Improving Defense Acquisition Workforce Capability

Please stand by for realtime captions.

Good morning. On behalf of the national academies of science, engineeringof the national academies of science, engineering and improving depends acquisition capability and data use I'd like to welcome you to our virtual workshop today. Thank you and data use I'd like to welcome you to our virtual workshop today. Thank you very much for joining us. My name is Tyler Kloefkorn and I'm a program officer with the National Academy of My name is Tyler Kloefkorn and I'm a program officer with the National Academy of Sciences engineering in medicine in the custody director for our committee. Today custody director for our committee. Today we are going to be investigating the melding of two topics. Those two being data science educationthe melding of two topics. Those two being data science education and the Defense acquisition process. To those of you who might be unfamiliar with the Defense acquisition process, To those of you who might be unfamiliar with the Defense acquisition process, it is obtaining and fielding of goods and services systems for military missionsof goods and services systems for military missions needs in general. Data science as we know is an evolving fieldscience as we know is an evolving field and today we are putting those two together to see what whenever experts have to say. With that I will those two together to see what whenever experts have to say. With that I will pass it to my colleague Dr. Benenson Benenson and for the information about what we are doing today.
we are doing today.
Good morning. Thank you Dr. Cluff one. It is a pleasure to be here.Cluff one. It is a pleasure to be here. We greatly appreciate our guests flexibility to participate.guests flexibility to participate. Our team wants to say a special thank you to I.T. staff at Sparks beat -- sparka special thank you to I.T. staff at Sparks beat -- spark Street digital. The purpose of this workshop is to bring representatives from the Department of Defense of this workshop is to bring representatives from the Department of Defense and data communities together to address how we can improve the data capabilities of the acquisition workforce.address how we can improve the data capabilities of the acquisition workforce. We have a very impressive roster of speakers with us today.roster of speakers with us today. I don't want to hold us back from getting started but I do want to share a few us back from getting started but I do want to share a few workshop logistics. First there is an opportunity for all participants to submit questions. opportunity for all participants to submit questions. There is a box right beneath the webcast and you are welcome to submit questions beneath the webcast and you are welcome to submit questions and those questions will be shared with the panel moderators.with the panel moderators. The agenda for today's workshop is also available on the webcast page. You should be

is also available on the webcast page. You should be up to see a link at the upper right but if you scroll down further, the agenda is the upper right but if you scroll down further, the agenda is available to download their as well as the speaker bios. As a resultas the speaker bios. As a result we will have brief speaker introductions because the bios will be visible on the website.introductions because the bios will be visible on the website. It is my great pleasure to introduce to the two cochairs of this study.to introduce to the two cochairs of this study. Lieutenant General Wendy Masiello and Dr. Rebecca Nugent. and Dr. Rebecca Nugent. There bios are built upon the project page associated with this webcast linked on the project page associated with this webcast linked on the right side. With that I'd like to introduce our cochairs. Thank you so much.
like to introduce our cochairs. Thank you so much.
  Thank you. I'm pleased to be part of this study and cochair with Rebecca who will talk to you in be part of this study and cochair with Rebecca who will talk to you in a minute. From the acquisition perspective we are always interested in figuring out how to make data-driven decisions. perspective we are always interested in figuring out how to make data-driven decisions. When we look at what type knowledge he affords usknowledge he affords us and data analysis and maturity data science as it is evolving, things have changed dramatically. data science as it is evolving, things have changed dramatically. How do we get our data from one step acquisition program to another so we can make smarter decisionsfrom one step acquisition program to another so we can make smarter decisions whether it is identifying good supply-chain opportunities, identifying suppliers to meet her needssupply-chain opportunities, identifying suppliers to meet her needs and better pricing across the acquisition community. That is what we are here to understand and acquisition community. That is what we are here to understand and find ways to what that looks like but prepare the defense like but prepare the defense acquisition workforce to employ and apply data and plan for it from the apply data and plan for it from the very beginning, not only in how they do their own business but within the programs they are how they do their own business but within the programs they are responsible for. We look forward to hearing from her panelists today. We brought together incredible talent to hearing from her panelists today. We brought together incredible talent and insight and we are looking forward to hearing from Mark guest speakers and panels todayforward to hearing from Mark guest speakers and panels today so thank you for joining us. Rebecca?
 Thank you Wendy.us. Rebecca?
 Thank you Wendy. To reiterate a warm welcome to everyone joining us on the web asked and a to everyone joining us on the web asked and a big thank you on behalf of Wendy and myself and the national Wendy and myself and the national academies staff put on today's workshop and we are grateful to have our committee members with us. and we are grateful to have our committee members with us. To think about the broader context, where focusing on the defense acquisitions community.

where focusing on the defense acquisitions community. This is not the only sector striving to improve data capabilities. Organizations are sector striving to improve data capabilities. Organizations are realizing the value and power of data data so we are seeing it across industry as we re-examine how to use data, how to of scale industry as we re-examine how to use data, how to of scale or retrain our current workforce to tackle those data capabilities and turn our datatackle those data capabilities and turn our data and leverage them for insights. Academia also is Academia also is throwing in changing data science building new training programs, data analytics platformsbuilding new training programs, data analytics platforms and trying to do research on both data science and data capabilities.on both data science and data capabilities. In today's workshop we have the opportunity to hear perspectives from a variety of these sectors. From the defense the opportunity to hear perspectives from a variety of these sectors. From the defense acquisitions community, from industry and academiaacademia to offer guidance on what the defense acquisition community can do to enhance data capabilities of the the defense acquisition community can do to enhance data capabilities of the workforce. With that I will introduce our first of three speakers for this first introduce our first of three speakers for this first morning session. Mark Crisco is the deputy of enterprise information for the office of the undersecretary of defenseis the deputy of enterprise information for the office of the undersecretary of defense for acquisition technology and logistics acquisition resources and analysis. He champions acquisition resources and analysis. He champions and facilitates innovative uses of information technologies to improve and streamline the information technologies to improve and streamline the acquisition process. Thank you for joining us this morning.

Thank you Rebecca joining us this morning.

Thank you Rebecca I think you Wendy as well as thanking the committee and the as thanking the committee and the national academies. Good morning all. I wanted to talk a little bit about the genesis of this study I wanted to talk a little bit about the genesis of this study and where it began. Congress and the national Defense authorization act of 2018, section 913 specificallyand the national Defense authorization act of 2018, section 913 specifically talked about improving acquisition outcomes for our workforce.for our workforce. And the use of data and analytics are critically important to that. In our journey and analytics are critically important to that. In our journey of moving to it data-driven organization we have recognized some of organization we have recognized some of our skills may be lacking and in the ever emerging capability of data availability and data science which and in the ever emerging capability of data availability and data science which has evolved and worked across the organization.the organization. It was fundamentally important for us to think about our workforce and think through this studyus to think about our workforce and think through this study of what we would do as an organization to improve, as an

organization to improve, not only these skills but the use of meeting those objectives because the goal is use of meeting those objectives because the goal is improving acquisition outcomes. The objective of this studyof this study was to look at the enhanced use of data management for our workforce to see what skills and how we enhanced use of data management for our workforce to see what skills and how we should think about this, rather than an individual transactional thingthan an individual transactional thing but think about this as a community of how we should move our department together.a community of how we should move our department together. In leading enterprise data we have seen over the past number of years we are propelling ourselves rapidlyhave seen over the past number of years we are propelling ourselves rapidly and tackling the transparency of data, the use of dataof data, the use of data and making it available across institutions. Sharing it across institutions. Sharing it across silos of excellence, whether it be the chief management officer or the acquisition communitybe the chief management officer or the acquisition community with the cost assessment communities. It is important as we have developed It is important as we have developed new techniques and organizational goals and making that and managing that data and making that and managing that data and making it available to the workforce, whether it be a program executive officerworkforce, whether it be a program executive officer or program manager or the undersecretary of defense, that information could be used.undersecretary of defense, that information could be used. Not only what we have done in the pastdone in the past of the silo of truncating information but looking for opportunities we wouldn't have otherwise look for. I am grateful for information but looking for opportunities we wouldn't have otherwise look for. I am grateful for the Academy of taking this in the body of working with this.the body of working with this. It is now the time for us to think about where we want to be in the future and how for us to think about where we want to be in the future and how we should guide this.

I only had a few comments because I would like to introduce my boss, Mr. I only had a few comments because I would like to introduce my boss, Mr. David Cadman who is the director of this organization of data and analytics and in his role,director of this organization of data and analytics and in his role, he ranges everything from the data management to the data analytics and the data analysisdata management to the data analytics and the data analysis on behalf of the undersecretary. He recently picked up the new job with his boss He recently picked up the new job with his boss being detailed to deal with COVID-19 of leading all the efforts COVID-19 of leading all the efforts in the organization of acquisition. With that, Mr. David Cadman.

Thanks Mark.With that, Mr. David Cadman.

