retirements of these trades people, that they are craftsmen and women who have honed their skills in these trades with years of experience. They are the employees who bring the utmost benefit to their employers by performing with the greatest amount of accuracy, efficiency, with the least amount of waste and defective parts. They

know more than how to push a button. They know why and when they are pushing a button.

It is imperative that employers have an avenue to capture the knowledge of these retiring trades people and pass that knowledge on to the next generation. We are short on time to do this. As more and more people are retiring, the expertise of these trades are leaving a void that will be nearly impossible to recapture, and it involves the loss of the art of the trade itself.

It is with this sense of urgency that AJAC was created and has been working to address the needs of the aerospace and manufacturing sector in Washington State. Although AJAC was created for the aerospace industry, we have been serving other manufacturing sectors as well. Because aerospace requires the highest level of precision machining, we can train people in other sectors, such as medical devices, marine technology, and such, to the aerospace standards; whereas, we can't do that the other way around.

So, how does our apprenticeship model work? Most of our apprenticeships are multi-employer programs. Ninety-three percent of the apprenticeship program happens on the job. The apprentice goes to work 40 hours a week and is connected with one or more mentor on the worksite who transfers their knowledge to them.

In this manner, they learn the most relevant knowledge, and they are trained on state-of-the-art equipment. Then one night a week, those apprentices come together at school to learn the theory behind everything they are learning on the job.

The beauty of a 21st century apprenticeship model like AJAC is that it provides the connection between experienced worker and the new person, as well as providing such support services as veterans support services, interim certificates, and perhaps most importantly, college credit that is transferable onto 2- and 4-year degree programs.

In the apprenticeship manufacturing sectors, there is a skill gap. Employers need skilled workers, and unemployed people need jobs. In order to address this skill gap, we have partnered with local workforce agencies to create something called the "manufacturing academy." This preemployment training program is an intensive, full-time, 8-week program where students are introduced to the manufacturing sector and learn the basics of safety, hand tools, and mechanical skills.

Fundamental to the whole program is that the students are introduced to a new career pathway, and they get to learn and practice the skills that will help them get jobs in the manufacturing sector. Employers are behind the idea from the beginning, and they are ready to hire the graduates into entry-level jobs, and then they put them into an apprenticeship program to further their education and training.

Apprenticeships are not just about giving some training. Apprenticeships are the vital connection between education, workforce development, and economic development. The cost for State and Federal agencies to run apprenticeship programs is much less than traditional education programs because the employers assist in covering the cost of the education.

When people become apprentices, they are full-time employees who earn a wage, which increases over time to a family wage job

as they become more productive. They receive medical and other benefits, no longer needing to rely on the State or Federal agencies for assistance while they are getting their education. This then gives them the ability to stimulate the economy by putting their income back into their communities.

People who build and maintain aircraft generally are not purchasing their own product. They may not be able to afford an airplane. However, they may be able to afford an airplane ticket or eat at a restaurant at a local airport or buy a trinket at a tourist destination, again stimulating the economy.

Apprenticeships—so, finally, apprenticeships are not just about giving someone an education. They are the vital connection between education, workforce development, and economic development. They are about empowering people to be autonomous and giving them education and career pathways in good, solid, family wage jobs.

The U.S. lags far behind other nations in apprenticeship funding and utilization. If we hope to maintain our edge over other nations, we must capture and not lose the art of these trades themselves.

Thank you very much.

[The prepared statement of Ms. Hopkins follows:]

PREPARED STATEMENT OF LAURA HOPKINS, EXECUTIVE DIRECTOR, AEROSPACE JOINT APPRENTICESHIP COMMITTEE

Thank you for the opportunity to speak with you today. My name is Laura Hopkins and I am the Executive Director of the Aerospace Joint Apprenticeship Committee, commonly known as AJAC.

Our organization was created in 2008 with funding from the State of Washington to address the aerospace and manufacturing sector workforce shortage issue. In the aerospace and manufacturing sector, employers have been looking at the reality of over 50 percent of their workforce being eligible to retire and a lack of younger generations getting trained in the skilled trades. Examples of the occupations we are talking about are Machinists, Aircraft Mechanics, Aircraft Interiors Technicians, and Composite Technicians.

One of the significant challenges brought on with retirements in the aerospace and manufacturing sectors is that these retiring tradespeople are crafts men and women who have honed their skills in the trade through years of experience. They are the employees who bring the greatest benefit to the employers by performing with the greatest amount of accuracy, efficiency and with the least amount of material waste and defective parts. They know more than how to push buttons; they understand why and when they would push certain buttons. They are capable of listening to the machines; know how to troubleshoot and adjust the equipment as needed. The deficiency brought on by these retirements is much more than just technical knowledge that can be easily taught. It involves the loss of the art of the trade itself.

It is imperative that employers have an avenue to capture the knowledge of the retiring trades-people and pass that knowledge on to the next generation. We are short on time to do this as more and more people with the expertise of the trades are leaving a void that will be nearly impossible to recapture. It is with this sense of urgency that AJAC was created and has been working to address the needs of the aerospace and manufacturing sectors in Washington State.

Although AJAC was created for the aerospace industry we have been serving other manufacturing sectors as well. Because aerospace requires the highest level of precision machining, we can train people in other sectors such as medical devices and marine technology to the aerospace standards whereas we cannot do that the other way around.

So, how does our apprenticeship model work? Most of our apprenticeships are multi-employer programs. 93 percent of an apprenticeship program happens on the job. The apprentice goes to their respective job site for 40 hours a week and is connected with one or more mentors who transfer their knowledge to them. In this manner they learn the most relevant knowledge and are trained with state-of-the-

art equipment. Then one night a week the apprentices come together at school to learn the theory behind everything they are learning on the job. The beauty of a 21st century model apprenticeship program like AJAC is that it provides the connection between the experienced worker and the new person, as well as providing things such as veterans support services, interim certificates and college credit transferable to 4-year university programs.

In the aerospace and manufacturing sectors there is a skills gap. Employers need skilled workers and unemployed people need jobs. In order to address the skills gap we have partnered with local workforce agencies to create something called the Manufacturing Academy. This pre-employment training academy is an intensive, full time, 8 week program where students are introduced to the manufacturing sector and learn the basics of safety, hand tools and mechanical skills. Fundamental to the whole program is that the students are introduced to a new career path and they get to learn and practice the skills that will help them get jobs in manufacturing. Employers are behind the idea from the beginning and are ready to hire graduates of the program into entry level jobs, who then progress into an apprenticeship to further their education and training.

Apprenticeships are not just about giving someone some training. Apprenticeships are a vital connection between education, workforce development and economic development. The cost for State and Federal agencies to run apprenticeships is much less than traditional educational programs because employers assist in covering the cost of the education. When people become apprentices they are full time employees who earn a wage, which increases to a family wage level as the apprentice becomes more productive. They receive medical and other benefits and no longer need to rely on state or Federal agencies for assistance. This gives them the ability to stimulate the economy by putting their income back into their communities. People who build and maintain aircraft generally are not purchasing their own product. They may not be able afford to buy a plane; however, they may be able to afford an airplane ticket, and eat at the restaurant in the airport and buy a trinket at a tourist destination—again stimulating the economy.

I want to leave you with this thought; Apprenticeships are not just about giving someone an education. Apprenticeships are a vital connection between education, workforce development and economic development. Apprenticeships are about empowering people to be autonomous and giving them education and career pathways in good solid family wage jobs.

Senator CANTWELL. Thank you.

And our last panelist, Mr. Tom McCarty. Thank you so much for being here. We have saved the best for last, and thank you for your work with the Society of Professional Engineering Employees in Aerospace.

Thank you.

STATEMENT OF TOM MCCARTY, PRESIDENT, SOCIETY OF PROFESSIONAL ENGINEERING EMPLOYEES IN AEROSPACE

Mr. MCCARTY. Well, thank you for inviting me, Senator Cantwell.

When I first received the invitation and read over the request, I am not an educator, and I thought, "What can I bring to this hearing?" And I represent 25,000 aerospace professionals in California, Kansas, Oregon, Utah, Texas, and Washington, and I have personally worked as a Boeing engineer for over 38 years.

I meet with the people I represent every day. I meet with new hires, young engineers and technical workers just out of school. I meet with mid-career professionals and people that have had almost 40 years in the workplace, such as I have had, and will soon be leaving the workplace.

And when I step back and look at this, I think about what are the challenges, what are the issues, what should we be doing in the next few years to maintain this profession and, in fact, more than

one profession, all of these professions of the professionals I represent?

I look at all of this and I think I need to make it as simple as I can. It is about the jobs and what we do with these jobs every day and how we can maintain our skills.

We talk a lot about we need to update our skills, and as a member of technical profession, we really are on the front line of that. We realize this more than everybody how fast and how incessantly the technology progresses.

When I started as a young engineer, almost 40 years ago, there were no personal computers. It was unheard of. And now there are PCs on every desk, and as we have heard, students now coming, graduating and coming into the workplace, they are very familiar with this form of technology. But the important thing, again, which we have heard, is that we have to have fundamentals, and they haven't changed.