Thanks Mark. I'm very happy to be here to talk to you virtually.here to talk to you virtually. I want to say the Department of Defensethe Department of Defense is clearly not an expert in this area. We are looking for guidance in this area. We are looking for guidance and

help from all of you but we would really like to but we would really like to leverage the great amount of effort being done commercially, academicallybeing done commercially, academically and part of our effort and what is our effort?and what is our effort? About a year ago I was given the task of rewriting the DoD 5000. was given the task of rewriting the DoD 5000. That doesn't mean a lot to you in the Lehmans world but that is you in the Lehmans world but that is the document the Defense Department buys stuff with. In buys stuff with. In the past we were able to compress everything into that document, and it is a massiveto compress everything into that document, and it is a massive multipage document that is supposed to address anything and everything the Defense Department wants to buy.to address anything and everything the Defense Department wants to buy. What we typically found, a lot of reasons not to use that,a lot of reasons not to use that, there is a lot of options out there and Congress kept adding in these good ideas called middle options out there and Congress kept adding in these good ideas called middle tier software development and other acquisition pathways but we didn't acquisition pathways but we didn't have a system that could actually do that.do that. We embarked on a rewrite of the policy and over the last year, we have written all of our of the policy and over the last year, we have written all of our policies again with the focus on making them more adaptive. on making them more adaptive. We have six tenants we try to follow. We have done a try to follow. We have done a pretty got -- pretty good job of getting them into place. We wanted to take this thing called job of getting them into place. We wanted to take this thing called middle tier which is software programs and big programs and make them more rapidprograms and big programs and make them more rapid and delivery capability faster. If you look at myIf you look at my policy on one side and data on the other side, what we want to do in data on the other side, what we want to do in this case, because we are broken up the 5000 into smaller documents we can integrate that faster. We want to broken up the 5000 into smaller documents we can integrate that faster. We want to take data based on the performance of these systems as we see them today and impact policy performance of these systems as we see them today and impact policy in a much more rapid fashion. In the past it took five years to update these policies In the past it took five years to update these policies and any time we opened up the policy there was an opportunity for people to add more and more and up the policy there was an opportunity for people to add more and more and it just got to be too cumbersome to manage.cumbersome to manage. In this case we are looking at these pathways separately as a standalone items in looking at having each of looking at these pathways separately as a standalone items in looking at having each of those be influenced by the performance of that policy. We have performance of that policy. We have data requirements. Marcus trying to help us put together data requirements and tracking and all of our programs in help us put together data requirements and tracking and all of our programs in these systems, and each of those pathways can be gauged andthose pathways can be

gauged and waited whether it is performing properly. properly. If the policy needs to be updated we can reiterate the policy. updated we can reiterate the policy. We don't want to wait five years it takes to update these things. It is to slow and not years it takes to update these things. It is to slow and not helping us and we are not making good decisions. The intentmaking good decisions. The intent of the six tenants we are focused on is empowering the program manager are focused on is empowering the program manager in data-driven analysis and our decision-making and we our decision-making and we want to manage risk more rapidly. The way you do rapidly. The way you do that again is to collect data. Each of the data items is unique for each of the pathways. Each of the data items is unique for each of the pathways. Software has a unique set of data would like to collect and comparedata would like to collect and compare and threw it into a big machine and have artificial intelligencebig machine and have artificial intelligence what we can't see very rapidly and quickly. rapidly and quickly. We know the Department of Defense is not a leader in this area but we should be and what we need is not a leader in this area but we should be and what we need to do is get better at what we do. We hired Michael Conlinwhat we do. We hired Michael Conlin who is the chief data officer for the department. I would like to introduce Michael Conlinofficer for the department. I would like to introduce Michael Conlin and let him talk. Thank you.
Thank you.

Thank you for those kind words.words. Hi everyone. We have, as you have singled out, an enormous challenge across , as you have singled out, an enormous challenge across the department. That challenge comes down to a cultural shift for us.down to a cultural shift for us. We have a long-standing culture of experience centered decision-making in the department and that culture has served of experience centered decision-making in the department and that culture has served us well in many challenges across the decades.across the decades. With the policymaking act becoming a law there is a new set of expectations for all the federal government and a law there is a new set of expectations for all the federal government and that is captured in the name of the act, the evidence-based name of the act, the evidence-based making act. What is critical to acknowledge is to acknowledge is the key role of evidence in our decision-making and evidence has a definition.our decision-making and evidence has a definition. Dated that has been statistically validated.validated. That becomes a critical element of the shift we are looking for within the Department of Defense. What we of the shift we are looking for within the Department of Defense. What we know is across the department, there was a relatively low level of literacythere was a relatively low level of literacy in data and in statistics. The challenge for us is to statistics. The challenge for us is to improve the level of literacy from the seniormostfrom the seniormost to the junior most. During the quality phase of the manufacturing sector in the 80s, we talkedDuring the quality phase of the manufacturing sector in the 80s, we talked factory floor workers with high school educations how to perform

calculus school educations how to perform calculus in order to understand the quality of the output.of the output. That kind of change is the same kind of change we are trying to the same kind of change we are trying to design for the Department of Defense. From the top to the bottom, From the top to the bottom, we need people capable of looking at data, understanding the quality of that data and using math at data, understanding the quality of that data and using math to make decisions about how competent they can be in using that data to make decisions. Whether it competent they can be in using that data to make decisions. Whether it is decisions around policies for acquisition pathways or whether it is decisions acquisition pathways or whether it is decisions in any other scope or domain within the department. domain within the department. We want people to get to the point where they understand all the basics of data quality the point where they understand all the basics of data quality and statistics and modern analytic techniquestechniques and a modern visualization storytelling techniques including the use of techniques including the use of machine learning and artificial intelligence techniques in order to techniques in order to make decisions. The challenge we have is we have got to reeducate over 3 million peoplehave is we have got to reeducate over 3 million people to get to the point where everybody in the department uses where everybody in the department uses data as a fundamental element of their decision-makingtheir decision-making and that is going to take a concerted effort and a concerted time.take a concerted effort and a concerted time. For this audience what we need to get to is a specific set of actions that apply those challenges we need to get to is a specific set of actions that apply those challenges in the acquisition pathways. We need very clear actionable recommendations need very clear actionable recommendations grounded in data. We have to lead by example so we need have to lead by example so we need recommendations grounded in data that is statistically tested but are actionableis statistically tested but are actionable and will derive changes of behavior by driving increased levels of literacy behavior by driving increased levels of literacy and understanding amongst the members of the Department of Defense, whether they are of the Department of Defense, whether they are in uniform, civilian or contractors. Throughout the department Throughout the department we are working to change the decision-making process, to change the way people the decision-making process, to change the way people interact with data to get to the point where data is not something that to the point where data is not something that is after-the-fact but data is seen as a leading indicator of seen as a leading indicator of the quality of your decision-making. We all know you cannot manage what you cannot measure.We all know you cannot manage what you cannot measure. Data is the expression of that measurement so it becomes criticalthat measurement so it becomes critical for good decision-making to recognize when we have good quality data to start with when we have good quality data to start with and that will always work from good quality going forward.good quality going forward. My request to this

group of individuals is to help us get there with clear of individuals is to help us get there with clear actionable recommendations well-rounded in data in setting a good example in and of themselves. in setting a good example in and of themselves. Thank you for that.
 Thank you so much Thank you so much . We are going to be taking some questions from the committee members. If you would like be taking some questions from the committee members. If you would like to use the raise hands feature on the zoom box we can call on the zoom box we can call on you. Well the committee members are thinking about their questions,are thinking about their questions, I would like to actually ask, Mr. Conlon, you just spokeask, Mr. Conlon, you just spoke about this culture shift about how it used to be this culture of experience about how it used to be this culture of experience centered decision-making. Now thinking about how to take about how to take data and turn that into data-driven decision-making and you cannot decision-making and you cannot manage what you do not measure which I really like. I wonder if you could which I really like. I wonder if you could talk about what you see as two parts, how we two parts, how we manage the culture shift from experience centered decision-makingexperience centered decision-making to maybe experience centered and a combination of dated driven decision-making and a combination of dated driven decision-making and why maybe this is the right time? What are the time? What are the positive things you see happening right now that we would be able to harnessnow that we would be able to harness to help the Department of Defense community move in this direction?
 Thank you for that.Defense community move in this direction?
 Thank you for that. There are a couple of things we can harness to help change the culture.things we can harness to help change the culture. I mentioned one which is the foundation for space policymaking act the foundation for space policymaking act and the federal government data strategy and action plan for the federal strategy and action plan for the federal data strategy. Another important item is the presidents management agenda which expresses is the presidents management agenda which expresses clear expectations for the use of federal government data, not only within the organizationof federal government data, not only within the organization but without the organization, in other words by industry, andin other words by industry, and I'm going to mention two more things. One of themmore things. One of them is one of the most senior decision-making senior decision-making meetings in the department, the secretaries review of the national defense strategy review of the national defense strategy and implementation and the deputies management action are now pivotingdeputies management action are now pivoting toward an emphasis on data. That data. That is been statistically doubt -- and that his current. We have had and that his current. We have had a long tolerance for data that is five years old and stated --that is five years old and stated -- David talked about or even three or four months oldeven three or four months old because our old-fashioned manual processes require three processes require

three or four months to get to the point where you can deliver some set of contentthe point where you can deliver some set of content . Nursing executives, the secretary and the deputy secretary said that not a good enough anymore. secretary and the deputy secretary said that not a good enough anymore. We need to be looking at live feeds of live data in real time, live feeds of live data in real time, not power points that reflect a reality somewhere in the past. Some a reality somewhere in the past. Some of these senior decision-making meetings there is an obvious and clear state of direction from the secretary and there is an obvious and clear state of direction from the secretary and the deputy that we are pivoting away from the old manual processes of generating PowerPoint slidespivoting away from the old manual processes of generating PowerPoint slides and onto modernization techniques of data. This is a top-down change.data. This is a top-down change. It creates pressure at the very top for the under secretaries the very top for the under secretaries in the principal staff to the Undersecretary to reform their own the Undersecretary to reform their own processes for generating content and hard appetite flowing hard appetite flowing down to the organization for up-to-date information. Where fortunate to have up-to-date information. Where fortunate to have the secretary and a deputy secretary that have significant experience. They deputy secretary that have significant experience. They have a voracious appetite for data that has been data that has been statistically validated and useful for policymaking. policymaking. And that creates an enormous opportunity for us to getopportunity for us to get the broader set of executives and their staff all the way down,and their staff all the way down, having a recognition of the need for good quality data. And it is in every need for good quality data. And it is in every single domain. Part of this is simply the good fortune to have great leaders in is simply the good fortune to have great leaders in the secretary and the deputy secretary defense position because they are both firm secretary defense position because they are both firm believers in the quality and the importance of the quality of the data.