And being the last speaker, I have had to make some notes because people have covered some of the things I wanted to, and I wanted to add a few things that weren't covered. But the fundamentals are important because unless a worker has a fundamental understanding of how to make measurements, what physics mean, what electricity means, how heat is transferred, they are not going to have the understanding to participate in today's technical professions. And I represent engineers, scientists, technical workers, and pilots now at the Boeing Company.

When I look back, how did I get interested in that? I was caught up in the transformation of what I consider the modern era, and I consider the modern era starting when I was born.

[Laughter.]

Mr. MCCARTY. And I looked up, as an eighth grader, and I saw the Sputnik, the light streak across the sky. And there was a huge transformation in American education and industry that that brought forth because people had a real, palatable fear that we were going to lose the space race to the Russians.

I mean, this was something talked about every day in the press and in conversation and in our schools. So there was a resurgence in what we now call the STEM core curriculum, and I took advantage of that. I was very fortunate, and I was able to go to a community college. I went to a technical institute when I graduated from high school, and I got an associate's of arts degree in electrical technology.

And I went to work at Bell Telephone Laboratories, and by virtue of tuition matching, which was industry's support, I was able to complete my engineering degree at Monmouth University funded by my employer. Those were really important things then, and they are really important now.

And I know at Boeing, we still have partnering with funding both undergraduate and graduate degrees, and part of the testimony—I have used my 5 minutes.

[Laughter.]

Senator CANTWELL. Now there is a good engineer for you.

[Laughter.]

Mr. MCCARTY. I brought my own timer. And I didn't realize I used my 5 minutes.

But I did want to say this. We, the members I represent—in summary, we are critically aware of the need to maintain our skills. Our professions require us to stay on the edge of technology. We are appealing to both the educational system and the employers to be active participants in maintaining these skills.

We want to be participants. We use our own money. We invest our own time to maintain and improve these skills, and I think this partnership is absolutely essential if the American worker is going to maintain our position as the technology leaders in the global economy. We have to do that, and what was that? Failure is not an option.

So, in conclusion, I want to emphasize that we are willing and able to do this, but we need the help of Government and educational institutions to foster and support this continuing learning that we are going to require.

Thank you, Senator Cantwell.

[The prepared statement of Mr. McCarty follows:]

PREPARED STATEMENT OF TOM MCCARTY, PRESIDENT,
SOCIETY OF PROFESSIONAL ENGINEERING EMPLOYEES IN AEROSPACE

My name is Tom McCarty and I am the President of the Society of Professional Engineering Employees in Aerospace. We represent more than 25,000 aerospace professionals in California, Kansas, Oregon, Utah, Texas and Washington. I've personally worked as a Boeing engineer since 1973.

I'm here today to testify about the importance of scientific, technical, engineering and math education to our Nation's national security and economic future.

The Space Race and the Cold War both served to focus national attention and national resources on scientific, technical, engineering and math education. Public investments created private sector employment and a workforce equipped for those jobs. The resulting growth in technological advancement put men on the moon, won the Cold War and produced technology that has transformed the world.

I was caught up in that transformation. And I have a clear memory as an 8th grader of watching the Russian Sputnik satellite streak across the night sky in October fifty-five years ago. American schools took up the challenge across the country. There was a universal commitment that we had to catch up with the Russians and that resulted in a new emphasis on mathematics and science education our schools. I personally benefited from that transformation and I was one of the thousands and thousands of students who were able to receive an affordable education as the result of public funding and corporate sponsorship.

American society has been reaping the benefits of these investments for decades. However, our Nation is at risk of losing its preeminent position in the global economy due to the changing demographics of the aviation workforce. In short, we're getting old. I'll speak specifically of the workforce that my union represents but the trends are generally applicable to the entire aerospace industry. Nearly 40 percent of the engineering workforce at Boeing will be eligible to retire in the next few years. As this workforce moves into retirement, it's not just their bodies that leave. The baby boomer retirement also represents a tremendous migration of intellectual capital out of the aerospace workforce.

America's position as the premier manufacturer of consumer goods has been seriously challenged in the last 50 years. Now our position as the high-technology aerospace supplier is threatened by credible, emerging high-technology development and manufacturing capability in South America and Asia. One of the larger markets for our high-technology output has been China. But for the past two decades, China has been aggressively implementing a plan to become a high-technology manufacturing leader in its own right. Whether we know it or not, we are engaged in a technology race that replaced the arms race once dominating our technology development. And just like the arms race, this is not a contest we can afford to lose. The consequences of that would be equally unacceptable for us and our children.

Our employers generally recognize the need for continuing employee training. We need to work with them to insure these programs will continue to be funded. We need to help develop programs and policies to ensure education and retraining funding is available to the workforce on a continuing basis. Engineering and technical

workers have made a serious commitment of their own resources to acquire and maintain their technical skills. It is vital to maintain our ability to compete. We cannot do this unless we help these workers maintain the technical capabilities of our American workforce.

A critical factor enabling the economic growth of this Nation was the commitment of society to fund universal education. The labor movement always recognized the importance of education and training and fought for universal education. In 1900, the goal was a literate workforce. A workforce of high-school graduates was considered more than adequate for the shops and mills at the turn of the century. That this is no longer sufficient for a high-tech workforce has been evident for quite awhile. Today, we see an alarming trend to reduce public funding for education at the very time we can least afford it.

It is once again time for the American labor movement to pressure the public and private sectors to adequately fund the education of the American worker. It is not acceptable that qualified students are denied entry into our state universities for lack of funding.

Our members are passionate about education. We have become a stronger and more effective force for change through our collective action. SPEEA members are already making their concerns known and are working for a better future. We serve on college advisory boards, we are members of school boards and volunteers from K–12, and we teach graduate courses at universities. We are partnering with our employers to provide more career growth opportunities in the workplace.

The ability of American industry to compete is based on the investment in the American workforce. Technology is a moving target. Unless we constantly learn new skills and new ways to think about how we create our products, we will lose our ability to compete. This learning process has to be accomplished by actually designing and building aerospace products. The knowledge we bring to the job is only the starting point. That ability is refined and developed by the collaborative environment of problem-solving in the workplace.

When technical work is outsourced, this begins the process of losing capability in that area which was outsourced. If this was not bad enough (and of itself it is), it gets worse because while our workforce is losing this opportunity to grow its skill base in this area, somewhere else, the workforce is now advancing its capability. In effect, we are falling behind at twice the rate. It's not hard to imagine that soon we will have created a self-fulfilling prophecy. We will need to outsource the work because someone else can do it cheaper, faster or better.

There is a critical mass of talent associated with a particular product or service. When that mass is achieved, a self-sustaining organization is created. New people join and bring new ideas and skills, and they are integrated into the experience base of the organization. In return, the experienced people share the specialized knowledge acquired over decades of product development and manufacture. This model has served American manufacturing very well, but now it is at risk. Outsourcing of the traditional work disrupts the flow of information and experience in both directions. The experienced workers lose the exposure to the emerging technologies, and the new workers do not get the full benefit of the tribal knowledge held by the experienced workers. When work is selected for outsourcing, these factors need to be carefully considered or the technical and innovative capabilities of the workforce can be drastically impacted.

The solution is going to take teamwork. The players are the employee, business, schools and government—each has a critical role. It's necessary for all of us to understand that role and become active partners in finding those solutions if we are going to preserve our position of leadership in high technology manufacturing.

Senator CANTWELL. Thank you.

Well, this is—go ahead and give him an applause because I——

[Applause.]

Senator CANTWELL. I just feel that the passion that you all have expressed is exactly what I need to share with my colleagues and others in the State of Washington to get them to understand that this is a critical moment and that aviation has a bright future, but that we have to prepare for it. And certainly, we have job openings, but we have to fill the skills gap.

And all of you are articulating some of those tools and things that we need to sharpen our focus on to make sure that that really

happens so that our State continues and the Nation continues to be a leader in aviation manufacturing.

I wanted to start with you, Ms. Gilman. You mentioned the FAA being a better partner. And you were reminding me that NOAA has a program that is a sea grant fellow program, where they, through NOAA, help in the education and support of those people who are interested in coastal resource issues, and maybe we should be looking at something similar with the FAA.

But we are about to, hopefully, reauthorize the new FAA bill and the next-generation system, and you were talking about formalizing the relationship even more. What did you have in mind besides something that would help with internships and programs? What are you looking for?

Ms. GILMAN. We are looking for the people expertise that can share the knowledge and skills that they have had throughout a career. There is a gentleman who has come to our school, has been involved since the day we started. The depth of his knowledge in aerospace and engineering and what he can share with us is vastly different than the capacity we have on our staff.

We would like to have those people sitting with us every day to share that knowledge and expertise and help us think about where we should be going. As most people in this room today have talked about, staying on the cutting edge, the bleeding edge, I think it is important for us.

And in education, reform moves quite slowly. And unless you have the industry partnerships and those who really know from a policy perspective, like they do at the FAA, I think we are slower to respond to those emerging needs.

Senator CANTWELL. Well, certainly, with the Next-Gen system, you would say that that would be a key opportunity with all of that. I mean, that is probably the biggest transformation on the Federal side in aviation in 30 or 40 years. And so, to have a good partnership then on how that delivery system and how the education would work would be very important.