If I could the importance of the quality of the data.

If I could chime in, there is an acknowledgment from our bosses that dataacknowledgment from our bosses that data -- they are willing to accept that. There isto accept that. There is a tolerance of joining them and frustrating them so eventually we can move forward but what I'm and frustrating them so eventually we can move forward but what I'm really impressed by his they don't immediately shoot the messenger. They say the data,don't immediately shoot the messenger. They say the data, I understand it is not there and next time do it right and show usthere and next time do it right and show us good information. We need to strike while we can.

That's need to strike while we can.

That's a great point. It is an important step in increasingan important step in increasing the maturity of the organization with respect to data. We with respect to data. We can have these clear

open communications and conversations that start with this data is and conversations that start with this data is not great because we have four priorities with four definitions of what we are trying to measure.four priorities with four definitions of what we are trying to measure. Now that we know who the authoritative sources are our next step is to come to a common definition of the authoritative sources are our next step is to come to a common definition of what this is and what good looks like and then next time we will be at that looks like and then next time we will be at that next step. We can have those open honest conversations those open honest conversations and they don't shoot the messenger, very healthy for the department.
very healthy for the department.
Thank you. I'm going to turn it over to Tyler to facilitate questions from the committee.
to turn it over to Tyler to facilitate questions from the committee.
We are soliciting questions from committee members.committee members. Christine if you would like to unmute yourself if you can and ask the question you had written.
to unmute yourself if you can and ask the question you had written.
Good morning and thank you for being with us today. I was curiousfor being with us today. I was curious as to how we can better make recommendations that are statistically solidbetter make recommendations that are statistically solid when the department has so little experience using data to make evidence-based decisions and I was wondering if little experience using data to make evidence-based decisions and I was wondering if you could give us some advice because I love the lead by example point but I'm a little because I love the lead by example point but I'm a little concerned about our ability to actually achieve you to -- charter for usactually achieve you to -- charter for us .
David, do you want to start the answer?
I was afraid you were want to start the answer?
I was afraid you were going to do that.
I agree. I agree. When you talk about major acquisition programs the data is extremely small. programs the data is extremely small. I remember arguing a lot with Bill Anton for example Bill Anton for example that a data set showing statistical significance is a challenge.statistical significance is a challenge. We have a lot of people in the department to also look at trends and say I see a trend people in the department to also look at trends and say I see a trend in the I see a trend doesn't really pass the test with engineers. doesn't really pass the test with engineers. What we really need to do is understand and educate our workforce so do is understand and educate our workforce so they understand these trends they see may not be real.see may not be real. On the other hand, the use of larger data sets, and I hope I can use of larger data sets, and I hope I can address this, consolidating more dated to get more information seems to be the path we want to go to get more information seems to be the path we want to go down.
That is exactly right. You said the keyword phrase right. You said

the keyword phrase in response to the question, that was statistically significant.that was statistically significant. The other day I saw a gorgeous set of slides that talked about some a gorgeous set of slides that talked about some analysis done by 18 on maintenance data for a set of on maintenance data for a set of [Indiscernible] those big heavy clinking things with treads on heavy clinking things with treads on the bottom. It was gorgeous the way they showed the correlation of thisgorgeous the way they showed the correlation of this . It wasn't a statistically significant sample size. There was a glaring omissionsignificant sample size. There was a glaring omission that they hadn't even considered whether samples from whether samples from 14 tanks would've been meaningful enough to do anything with.meaningful enough to do anything with. The answer is we have got to use the basis of statistics.got to use the basis of statistics. When we report of set a date on a population, we have got to spell it out. Not only help a date on a population, we have got to spell it out. Not only help in the sample size was but whether or not it would be statistically significant or what the but whether or not it would be statistically significant or what the threshold is, and what level of competence. A better statementof competence. A better statement would have been we have a sample on 14 tanks and in order have a sample on 14 tanks and in order to reach decisions with a 95% confidence level we would have needed 95% confidence level we would have needed a sample size of from 49 tanks. That would have been statistically significant.tanks. That would have been statistically significant. It is though kinds of statements that need to be critical that we is the fundamental statements that need to be critical that we is the fundamental basics of statistics to characterize the data we have got. We would then data we have got. We would then go on to add things like a basic confusion matrix in terms a basic confusion matrix in terms of percentage of positives and true positivesand true positives and true positives versus true negatives, etc. All those basicsnegatives, etc. All those basics need to be part of each of the sets of data we characterizeeach of the sets of data we characterize so people can understand the usefulness of what they are the usefulness of what they are looking at. Let me give you a counterexample if I may. Pro public ayou a counterexample if I may. Pro public a did a coverage of an algorithm created to predict recidivism an algorithm created to predict recidivism by criminals that was deployed widely at the state and local level.widely at the state and local level. The actual accuracy of that algorithm was 62%that algorithm was 62% which the creators of the algorithm went 62%.algorithm went 62%. Everybody that can hear my voice knows 62% is next to meaningless becausevoice knows 62% is next to meaningless because 50% is the flip of the coin. None of the people that the coin. None of the people that received that algorithm had basic training on statistics training on statistics and they thought 63% was fabulous. We all know when you get under the covers We all know when you get under the covers and you look at true versus false positives and true versus false negatives, it was just versus false

positives and true versus false negatives, it was just shockingly bad. The algorithm never published there confusion matrix.never published there confusion matrix. As a consequence people were unable to make judgments. What we need this group unable to make judgments. What we need this group to do is do that little bit of extra math, publishlittle bit of extra math, publish at what point the sample size would be statistically significant, sample size would be statistically significant, what level of confidence you can have on the basis of that sample size and published the mathematical have on the basis of that sample size and published the mathematical calculation of rescission, recall, accuracy and validity should be accuracy and validity should be the default kind of behavior because it creates the opportunity to have those conversationsbecause it creates the opportunity to have those conversations from our executives when they look at those results,they look at those results, and you see the blank look on their face and they don't understand. That gives us look on their face and they don't understand. That gives us the opportunity to have those conversations. Just build it in as though you have a knowledgeable audience and that Just build it in as though you have a knowledgeable audience and that will be a trigger for the audience to turn to us and ask for help becoming more knowledgeable.the audience to turn to us and ask for help becoming more knowledgeable. David, would you like to amplify or shift anything I said?

You amplify or shift anything I said?

You are right. The issue is a lot of our current a lot of our current bosses are very well educated and they do challenges on a significant number of itemsand they do challenges on a significant number of items . I really enjoy having that mental discussion with our bosses on whether that makes sense or not.mental discussion with our bosses on whether that makes sense or not. But again, the workforce needs to be educated. We need to work with needs to be educated. We need to work with you guys to get this is a ground up issue and have is a ground up issue and have everyone understand. You coming straight out of college andout of college and so much more knowledge working with these systems then we do, with these systems then we do, you kinda have to have a mix of the new and the old folks to share the knowledge but then mix of the new and the old folks to share the knowledge but then they share the experience base and they are not afraid of these programsand they are not afraid of these programs .

Thank you very much.

I'd like very much.

I'd like to turn out to Wendy.

Thank you very much.

Thank you very much. You have been working in the Department of Defense for a little while now and one of the thingsthe Department of Defense for a little while now and one of the things you probably have come to discover is we don't have good data pretty much anywhere discover is we don't have good data pretty much anywhere and

certainly not at any depth to do the type of analytics I think you are hoping we are to do the type of analytics I think you are hoping we are going to be will to do. It comes from different services, perspectives and definitions It comes from different services, perspectives and definitions and I am wondering, is there a DoD plan to figure a DoD plan to figure out a way to consolidate and can standardize and can standardize and clean data so we can do the type of analytics you are hoping we are the type of analytics you are hoping we are going to be able to achieve? You are right, the young people come in expecting to use all of You are right, the young people come in expecting to use all of this intelligence and the understanding they have on data analytics and they come in are finding they have on data analytics and they come in are finding a lot of frustration about what the department has available to accomplish those expectations.what the department has available to accomplish those expectations.
 That's a great question for Mark.
question for Mark.
  I could see that one coming our way. Yes, coming our way. Yes, Wendy. Everything you said is true. We have been hitting that piñata for a while. We have been hitting that piñata for a while. While I can't speak for all the data sets in the department, we made a bit of headway with all the data sets in the department, we made a bit of headway with the services on getting a common definition up-and-down.common definition up-and-down. From my vantage point, we have been working on authoritative definitions for limited data setwe have been working on authoritative definitions for limited data set that at least will give the department a pivot point for other data sets.the department a pivot point for other data sets. I wouldn't say that it would all be good, but I would think in would all be good, but I would think in our realm for the major programs which we had focused so many years on because which we had focused so many years on because they represent so much resources where going down and through with the departments.where going down and through with the departments. The acquisition categories are two, three and four programs and the services two, three and four programs and the services have agreed that they too need this. We have been a coalition of the willingneed this. We have been a coalition of the willing to have the authoritative definitions all the way through.all the way through. The cultural issue ultimately becomes the transparency.becomes the transparency. That transparency is generally cloaked in to what you going to do with it or cloaked in to what you going to do with it or to me with that data? We have tried to manage that cultural shift in saying We have tried to manage that cultural shift in saying we are stopped [Indiscernible] we previously did] we previously did in beating you up and program managing you from afar. Empowering the services program managing you from afar. Empowering the services and the shift of the services and using the data and having insight to and using the data and having insight to that data to do other missions we do, looking at portfolios,missions