Ms. GILMAN. Absolutely. Our students will be part of a workforce that is very much changing. Right now, we have a number of graduates who want to work in unmanned aircraft systems, and we need to know more about it as educators so that we can prepare our students to go into those areas.

Senator CANTWELL. And what about Ms. Schaeffer and others that mentioned this issue about fundamentals? I mean, Mr. McCarty talked about it as well. You are seeing students in your high school. Are they coming with a higher interest or skill level in those fundamentals, or are you having to teach those fundamentals in a way that is helping some of those students to really step up?

Ms. GILMAN. Well, I think that the student body at Aviation High School, it is a cross-section that you would see in most public schools. I think the inspiration is to grapple with really complex problems that engineers, machinists, others are experiencing in the workforce so that they can solve those kinds of problems.

Senator CANTWELL. So——

Ms. GILMAN. I wouldn't say they all come with the inspiration to do high-level work. But certainly, when you ask them to build a

product, develop a heat shield, or to test the structural integrity of a wing beam, and you present that, you require students to present that to industry experts, that becomes your high-stakes part of learning.

And students want to do better when they know that the people they would like to be like are assessing their work and giving them feedback.

Senator CANTWELL. So that is on the inspiration side. Back to the fundamental side, Ms. Schaeffer, were you saying that at the entry-level, some of these people are coming in even for these 2-year certificate programs without the entry-level skills that you are looking for to put them into these certificate programs?

Ms. SCHAEFFER. The certificate programs, to have two certificate programs completed takes 12 weeks. We are finding that probably half of the students do not have the fundamentals of math. So we do an intensive math learning with the students.

We find that once the students are in the certificate, once they are in it, they are passionate about airplanes. Then learning math and some of the other fundamentals becomes something more desirable for them to learn, and they grasp it. With the addition of the online learning, they can repeat it and do remedial learning.

Senator CANTWELL. So what is the entry-level math that you put them through before you get them into the certificate program?

Ms. SCHAEFFER. They come into our certificate program with a high school diploma or a GED requirement, and we train them for the math if they don't understand the math concepts.

Senator CANTWELL. And what does that mean, you train them for that?

Ms. SCHAEFFER. We train them on the basic fundamentals, decimals, fractions——

Senator CANTWELL. Within the certificate program, you are saying?

Ms. SCHAEFFER. Yes. Yes.

Senator CANTWELL. OK. OK. And what do you think about that, Laura? What are you seeing in the apprentice program on that same issue of fundamentals?

Ms. HOPKINS. Yes. We have the same dilemma. We have employers who are ready to hire, and they are trying to find people. In fact, today, I have an employer up in Snohomish County is looking for 20 employees. Another one is looking for 15, and they are coming to us, saying "can you help us find good candidates for these positions" because they are having a hard time finding folks who have the fundamental skills.

So what we are looking at doing right now with that particular group of employers is running our manufacturing academy. They are actually looking at paying us to run one of our manufacturing academy programs, which will teach the fundamentals. Everything from safety to manufacturing basics—so it is not just the math, but it includes math, physics, and also basic hand tool usage. Because most of the folks, as somebody mentioned, they don't grow up working in their garage anymore. So they don't even know how to use a drill or a bandsaw or anything like that.

So, in our manufacturing academy, we have this opportunity for them to learn all those fundamentals. We are able to identify who

the really hard-working folks are and who are really determined to do this kind of work and who have the mechanical aptitude. And then we place them directly into these jobs.

As soon as they get hired, then they join the apprenticeship program. It is an ongoing career path, where they can start with having no skills and end up being a master mechanic.

Senator CANTWELL. So, Jim, we are missing something here on this shop side, aren't we? I know a young person who just told me the other day, who was very good at building and shop, and I said, "How come you are not taking more classes?" And it really is that it is very hard for them to continue that. They don't really have the choice.

I mean, is there something we should be doing, Ms. Gilman? I mean, you are seeing this in one high school. But are there other things that we could be doing at other high schools to stir the interest?

Ms. GILMAN. Thank you for asking that. I loved your comments about shop class because—and it just reminds me that if we don't provide the inspiration during the high school years—sooner would be nicer—that we don't get people who end up in the industries for which we need their skills and their knowledge.

Shop at Aviation High School could be in an English class. It could be in any class there because we don't use the concept of—the context of aviation and aerospace just to be in a class where they may be building an airplane or trying to figure out how to engineer something, innovate something new. But that context is spread throughout the entire curriculum.

So students might be designing a set to perform Macbeth here on this stage at the Museum of Flight using an aviation context, and they still can learn the types of skills that you were referring to. I was a technical educator for many years, and I realized that you have to blend the two. It doesn't happen just in isolation.

And I think that Laura and Ms. Schaeffer and everyone who has spoken here today would love to have students come to them that they could accelerate rather than remediate. And as a skills center director, that spoke to me and seeing students come, as juniors and seniors, who were not prepared to do the kinds of work. They didn't have the math/science backgrounds that they needed to do.

They didn't understand that if you want to be a world-class chef, you do have to know math. And so, I think you can do it in other schools if you make a context run across the curriculum rather than separating it.

Senator CANTWELL. Back to the overall apprentice numbers. How many job openings do you think that we have right now that could be filled by apprentice? I mean, what do you think the demand is for——

Ms. HOPKINS. That is a really great question. I think right now, currently, we have over 90 apprentices in the system, and we are growing like crazy. We have actually tripled in size this summer and are expecting to do similarly by winter quarter.

So, in terms of the numbers, we know that we have the capacity for thousands. Right now, the big hurdle for us is around the economy because with an apprentice, they have to get hired. So an employer has to invest in this person enough to actually hire them on,

give them benefits, and all that. So it is easy—it is not so simple as someone just going to college.

So, as the economy has started to shift, in the manufacturing sector, we are seeing more and more employers who we have been talking to for the last 2 years suddenly say, OK, now I am ready. I am actually hiring. Let us put people in.

And so, we are expecting to grow. But we definitely have the capacity to do thousands of apprentices, and we think the employers are out there. We already have those partnerships that are growing.

A lot of these folks that we are working with have never thought of apprenticeship before. It seems like something they would have been involved in in the manufacturing sector, but they haven't been. So we are actually introducing them to the concept of what apprenticeship is, how it works, and kind of trying to work them through some of their fear issues around Government getting involved in their business.

And once we get those issues resolved, we are able to help get them on. And so, what has happened now is we have had employers who participated, put in one or two. They have tried it out. They have seen that it is good. They are putting more in, and they are talking to their colleagues about apprenticeship programs. So it is growing quite rapidly now.

Senator CANTWELL. So you would have said that the demand could have been there sooner, but now employers really feel like they are in that hiring sprint that they now they wish——

Ms. HOPKINS. Right.

Senator CANTWELL.—there is more demand?

Ms. HOPKINS. Yes, exactly.

Senator CANTWELL. So if we would have had it timed perfectly 2 years ago, we would have accelerated. Is that right or——

Ms. HOPKINS. Well, we started 2 years ago, but the employers couldn't hire. Because of the economy, they were actually laying off. So they weren't in a position, even though when we would go out there and talk to these employers, they would look out at their shop, and they see all these folks with gray hair who they know are their last remaining folks who know how to work on this machine, on these processes.

But they couldn't replace them, as much as they wanted to, because they were just trying to survive. So they would say, please, help us. And we would say we would love to, but you have to hire somebody in order to put them in the apprenticeship program. That was the great catch–22 that we were in. And now that we are seeing a shift in the manufacturing sector where they are starting to pick up now, slowly but surely, then they are putting them in.

So in terms of what would help us be able to put more people in, one of the things that we are going after in Washington State is a tax incentive for employers every time they hire an apprentice they would get a $5,000 tax incentive for doing so. And our employers that we have talked to said that that would be significant for them.

Of course, that is at a State level at this point. But that is what we are trying to put forth for the next session.

Senator CANTWELL. And Mr. Dunlap, Ms. Gilman talked about spreading the Aviation High School to other parts of the State. You are seeing these potential workforce candidates at the certificate level. What do you think about that as it relates to Spokane?

Dr. DUNLAP. Yes, I think that is an excellent idea. In my experience, when you can contextualize education, it becomes far more meaningful for students, and they can make connections to the real world. And so, an aviation high school does precisely that.

There are other magnet-type high schools that do that in other disciplines, but I think there is a great opportunity to get young people interested in the aerospace industry cluster by starting at an earlier age. And so, I think it is a great idea to expand the concept of aviation high schools throughout the State.

Senator CANTWELL. OK. And one note, I know that part of the Department of Labor grant will focus on helping the education and training of returning veterans. But is there more to be done there? Since there is a good, trained skill set already there with our veterans, having so many of them returning creates an opportunity to focus on how to upgrade their skills to meet the demand that is being sought right now in aviation. Would that be a very good thing to do?

Dr. DUNLAP. Yes, and Laura is actually working on a portion of that as well. One of the difficulties for our returning veterans is that while they may have worked and acquired aviation-related skills, they don't receive the FAA certification for that while they are in the service.