we do, looking at portfolios, up and down with the commodity sectors, not running programs from afar. commodity sectors, not running programs from afar. This cultural shift will take a while. while. We have also had to navigate the various transparency aspects of sharing.the various transparency aspects of sharing. Our data now goes to Michael Conlinto Michael Conlin and they can have a pivot point for where we are going. We have been measured in pivot point for where we are going. We have been measured in our response and we focused principally on the major capability area, the middle tier.principally on the major capability area, the middle tier. They are both almost done in terms of getting data in alignment. in terms of getting data in alignment. Now the services will have to go down and through. And were going to focus on to go down and through. And were going to focus on the other pathways of that data set and bring that in alignment so we are efficient set and bring that in alignment so we are efficient and effective. Is one battle at a time it appears but everyone recognizesat a time it appears but everyone recognizes it is not only the data you have, it is the data you could have sodata you have, it is the data you could have so looping back to the other conversation, not only inside the soda straw we conversation, not only inside the soda straw we have look in and the process this with the data but looking outside the box this with the data but looking outside the box and even throwing the box away and can I use statistics with what and can I use statistics with what I have? Go to war with the information we have and use analytic techniqueswith the information we have and use analytic techniques and even the smallest of authoritative to pivot off of that authoritative to pivot off of that to analyze and come up with recommendations. I see us moving that waywith recommendations. I see us moving that way but we should move faster. More data is available More data is available . We need a workforce that things fundamentally different that things fundamentally different even before they walk into those environments because it looks like technology to them and it doesn't environments because it looks like technology to them and it doesn't look like technique in their knowledge and I think this is where we want the panel to help and I think this is where we want the panel to help guide us with how we launch that faster into that environment because things that faster into that environment because things are now made available.

 Thanks, Mark.

Thanks, Mark.

  We have questions from Ann and Rebecca Ann and Rebecca and [Indiscernible]. Ann ?

 Thank you. ?

 Thank you. It was mentioned the task is to educate is to educate 3 million individuals on evidence-based decision-making. As you think of decision-making. As you think of that education, have you thought about what you would consider your baseline knowledge that about what you would consider your baseline knowledge that all 3 million should have? And among those 3 million, perhaps there are some setsAnd among

those 3 million, perhaps there are some sets that would need different levels of understanding or different levels of knowledge of understanding or different levels of knowledge and if so, what are sort of some of the basic things everyone should know versus whatare sort of some of the basic things everyone should know versus what some of the more sophisticated or advanced knowledge others might know or advanced knowledge others might know we need to know?

> Michael and I are debating on who should jump in first. I can only talk on who should jump in first. I can only talk from acquisitions. We have a great acknowledgment of the fact our acquisition workforce doesn't know great acknowledgment of the fact our acquisition workforce doesn't what they need to know related to data analytics. We are trying to incentivizerelated to data analytics. We are trying to incentivize the focus to learn. Some of the older folks like me, maybe I'm notSome of the older folks like me, maybe I'm not that interested in taking a class but somehow there has to be a class but somehow there has to be a motivation for me to do that. The younger folks we talked about come in with that skill mixed from The younger folks we talked about come in with that skill mixed from college and anxious to use those tools. The issue istools. The issue is , what we have looked at his this prudential idea, part of his this prudential idea, part of the idea of certification we are changing, fundamentally changing the way we are doing credentialingwe are changing, fundamentally changing the way we are doing credentialing and what a person needs no one one job than what a person the snow in another job no one one job than what a person the snow in another but on the other hand I'm not sure I want to do date what this person I'm not sure I want to do date what this person should know. I want to drive internally inside their head.drive internally inside their head. I want to learn this stuff because it is important to learn from a career standpoint and we are looking stuff because it is important to learn from a career standpoint and we are looking at these data analytics credentials as a way you have the opportunity to take this class, I'm not telling you as a way you have the opportunity to take this class, I'm not telling you you have to but if you want to take this class a gives you a large opportunity. And if I you want to take this class a gives you a large opportunity. And if I can take this class and get a credential that is transferablea credential that is transferable , and industry to government, it is all the same credential with the same sort of criteria, that is it is all the same credential with the same sort of criteria, that really important and a lot of people will want to take that class from a career standpoint lot of people will want to take that class from a career standpoint and developing things. The acquisition is slightly easier.acquisition is slightly easier. Looking at it from the broader base of the entire department.broader base of the entire department.

 That is a great start.great start. I boil it down to a handful of things everybody in the department should understand. a handful of things everybody in the department should understand. I think

everybody should understand the basics of descriptive statistics. There's maybe a dozen terms basics of descriptive statistics. There's maybe a dozen terms and concepts that are included in that and I've used some of that and I've used some of them before but it is things like statistical significance, things like statistical significance, it is minimum maximum, standard deviation, those kinds of basicdeviation, those kinds of basic descriptive statistics that I think everybody can learn and should learnthink everybody can learn and should learn to look at data and understand it. Everything right up understand it. Everything right up through regression knowledge. Some data sciences will easily at sciences will easily at knowledge 80% of the time our work ends when we develop [Indiscernible]work ends when we develop [Indiscernible] that tells us what we need to know. The second set of thingsneed to know. The second set of things is basic visualization techniques. There are certainly people who don't There are certainly people who don't know how to read a pie chart.chart. But I think most people understand pie charts, scatter plots and things understand pie charts, scatter plots and things like that and that is where typically you would apply a regression line because the reason where typically you would apply a regression line because the reason that is so critical, it is not the absolute position on not the absolute position on the line, it is the slope of the line and when you plotslope of the line and when you plot a regression line it becomes clear what is going on.clear what is going on. More modern diagrams like bubble charts and [Indiscernible] there is charts and [Indiscernible] there is between half a dozen and a dozen of those which are criticala dozen of those which are critical for understanding different types of data. Not all datadata. Not all data doesn't follow a curve. The real world is more complex and sometimes there is more than two variables but The real world is more complex and sometimes there is more than two variables but maybe there is about a dozen different visualization techniques different visualization techniques that are powerful for people to understand. For most folks,understand. For most folks, that pair of groupings, basic description statistics and visualizations is more than enough to get them basic description statistics and visualizations is more than enough to get them confident and competent in dealing with the basics of data.dealing with the basics of data. There is a smaller subset of people that are going to get into inferential statistics and they will need to of people that are going to get into inferential statistics and they will need to understand Bayesian inference and all those things but for most folks just those basicsthings but for most folks just those basics , and I generally believe everybody from the top to the bottom can absorb those basics without too everybody from the top to the bottom can absorb those basics without too much difficulty. Excellent.Excellent. I want to be careful with time. I know we have with time. I know we have you for a few more minutes.
[Indiscernible] can you go with your question?
[Indiscernible] can you go with your question?
My question is given the needthe need [Indiscernible]

Did you get that? I have Did you get that? I have a written version of that, would be helpful if I read that?
would be helpful if I read that?
This sounds like a mark question.
I didn't hear the question. question.
I didn't hear the question.
How can DoD reconcile the need for live data access with the need for live data access with the silo culture across different organizations, different organizations in the need for data security and assurances? different organizations in the need for data security and assurances?
That's a complex topic. The need for data, one it is The need for data, one it is in statute now. It is to be transparent across the department for use we are to be transparent across the department for use we are an entity. We should have access and transparencyaccess and transparency within the laws, policies and regulations. I like to think about it in regulations. I like to think about it in a couple lights. Access and dissemination issues as well as security issues.dissemination issues as well as security issues. Historically we look at it from a security perspective. We got it in the system and from a security perspective. We got it in the system and locked it up and extended privileges we thought would need access. That world needs to privileges we thought would need access. That world needs to come to an end. We need to share across platforms the data and need to share across platforms the data and the environment. What we did within the acquisition community. We ventured offwithin the acquisition community. We ventured off based upon a few RAND studies publicly available on dissemination studies publicly available on dissemination of information that talk about the complexity of the law, the complexity of the law, policy and regulation associated with managing data. Our tools, techniques and technologies are data. Our tools, techniques and technologies are getting better at managing that. In our data when we share, if In our data when we share, if I share with Michael for instance we give them the data in the data modelwe give them the data in the data model and give the security classification guide associated with the data so they have guide associated with the data so they have a start of was a proprietary publicly available? publicly available? It doesn't answer the question when you fuse other data sets across other sectors of thiswhen you fuse other data sets across other sectors of this but I think we will continue to work through that.continue to work through that. Historically the answer has been no, I'm not going to share the data no, I'm not going to share the data just because. Now the tools and techniques are available to have and techniques are available to have that data and share that data in use that. I think data in use that. I think that becomes a demand signal for the institution to share more. for the institution to share more. If you are not in, we know you were not in and we know what you are know you were not in and we know what you are missing from the data sets. I think we will have to continue to work through the policy and process perspective I think

we will have to continue to work through the policy and process perspective of the management of data and it will evolve in termsit will evolve in terms of how we need to not only secure it but I've access to it not only secure it but I've access to it and protect it when we have it in our arenas.
 I think it in our arenas.
 I think the intelligence community has done some interesting groundbreaking work in termssome interesting groundbreaking work in terms of how you overcome these kinds of challenges usingkinds of challenges using a combination of technology on one hand but governance roles and responsibilities on the other. Were going to have one hand but governance roles and responsibilities on the other. Were going to have to work in both of those domainsdomains in order to produce long-term change within the department. Both of those change within the department. Both of those are necessary, but they won't be sufficient the further they have be sufficient the further they have to go. As an example we have over we have over 500 information classification guidelines and most of those are domain specific.most of those are domain specific. We don't have rich guidelines for what happens when you join data from two domains. for what happens when you join data from two domains. That is one of the interesting projects we are working on, and nobody should think projects we are working on, and nobody should think this is on the critical path to sharing data, it is not. Were going to taketo sharing data, it is not. Were going to take all of those classification guidelines and dump them into and dump them into natural language processing algorithms we have developed and we have developed and trained our departments in the way of speaking to identify not onlyof speaking to identify not only where there are contradictions but to create a tool that will automatically classify but to create a tool that will automatically classify joint up date. When we make those tools available we should see even make those tools available we should see even faster use it data. This is about enabling use of data, in the same is about enabling use of data, in the same we have having the brakes on your car lets you go faster because you know you on your car lets you go faster because you know you can stop when you need to. Having a tool that automatic the classifies dataHaving a tool that automatic the classifies data gives you that same kind of function because you can turn up or turn downof function because you can turn up or turn down the breadth of access based on a given set of content. We are trying to based on a given set of content. We are trying to create that type of wreaking mechanism.

  I'd like to cycle back a little bit on this because we talked about analytics and analysis. I thinka little bit on this because we talked about analytics and analysis. I think the term data literacy of understanding the mechanisms of data management is a willful conditionunderstanding the mechanisms of data management is a willful condition . Understanding just the basics of the conversation we just had is lost on of the conversation we just had is lost on most people

within the department. We need to break down that silo as well or else We need to break down that silo as well or else the answer will always be know because it is mine.because it is mine. We have to break that down with a data literacy conversation that we feel we are protecting down with a data literacy conversation that we feel we are protecting the nation and the data of the nation.
the nation.

Thank you both. I wanted to just see if we could get one more question in with Melvin.wanted to just see if we could get one more question in with Melvin. Then we will transfer to the next panel.

Melvin Greer,the next panel.

Melvin Greer, the chief data scientist at Intel. We have been Intel. We have been evaluating an approach associated with change in the culture that you talked about where we treat data in the culture that you talked about where we treat data as a weapons system. In all other weapons systems they have an owner,all other weapons systems they have an owner, we understand under what conditions the weapon system works well it doesn't work well,the weapon system works well it doesn't work well, somebody functionally aligned for that weapons system across the entire department. Is this that weapons system across the entire department. Is this an approach you have tried and do you think this is the kind of approach that would help break down and do you think this is the kind of approach that would help break down some of the silos and cultural barriers that have been discussed?barriers that have been discussed?

Where do we start with an answer to Melvin's question. It is an interesting questionstart with an answer to Melvin's question. It is an interesting question because we do have actual weapons systems and we have data on those weapons systems and we have data on those weapons systems as well. The first part of what you said I think fundamentally first part of what you said I think fundamentally applies directly. Knowing who is responsible for that particular weapons system responsible for that particular weapons system or that set of data with respect to the quality, with respectwith respect to the quality, with respect to its ability to be access and linked and trustedaccess and linked and trusted and all of those very are -- characteristics.are -- characteristics. That aspect is fundamental. You cannot manage anything You cannot manage anything if you don't know who is responsible first and foremost. You have to have aresponsible first and foremost. You have to have a question of evidence rules for data and names in the frame for those roles. data and names in the frame for those roles. That is the stage we are at in many areas within the department, at in many areas within the department, getting clear on which data sets are authoritativesets are authoritative and the people who have the governance roles for it. the governance roles for it. I have kind of a nuanced approach. I don't think all data approach. I don't think all data deserves equal treatment. We have data that is critical for departmentwide decision-makingdata that is critical for departmentwide decision-making and that is different from the data the data that might be used for a

small stead of people for a specific local purpose and those things should be small stead of people for a specific local purpose and those things should be treated differently but the overall governance rolesgovernance roles should be common across the department. department. Once you have got that in place, the next big thing is to shine a spotlightplace, the next big thing is to shine a spotlight on the quality of the data itself.data itself. Every visualization should include clear labeling. labeling.

  I'm sorry, I don't mean to interrupt but I think the technical issues are clear. The question to interrupt but I think the technical issues are clear. The question is can the data as the weapons system approach be used as a lever to break the weapons system approach be used as a lever to break down cultural barriers and how the sharing of data is done. the sharing of data is done.

  My initial suspicion is that would not resonate with the community here.that would not resonate with the community here. Number one, we are not at a point where they see it as equivalent.are not at a point where they see it as equivalent. The second is the data isn't data isn't as reliable as the weapons systems themselves. Mark or David, do themselves. Mark or David, do you think it would be an effective metaphor for the community we serve? an effective metaphor for the community we serve?

  We have done some of that. We have not used that that. We have not used that term a weapons system but by creating a federation with the components on databy creating a federation with the components on data and being narrow if you will on saying that the most important thingwill on saying that the most important thing is we would have a data strategy. Our shift has data strategy. Our shift has been with the advent of all the policy changes they have talked about earlier to do all the pathwaysthe policy changes they have talked about earlier to do all the pathways and the services have been all in with us in saying that is a part of all in with us in saying that is a part of this because they have recognized, maybe not in a weapons system construct, maybe not in a weapons system construct, but they have recognized this data is going somewhere and either they are going data is going somewhere and either they are going to participate and help us get to where we need to goget to where we need to go or else it will be at the demise of anyone who uses that data so they have been very willing at the demise of anyone who uses that data so they have been very willing to do that. I would say culturally that doesn't extend up and down through all the say culturally that doesn't extend up and down through all the components of the organization, but we have sectors. I like to think of we have sectors. I like to think of them as [Indiscernible]. Having a data model Having a data model and and access and dissemination guide for all programs in the department is critical for all programs in the department is critical so we think about that as a missionary construct.as a missionary construct. We just had the opportunity to take a demonstration to

take a demonstration where they were consuming data include hours in the tools hours in the tools and techniques and they were -- we could -- we could say to them this is your data in here is how it is being useddata in here is how it is being used and your fingerprints are on this data. You are part of this data. You are part of this whether you recognize it or not. It was a shift of not only thinking about how not. It was a shift of not only thinking about how we share it, but how we manage it. It was intended manage it. It was intended to be shared across the organization. Were also working a memo that will hopefully be signed Were also working a memo that will hopefully be signed that institutionalizes that within the acquisition community to have a data model.acquisition community to have a data model. We have it and promulgate that and we have a single source promulgate that and we have a single source within the department, we called the acquisition data management framework that is not complete and may never the acquisition data management framework that is not complete and may never be complete but gives us a framework of what we know and what we don't know.a framework of what we know and what we don't know. We can manage data as an enterprise and use it as an enterprise and use it as a standard and a framework for definitional matters and understandfor definitional matters and understand who has the authoritative source of that. In many cases that is going to be of that. In many cases that is going to be the services. I think we are some where thereare some where there but we have a very narrow data set because we started with major weapons systems so it was a very narrow data set because we started with major weapons systems so it was a very finite number of programs but they are adopting that throughout the programs throughout the services are adopting that throughout the programs throughout the services as well.

Thank you Mark.you Mark. . I unfortunately need to stop, we are already well over your time.stop, we are already well over your time. We have many participant questions and a few other questions we may follow up with but we want to and a few other questions we may follow up with but we want to thank you for sticking with us even past the time.us even past the time. Rebecca, can I pass to you?

Of course.you?