And so, when they get out of the service, there is no formal process or easy process for them to take those skills and then get FAA certification for those. And oftentimes, they are told they have to start from the beginning. And in other instances, they may be given some credit for the schooling that they have learned.

And so, that is one of the things of that we are trying to tackle, and Laura can address that as well, I believe, in terms of how do we provide a system for veterans so that they receive the credit for the training and experience they had in the service.

Ms. HOPKINS. Yes. Just to expand on that a little bit, in today's world, the FAA has a system by which if you go to an A&P school or an airframe and power plant school, you can then apply to take a test to get your airframe and power plant license. You can also apply to take that test with work experience.

However, you have to have a certain kind of documentation, and it has to be documented in a certain way. And so, what is happening today is people are coming out of the military without the same documentation standards that the FAA requires in order to meet those—be able to go, apply to take that test.

And so, you may have people coming out of the service who both have the same experience level, but when they go to the FAA, depending on who the FAA person is interpreting that, they could interpret it different ways. So there is two pieces to this.

One is that the military doesn't provide the proper documentation that they need by the time they leave service. So that is the first piece. And the second piece is that when they do finally arrive at the FAA, there isn't a standardized documentation system in place. So there isn't a thing that says, OK, if you have done this,

this, and this, and it looks this way, you will then be able to go, take your airframe and power plant.

So it really is up to the FAA inspector. So if you show up 1 day and you get Joe, they may allow you to go take both your airframe and power plant tests. You show up the next day and you get Susan, you may have to go back to A&P school for 2 years. And it is up to that inspector you happen to run into that time.

Senator CANTWELL. Well, with the number of returning veterans, that would be something that I think would be easy to fix. I am not saying anything at the FAA is easy to fix, but——

Ms. HOPKINS. Right.

[Laughter.]

Senator CANTWELL. I am saying that it seems that if you could agree on what that standardization is, that you can set up a system, right? Is that correct? Because you are talking about somebody who is an aviation mechanic in the military. So different aircraft, different structure, but very similar backgrounds.

Ms. HOPKINS. Right. There are a couple of tricky things to this. One is that because the airframe and power plant license, the way that they are structured, when you go to take your license, you have to test on every type of aircraft. So small aircraft to large aircraft.

Most of the folks coming out of military only have experience working on large aircraft. But there is a Federal aviation regulation that states that you can't combine work experience and education together to be able to qualify to go take your test.

So the military people coming out of service can't go to the FAA and the FAA say, OK, you just have turbine experience—you haven't had experience working on reciprocating engine. Go back to school just for that. Instead, they have to tell them start over.

Senator CANTWELL. So what would the solution be in that instance?

Ms. HOPKINS. Right. If they could change the law so that they could go to the local community college and just take the piece of—the section of class that they just need and not the entire 2 years, that would be—that would transform the aviation education experience. It is an antiquated law that makes no sense in today's world, but it still exists.

Senator CANTWELL. OK. Great.

All right. Anything else from the panelists? You guys have been great today. Thank you so much for your work in this area.

Any final comments that anybody wants to make? I gave the first panel an option. You guys were so inspirational, I don't know that I need to ask the same question. But I will ask a different one. If there was one thing that we could do that would be helpful, what do you think that would be as it relates to preparing this workforce and to helping you do your individual jobs?

And maybe we will start at the other end since—Mr. McCarty, if you wanted to start with that?

Mr. MCCARTY. Well, there is "a thing" that we are doing, and we certainly can use support, and I want to bring it to your attention, Senator. And it is here in Washington State is receiving a lot of attention. That is the First Robotics competition.

Boeing is a large sponsor of that, as well as other companies here in Washington State. SPEEA has been an ongoing sponsor, and I am hoping to increase our role. SPEEA members work with the robotics teams in the schools and help them build their robots.

But the point was how do you get young people interested in pursuing a career in manufacturing, aerospace, engineering, or the technical fields, and how do you give them hands-on experience? As we have heard, a lot of dads don't have garages or moms don't have garages to bring their daughters in and teach them some of these skills.

But we can take that to the schools, and the students get their kit, they put on their safety glasses, they pick up their drills. They drill and solder and build their robots, and it generates a lot of enthusiasm and exposure.

So we can do these kind of things. They are not terribly expensive, and they generate interest and enthusiasm in our young people and show them that a technical career can be interesting, rewarding, and satisfying.

Senator CANTWELL. Has that already taken place this year, or is it still coming up, the robotic competition?

Mr. MCCARTY. I think this cycle is completed, and after the first of the year, we will be starting the next cycle.

Senator CANTWELL. All right. Thank you.

Ms. HOPKINS. I actually have three things. I know I am supposed to stick to one. But——

Senator CANTWELL. OK.