Of course. Thank you all. I think to Tyler's point, it sparked a lot of conversation from the committee and think to Tyler's point, it sparked a lot of conversation from the committee and the participants. We will be sure to reach out with sure to reach out with other information but thank you for sharing your time with us this morning. for sharing your time with us this morning. We are now going to turn it over to our first panel which is going to it over to our first panel which is going to be moderated by our study committee member Christine Fox.committee member Christine Fox. Christine became the assistant director of policy and analysis of the Johns Hopkins of policy and analysis of the Johns Hopkins University of applied physics laboratory in 2014. 2014. Previously she served as acting deputy secretary of defense with her appointment becoming the highest rankingsecretary of defense with her appointment becoming the highest

ranking email official in history to serve in the Department of Defense serve in the Department of Defense and previous to that she served as the director of Cos assessment and as the director of Cos assessment and program evaluation in the office of the secretary of defense. She possesses three decades of experience the secretary of defense. She possesses three decades of experience as a analyst and resource manager focusing on defense issue with the special emphasis manager focusing on defense issue with the special emphasis in operation. I will turn it over to Christine.it over to Christine. Thank you everybody for being here.here. I would really like to think our panelist plebe today. This is an important topic. I know think our panelist plebe today. This is an important topic. I know I'm biased having been a data analyst. Think anyone who has toucheddata analyst. Think anyone who has touched defense acquisition, surely there must be a better way.must be a better way. That is followed with the believe the data must exist, all I have to believe the data must exist, all I have to do is find it. That is usually followed by a sad realization the data don't existis usually followed by a sad realization the data don't exist . That is also followed by the resolve it is time to start by the resolve it is time to start collecting now to make future decisions and that is decisions and that is followed by staff rotation and the process starts again.the process starts again. This whole study is trying to break that pattern so it is to break that pattern so it is a privilege to be part of it. I think the panel we have is the it. I think the panel we have is the right panel to get us started.started. If we could break it in do all the things we just heard, what would change? How would in do all the things we just heard, what would change? How would it change? If we had to start somewhere in your experience,to start somewhere in your experience, where would we start and focus? That is going to be our focus? That is going to be our goals for this morning. I'd like to start with their first speaker [like to start with their first speaker [Indiscernible] at Johns Hopkins applied the six lab and it makes me applied the six lab and it makes me very happy. She was confirmed by the Senate is the undersecretary of the Air Forceby the Senate is the undersecretary of the Air Force and served as the acting Secretary of the Air Force. She served in his can Secretary of the Air Force. She served in his can spurned to be [Indiscernible] on the joint staff where she was on the joint staff where she was the director. There is really very few people I know that have this understandingreally very few people I know that have this understanding of the Pentagon and the way things work, the services,the way things work, the services, the office of the secretary defense, the budget and the defense, the budget and the acquisition process. We are fortunate to have you today Lisa and thank you for being with us.to have you today Lisa and thank you for being with us.

 Thanks, Christine. I'm excited about this project and thrilled to be here this morning.I'm excited about this project and thrilled to be here this morning.

This is great that you teed me up first that you teed me up first because the areas I wanted to focus on our largely the acquisition process.focus on our largely the acquisition process. I'm going to start talking about the operational requirements processabout the operational requirements process because this is a title X statutory requirement that the chairman and the joint X statutory requirement that the chairman and the joint chief share and delegate through the joint portions but it involves the combat the joint portions but it involves the and command, the components of those commands which are represented of those commands which are represented of course by the services in framing what becomes a program in the acquisition process.in framing what becomes a program in the acquisition process. The upfront piece is so critical. And actually vacant critical. And actually vacant of all the things I've been listening to.listening to. The data that is there is anecdotal at times. is anecdotal at times. It is based on a wide range of sources to include experience, range of sources to include experience, exercises, modeling and analysis of operational plansanalysis of operational plans and the operational planning process itself. Experiments itself. Experiments and inputs that come in at various points in time into at various points in time into the department and then to either the White House and/or Congress. either the White House and/or Congress. You have got a large set of data coming from different placesset of data coming from different places in different formats. It could be emails could be emails with very important data that begins the process of acquisition. begins the process of acquisition. It is setting the need operationally and setting the parameters for operationally and setting the parameters for the trade-offs down the road. Those trade-offs include the macro if Those trade-offs include the macro if you will solution trade-off as well as more of the micro trade-offsas well as more of the micro trade-offs of the prime contractor deciding to spend a little bit more funds deciding to spend a little bit more funds to get one more mile-per-hour out of the capability developedof the capability developed versus applying those dollars to another portion of the capability so it really setsanother portion of the capability so it really sets the program off from the very beginning. very beginning. Given the fact it is such a wide ranging complex process,a wide ranging complex process, I really wanted to focus on a couple of the areas listed there.on a couple of the areas listed there. Let's start with the work capability shortfall process. capability shortfall process. This is an annual process that goes on throughout the year and culminates with a report generatedgoes on throughout the year and culminates with a report generated to the secretary of defense that flows with the budget submission the following year. that flows with the budget submission the following year. It is taking all the input from the combat and commandthe input from the combat and command from the various experiences I just described and capturing the just described and capturing the shortfall areas, given their unified combat and command plan missions, combat and command plan missions, given to them by the president,

what are those capabilities what are those capabilities that are short and a priority to address?priority to address? This process assesses as you can imaginecan imagine a range of varying levels of requirements statements and comes forward of requirements statements and comes forward with the most pressing actually aligned to some idea of time aligned to some idea of time and schedule. The dated that is used is not captured well from year to year.that is used is not captured well from year to year. It is not hand it off well to the programming community with the acquisition communityoff well to the programming community with the acquisition community . I like the idea of data literacy capturing the data of data literacy capturing the data and getting it into a format that could be fed into tools would be that could be fed into tools would be incredibly helpful for this important process process of identifying the priority areas to address within the department. Let's turn to combat address within the department. Let's turn to combat effective analysis. This is a part of beginning to understandpart of beginning to understand the requirements in those capability areas that are shortareas that are short and what is done there is a cost-benefit analysis. Where isis a cost-benefit analysis. Where is the knee in the curve and spending a few more dollars or little more time to get that extra and spending a few more dollars or little more time to get that extra one mile-per-hour or whatever the metric is. is. Again, data is housed on laptops, in emails. The value of having in emails. The value of having good solid repeatable, reliable and credible data to underpin this process would be incredibly helpfuland credible data to underpin this process would be incredibly helpful is that then is handed off to an acquisition program off to an acquisition program to use for those trade-offs across the life of the program. Architectures and across the life of the program. Architectures and roadmap development, this is another area that has had its peaks and values and success in the department.area that has had its peaks and values and success in the department. The idea that you would take a portfolio of capabilities,take a portfolio of capabilities, building architecture which lays out from an engineering level from an engineering level all the interoperability requirements of that capability area and then a roadmap for where programs arecapability area and then a roadmap for where programs are in delivering the capability? Did it would be enormously helpful.Did it would be enormously helpful. Finally cross portfolio prioritization. In the history of the department, management of portfoliosIn the history of the department, management of portfolios has been done very well within the portfolios I would say across time,within the portfolios I would say across time, the cross portfolio decision has been where it has fallen apart. Data would has been where it has fallen apart. Data would be very helpful there. I'm speeding up because I'm running through my time,speeding up because I'm running through my time, now focusing on the second area, cost estimationarea, cost estimation is another title X requirement of the department. People who doof the department. People who do cost estimates in the department are the unsung heroes of the acquisition

process.are the unsung heroes of the acquisition process. These individuals largely with their hands tied behind their backs are seeking their hands tied behind their backs are seeking to estimate the total ownership cost of the programcost of the program from the beginning of the requirements generation all the way through requirements generation all the way through to disposal or sustainment cost. These individuals are dealing with diverse These individuals are dealing with diverse and dispersed data. They are not only responsible for getting data from previous programsare not only responsible for getting data from previous programs that are DoD programs but also responsiblebut also responsible for going out and surveying data out there in the world on new data out there in the world on new manufacturing techniques, on costs to what a commercial to what a commercial relevant business foresees for a similar type of technology.a similar type of technology. They must by title X identify the key cost drivers in this process identify the key cost drivers in this process and generate the independent cost estimates that accompanied the program.estimates that accompanied the program. I have listed there again production rate declarations which are just another aspectproduction rate declarations which are just another aspect is a program approaches its initial or its full production rate.initial or its full production rate. With just 10 minutes, these are the two areas I wanted to focus on. They happen to are the two areas I wanted to focus on. They happen to be the beginning of that acquisition process. I wanted to quickly say for me visible data,process. I wanted to quickly say for me visible data, credible data, data that can be repeated, can be repeated, adaptable data that adds speed to the process and allows for exchangespeed to the process and allows for exchange across the functions of the department which from a requirements to acquisition department which from a requirements to acquisition to programming leads to flow more seamlessly. That would be my desire flow more seamlessly. That would be my desire and I think in the end we would also be able we would also be able to better support these processes that we need to do, the we need to do, the iterative acquisition that we are all seeking to deliver.all seeking to deliver. With that I will end my comments.
That was perfect.my comments.
That was perfect. Thank you very much. I think you described the dream of our I think you described the dream of our committee excellently. I'd like to know turn toknow turn to [Indiscernible-Low Volume] before retiring from the Air Force in taking this position,before retiring from the Air Force in taking this position, he served as the commander of the Air Force sustainment center where he is responsible for supply of the Air Force sustainment center where he is responsible for supply chain management and just a few little things.few little things. [Indiscernible] particularly in areas of expertise like sustainment. Over in areas of expertise like sustainment. Over to you.
Thank you Christine. Lisa is always you Christine. Lisa is always a tough act to follow. What I want to do today is take you What I want

to do today is take you to an application of data and how I used it in the sustainment business. It and how I used it in the sustainment business. It was interesting to talk on the DoD perspective about what they are trying to do in the future but I the DoD perspective about what they are trying to do in the future but I do believe data has to meet the application.meet the application. Is much like a research engineer and an application engineer. I think engineer and an application engineer. I think we have to focus on the application of the data and is it a chicken or an egg?application of the data and is it a chicken or an egg? Let me talk to you about how I did it.about how I did it. If I go to my first chart, back in the start of sequestration first chart, back in the start of sequestration in 2011, 2012 we were given an opportunity under then General Hoffmangiven an opportunity under then General Hoffman to reshape Air Force material command which is responsible for command which is responsible for acquisition sustainment tests and the technology development of the Air Force. During that period technology development of the Air Force. During that period of time the challenge was how do you drive a more effective and efficient organization?how do you drive a more effective and efficient organization? I was given the responsibility to stand up to sustainment centers.to stand up to sustainment centers. 35,000 votes, $16 billion worth of working capital fund and all the Air Force of working capital fund and all the Air Force operations and supply chain as part of the reorganization.of the reorganization. At that point in time it was probably the biggest change that had been made into the Air Force material it was probably the biggest change that had been made into the Air Force material command business in the last 20 years. From that start, let me say how we years. From that start, let me say how we started this one was what is the mandate? The charts I'm going to use is the mandate? The charts I'm going to use right now for charts I used to give a presentation back to give a presentation back in 2015. These charts were changed or altered. These are my original charts.changed or altered. These are my original charts. The mandate I had what I believe we owed the Air Force was effective ready systemsI believe we owed the Air Force was effective ready systems and doing it to drive the cost down.drive the cost down. -- Out. The cost of readiness would determine the size of the force we could afford and the size of readiness would determine the size of the force we could afford and the size of the force determines how we fight and win in the war.and win in the war. We kind of worked through that operation and we wanted to that operation and we wanted to do it in the means, if I look at the bottom box is what we thought were the things we if I look at the bottom box is what we thought were the things we had to influence. We had to drive an integrated approach. We had to be will deliver drive an integrated approach. We had to be will deliver a cost-conscious culture, we had to be a will to synchronize both from what I to be a will to synchronize both from what I would say the shop floor all the way up to the chief BBs door and had all the way up to the chief BBs door and

had to create a leadership culture to understand this is all about how we run and manage the business. to understand this is all about how we run and manage the business. That is how we started. While this is the operating methodology, some key points I want While this is the operating methodology, some key points I want to make, in the upper left was our leadership model.left was our leadership model. We developed an organizational leadership model. I would venture model. I would venture to say organizational leadership is something that is very hard to find and study. that is very hard to find and study. We can find all kinds of books on leadership attributes and traits but this says in the middleof books on leadership attributes and traits but this says in the middle you go for you, goals or your outcome. You only have three levers you can pullor your outcome. You only have three levers you can pull of people, resources and processes and then the next layer are what I and then the next layer are what I would call the four areas I needed the data to drive. One was speeder throughput,I needed the data to drive. One was speeder throughput, the other was saved of the workforce, quality of the outcome and the cost effectivenessthe workforce, quality of the outcome and the cost effectiveness and then creating the culture you needed for the organization. I wanted you needed for the organization. I wanted to draw your attention to the center of that box which is the process piece center of that box which is the process piece of how we were going to do business and it was all data-driven.do business and it was all data-driven. Understanding what was happening at the point of execution and being able to surround whatthe point of execution and being able to surround what we would call the impact layers, in this case the mechanics of what layers, in this case the mechanics of what they needed to be successful and emanating that out throughout the entire value stream of how the work and emanating that out throughout the entire value stream of how the work is done. If I look to the upper right-hand chart, that was the frame from to the upper right-hand chart, that was the frame from the chief BBs door to the shop floor. I had a picture shop floor. I had a picture where the Chief of Staff of the Air Forcethe Air Force -- in terms of budget and resources budget and resources -- in the lower right was the maturity matrix of how right was the maturity matrix of how we started our goals, what did we believe was part of the possible? What did we want did we believe was part of the possible? What did we want to achieve? In the steps everybody had to take.everybody had to take. I talked about across 35,000 folks and operating basesfolks and operating bases and then how we get everybody aligned so everybody get everybody aligned so everybody was working under the same objectives, goals, data sets objectives, goals, data sets and responsibilities.
This chart was a chart we used for thechart was a chart we used for the four star at the end of every you to sum up. I like this chart for of every you to sum up. I like this chart for this presentation because in this case speed, how did we push weapons case speed, how did we push weapons systems to the processing line, in some cases back tears -- in some cases back tears -- faster and some of the red.

Based on that datared. Based on that data we could assess what worked, our lessons learned and more importantlyworked, our lessons learned and more importantly planning for a way ahead and what we had to do to implement and what we had to do to implement for the next year and how it got better. This was in the it got better. This was in the speed category. Let me give you why this was important. Speed is how fast you why this was important. Speed is how fast aircraft fly to the depth those and increasing speed we were able those and increasing speed we were able to turn back the wings worth of aircraft back to the operational base versus sitting in the depotworth of aircraft back to the operational base versus sitting in the depot in terms of overhaul and maintenance. Remarkable progress, maintenance. Remarkable progress, plus take on more work. More modifications what we were More modifications what we were doing the overhauls at the same time. More capability back to the field.time. More capability back to the field.

 Cost effectiveness, I wanted to drive I wanted to drive the culture [Indiscernible] take out of the working capital fund $1 billion. take out of the working capital fund $1 billion. In the first nine months we were closing in on the billion dollars so went from we were closing in on the billion dollars so went from the road to 1 billion and beyond. One of the unique attributes of the and beyond. One of the unique attributes of the working capital is cost savings or cost avoidanceor cost avoidance turn into budgetary cost savings in the future. The in the future. The chart below shows the pattern we did with rates. If I look at the rate did with rates. If I look at the rate structure in the depot between 13 and 16 you can see the rates in 16and 16 you can see the rates in 16 lower than the rates were in 13 because of what we were able to drive in 13 because of what we were able to drive into the cost-effectiveness arena. We did a both in performance and cost structuredid a both in performance and cost structure so we were able to deliver cost-effective readiness. Part of this discussiondeliver cost-effective readiness. Part of this discussion was how do you drive it into the culture?it into the culture? What this picture represents is we created a senior leader courseis we created a senior leader course and every year when we got the new senior leaders and, whether it was Lieutenant Colonel and abovegot the new senior leaders and, whether it was Lieutenant Colonel and above or GS 14 and above we brought them through a sustainment leadership course that were we brought them through a sustainment leadership course that were taught by, and at that point in timethat point in time I was I would call it the facilitator for each of the courses. Making sure folks come into it the facilitator for each of the courses. Making sure folks come into the organization or those in the organization understood how the processes work,the organization understood how the processes work, how the people, training and skills needed to be done and skills needed to be done and how we were going to drive to that overall culture change to drive the performance improvement.drive to that overall culture change to drive the performance improvement. What I would tell the leaders when they came

in,leaders when they came in, you can do more discreet this place up then you can by doing good until you learn how all the this place up then you can by doing good until you learn how all the dots connect and how the system operates. system operates. That was our culture change in the organization.the organization. I know I'm giving you kind of a brief overview of what we needed to do from a sustaining kind of a brief overview of what we needed to do from a sustaining perspective but I am now the vice president for sustainment for Lockheed Martin Aeronautics.the vice president for sustainment for Lockheed Martin Aeronautics. I think we have set up for you to up for you to walk you through what we are doing at Lockheed Martin for this digital transformation along doing at Lockheed Martin for this digital transformation along the same type of journey to put in play what is neededto put in play what is needed to execute across-the-board programs and how we interface to drive the most and how we interface to drive the most effectiveness and efficiency. I don't want to use it too much more time but I just wanted want to use it too much more time but I just wanted to give you that overview of what I did while we were in the Air Force and now what we of what I did while we were in the Air Force and now what we are able to do from the largest defense contractor for Lockheed Martin as we move through this process the largest defense contractor for Lockheed Martin as we move through this process as a company and I would just end their.
 would just end their.
  Thank you very much. It is always nice to see examples of cases were you actually achieved is always nice to see examples of cases were you actually achieved or achieving culture change. I like to turn out to our next speaker which is Gary Bliss. Gary's like to turn out to our next speaker which is Gary Bliss. Gary's the is the director [Indiscernible] and reports to Indiscernible] and reports to the Undersecretary for acquisition and sustainment. Gary is held this sustainment. Gary is held this position since it was established in 2009 under the what comes system and acquisition.in 2009 under the what comes system and acquisition. [Indiscernible] was created to analyze each major decision and to analyze each major decision and identify root causes. His efforts as director I think gave us efforts as director I think gave us [Indiscernible] a data analytics in the acquisition process. Gary, it is a analytics in the acquisition process. Gary, it is a pleasure to have you. Thanks for joining us. for joining us.
  I was smiling Christine because the correct title is former directorbecause the correct title is former director because I retired in September 2018. 2018.
 This session was started is improving workforce capabilities and data analytics and then started is improving workforce capabilities and data analytics and then you added what specifically would be change? be change? I will absolutely meet my time budget and go through my impressions of the same although I wouldtime budget and go through my impressions of the same although I would prefer everyone to the previous session where example Mark and Davesession where example Mark