Ms. HOPKINS.—the first thing, I would say, is assistance with the FAA. We have a lot of issues that we are trying to resolve with the FAA. And so, getting to a place of collaboration rather than where now it seems like we are constantly battling them would be a really significant step for us to be able to move forward. So that would be one big piece.

The second item would be around apprenticeship utilization. We are far behind other nations around the world in terms of utilizing apprenticeship. Even just in Scotland, they have an $800 million budget in Scotland for apprenticeship. I think, in Washington State, we have about a $1 million budget for the entire system. So there is a lot of work that could be done there around supporting apprenticeships and using that as a model of training.

And then the third piece I would just say is partnerships. I had the great opportunity to go to the Paris Air Show this past year. And while we were there, we were able to witness the collaboration between Lufthansa Airlines and their local entities. And they actually created not an organization, but they built a site that was utilized in partnership, and it was funded by a partnership of the university, the 2-year and community technical colleges, businesses, and the government all came together and chipped in. And they all share that site.

So they have one fuselage, and on there, you have the university researchers doing research on how to utilize the cargo space. On the top part of that fuselage, you have wiring where the 2-year degree folks are learning how the wiring system works, and they are transferring information between each other. And the government

and the employees are the ones who are funding the researchers from the university.

And so, this amazing partnership model I think is something that we are going to need to do more and more in the United States in order to be more efficient and effective.

Thank you.

Senator CANTWELL. Thank you.

Dr. DUNLAP. Well, I had two things. And Laura mentioned one, and that is to bring the FAA training systems into the 21st century. That desperately needs to be done not only for veterans, but just in terms of bringing the curriculum up to date.

The second is that many of our career and technical programs are funded by Carl Perkins funding, which is Federal funding for those types of programs. And it seems that every legislative session, there is a threat to cancel or reduce funding for those programs.

And it is critical that that funding remain in place or even increase because without that, you will see even more career and technical programs at the high school and college level disappear.

Senator CANTWELL. Thank you.

Ms. Schaeffer?

Ms. SCHAEFFER. Additional funding support for the student loan program that we have through the WATR Center, as well as some funding support to the skills centers so their students can participate and earn that core aerospace certificate before they graduate.

Senator CANTWELL. Before they graduate from the——

Ms. SCHAEFFER. High school.

Senator CANTWELL. OK. And how many high schools offer that?

Ms. SCHAEFFER. We would collaborate with the high schools or the skills centers, as we are starting to do now. And Edmonds Community College WATR Center is offering some scholarships. But if we could offer more scholarship-type opportunities for those high school students to recruit them and get them excited, we are sure that more and more students would pursue aviation and aerospace.

Senator CANTWELL. OK. Ms. Gilman?

Ms. GILMAN. Well, my recommendation is to create more models that are responsive to workplace, workforce needs. And that would be a longer conversation than right now, but we would like to be asked. We would like to be engaged in the conversation and the work to help to be more responsive. And certainly, that needs to go from kindergarten through 12th grade and on into the post-secondary education system.

Senator CANTWELL. Great. Mr. Bearden?

Mr. BEARDEN. I think, first off, I would have to agree with Laura that we have fallen behind as a country. And I think some of the evidence of that is—and this is no offense to the industry and corporations—is how they are looking for quicker fixes to the problems they are facing right now. I think that is because they have let our manufacturing and training of young folks to fill in when us folks that are going to retire, leave, do.

We like to call the apprenticeship the original 4-year degree because when you hire a journeyman, a graduated apprentice that is now a journeyman, you can't have a finer employee, skills wise. I

can point to few of them sitting in this room that I know are journeymen.

I think that this is all of our problem. This isn't a problem that the Government just needs to throw money at or the companies need to throw money at. This is a decision on whether we want this country to remain the number-one manufacturing country in the world. And if we believe that, then we all have to invest. Whatever we can invest, we have to, whether it is our time, whether it is volunteering, whether it is companies supporting apprenticeships, like AJAC and our internal IAM-Boeing joint apprenticeship.

That is what we have to do, and it is a decision that we need to make. And if we keep waiting, we are going to be the losers.

Senator CANTWELL. Well, I can't say it better than that. So we will definitely take this information back to Washington, D.C. Again, thank you all for participating in it, and I thank the chairman of the committee for allowing us to have this field hearing.

We are going to focus on aviation manufacturing, Mr. Bearden. We are not going to let that happen. We are going to take up the charge, and I just thank everyone for participating in this important hearing and look forward to working with you on these solutions.

We are adjourned.

[Applause.]

[Whereupon, at 12:33 p.m., the hearing was adjourned.]

○