and Dave and their work and had a very rich discussion about related topics.had a very rich discussion about related topics. Let me start off by observing the necessary conditionobserving the necessary condition for use with data analytics that influences decision-making that is essentially that influences decision-making that is essentially three things. It is [Indiscernible] do the work, [Indiscernible] do the work, analytic tools available and as we spent most of the as we spent most of the time discussing availability of data.. It strikes me this data is Sue really revolves around is Sue really revolves around two dimensions, one is the depth in one particular depth in one particular organizational field and the other is the issue of costis the issue of cost . One of the aspects of the problem, the of the problem, the data problem is the nature of these data systems. You've got to of these data systems. You've got to remember for DoD [Indiscernible]] islands of functional fields tied to organizations tied to organizations which very much have their own specific charter and value stream they are delivering own specific charter and value stream they are delivering every day. Of those three big categories [Indiscernible]big categories [Indiscernible] I'd like to spend my comments addressing the latter.comments addressing the latter. [Indiscernible]
Gary, can you interrupt you. You sound Gary, can you interrupt you. You sound is low and I was wondering if there's any way we could get you closer to wondering if there's any way we could get you closer to your mic to hear a little better.
Thank you for better.
Thank you for clarifying that. Is this any better?
better?
A little, thank you.
Let me start off by observing Let me start off by observing one of the difference between the DoD data problem and those that the DoD data problem and those that exist in the private sector is many of our functional fields within DoD have is many of our functional fields within DoD have statutory authority. Is incredibly important because it limits the them will -- because it limits the them will -- by federal law [Indiscernible].Indiscernible]. With regard to the operational services but again,services but again, those institutional prerogatives are fixed and away which fixed and away which are very difficult for the I.T. and analytic community to overcomeand analytic community to overcome and it is just something we have to note. The second thing we have we have to note. The second thing we have to note is in each of those functional fields there isof those functional fields there is [Indiscernible] legacy data systems. I would like to systems. I would like to say for people in the Navy I am certain [Indiscernible]I am certain [Indiscernible] and that system where it is still running is performingis still running is performing and organizationally vital function for some peace of the enterprise.for some peace of the enterprise. This point that each of the systems primary purposethe systems primary purpose is to achieve their mission again we have to recognize again we have

to recognize [Indiscernible]. I took for some reasontook for some reason [Indiscernible] I remember at the end of the courseremember at the end of the course most analysts make the mistake in focusingthe mistake in focusing on a problems objective process and its goal. The and its goal. The real nature of most [Indiscernible] and what drives their solutionIndiscernible] and what drives their solution is actually the constraints. I thought that was a useful pieceI thought that was a useful piece . I think Mark's approachapproach to the data that would be made visible and the cost enterprisebe made visible and the cost enterprise is really the most important piece of this piece of this data availability through data transparency. I would like to point out there are three elements to I would like to point out there are three elements to do this. First of all, understand specifically what we are talking about in understand specifically what we are talking about in terms of data governance. It is the semantics of the data is the semantics of the data and their definitions and what they mean. In they mean. In my experience the more difficult semantic agreement is the agreement on authoritative sourcing for any given semantic agreement is the agreement on authoritative sourcing for any data element. It is very important and [Indiscernible].is very important and [Indiscernible]. That is what governance means. That is all it means. That is all it means. [Indiscernible]. We are not telling you how to do it but for the dataWe are not telling you how to do it but for the data you make transparent to us, these are the semantics. these are the semantics. The second element seems to beto be [Indiscernible]. We don't need all the data for transparency because across don't need all the data for transparency because across functions there lots of things [Indiscernible].[Indiscernible]. We economists are famous for observingobserving that a complex economy can be coordinated with very little information.be coordinated with very little information. We do need to identify what is critical and what is critical and something that will evolve through time. Appetite control is the second Appetite control is the second element of governance. I used to say [Indiscernible]to say [Indiscernible] a governance institution needs to have over its domain the authority of [have over its domain the authority of [Indiscernible] and all the stakeholders need to represent stakeholders need to represent their equities [Indiscernible].. Steps that are first of all recognize what the goal is.all recognize what the goal is. It is a tapestry of relationship and interfacesof relationship and interfaces with transparency. Governance is the key thing we need to make this work.is the key thing we need to make this work. And finally functional transparency is what we are going for. is what we are going for. Actually I have [Indiscernible] [Indiscernible] I was very gratified to hear about the progressto hear about the progress [Indiscernible].

Thank you

Thank you so much. We appreciate your remarks and removed her last bigger on remarks and removed her last bigger on the panel then we

want to try to get a couple questions in. We would like to move to try to get a couple questions in. We would like to move to
[Indiscernible] the director of land and naval were [director of land and naval were [Indiscernible] and I know from personal experiencefrom personal experience [Indiscernible] and the frustrations of getting access to good data. the frustrations of getting access to good data. Her work is very dated intensive intensive and she lives in that analytic arm of the Pentagon we can get arm of the Pentagon we can get the opportunity to understand the challenges [Indiscernible] [Indiscernible] thank you so much for being with us.
with us.
[Indiscernible] Lisa, it used to work with you when I was at the [Indiscernible it used to work with you when I was at the
[Indiscernible] agency and Bruce I interacted with you when I was doing [Indiscernible] andinteracted with you when I was doing
[Indiscernible] and we did things along the line with
[Indiscernible] at the Navy. I'm line with [Indiscernible] at the Navy. I'm very honored and thank you for inviting me here.for inviting me here. What I'm going to talk about today is a little bit about who we are and what data we about today is a little bit about who we are and what data we have and what data we don't have.have. I'm the cost analysis division director and that is a mouthful.division director and that is a mouthful. I am responsible for acquisition cost estimates for the ground vehicle
[Indiscernible] portfolio.cost estimates for the ground vehicle
[Indiscernible] portfolio. My functional role is focused on sustainment costs withfocused on sustainment costs with data policy, collection and reporting. I have been in acquisition estimator for almost 20 years. I love I have been in acquisition estimator for almost 20 years. I love the field. My focus for most of that time really most of that time really has been on the sustainment phase of the program. What do we do?of the program. What do we do?
[Indiscernible] we are an independent advisor to are an independent advisor to the secretary. [Indiscernible] on programmatic resource] on programmatic resource allocation issues. The word educator is the department educator is the department analytical community. We hire operations research analysts.research analysts. They are broad-spectrum of [Indiscernible] like operational research, Indiscernible] like operational research, economics and applied math, physical science and engineering and otherscience and engineering and other technical fields. We typically higher higher
[Indiscernible] which they typically have 24 credits of math or sciencestypically have 24 credits of math or sciences with at least three credits of calculus. When I interviewed for this position of calculus. When I interviewed for this position I asked the director if you sees the goal is more data scientist and sees the goal is more data scientist and research analyst and he said yes. That is one of the reasons [Indiscernible] That is one of the reasons
[Indiscernible] the current COVID-19 pandemic. There was a lot of

data but very hard There was a lot of data but very hard to make it into information to provide to decision-makers. [to provide to decision-makers. [Indiscernible] data analytics. We are not health providers or educated in the medical field but We are not health providers or educated in the medical field but we can do data analysis. The [Indiscernible] is the principal office for independent cost analysis within The [Indiscernible] is the principal office for independent cost analysis within the department [Indiscernible] and realistic estimates for acquisitions. and realistic estimates for acquisitions. With that said, we need to have data to do our work.need to have data to do our work. One of the responsibilities of the CAPE is to an actual the CAPE is to an actual cost data and other related information for our acquisition program. information for our acquisition program. [Indiscernible] it ramped up in the early 2000's after theup in the early 2000's after the [Indiscernible] 2009. The CAPE has partnered The CAPE has partnered with military department cost agencies to implement what is called the cost assessment datato implement what is called the cost assessment data enterprise. It collects proprietary data required to enable the community to perform proprietary data required to enable the community to perform a quality estimate. It is the primary data source for acquisition programsthe primary data source for acquisition programs . We use an analogous [Indiscernible] as our analogous [Indiscernible] as our starting point. If the Navy needs a new ship we can look at what needs a new ship we can look at what other programs are similar in size and capability and capability and we use that data as a starting point for cost assessment. [a starting point for cost assessment. [Indiscernible] we use the data to update program estimates and various milestones like the full rate production decisiondata to update program estimates and various milestones like the full rate production decision meeting performance cost and schedule based on information we are collecting from the contractor. Not only does based on information we are collecting from the contractor. Not only does this data inform [Indiscernible] which is ultimately our customer, which is ultimately our customer, they improve contractor negotiations for follow-on contractsfollow-on contracts meaning the information we are getting now we can see how well the contractor is doing getting now we can see how well the contractor is doing to make sure we have [Indiscernible] going in. [Indiscernible] going in. The repository I was talking about includes contractor and subcontractor cost reports. These are the labor and material costssabout includes contractor and subcontractor cost reports. These are the labor and material costss and acquisition costss and programmatic information and the capabilityprogrammatic information and the capability . It includes over 600 active legacy programs, 600 active legacy programs, over [Indiscernible] about 3000 users primarily governmentabout 3000 users primarily government but some industry. We have evolved to make sure we are capturing acquisition data as have evolved to make sure we are capturing acquisition data as pathways have progressed. Such as middle tier

acquisition in different contract types middle tier acquisition in different contract types . We make sure we layout policies to collect all of that information. Overtime we have collected more layout policies to collect all of that information. Overtime we have collected and more data. The data synthesis has increased.data synthesis has increased. Now we streamline even more by using contractor data structure to reportmore by using contractor data structure to report so we are not forcing them into a prescribed structure. With CADE them into a prescribed structure. With CADE is primarily contractor cost for development and production.for development and production. [Indiscernible] fuel, maintenance, etc.maintenance, etc. [Indiscernible] a database called visibility and managingdatabase called visibility and managing [Indiscernible] we have been pingedhave been pinged by Congress by not having enough sustainment costs for programs so they like to help us out. enough sustainment costs for programs so they like to help us out. They direct and develop an enterprise system so the enterprisean enterprise system so the enterprise [Indiscernible] is a data platform for cost dataa data platform for cost data of major weapons systems within the [Indiscernible]within the [Indiscernible] basically taking systems the services have been developing and we services have been developing and we pool that information in to a common taxonomy for completenessa common taxonomy for completeness and accuracy and frequency issues we have seen in the past. we have seen in the past. Having access to data means we are bringing in terabytes means we are bringing in terabytes worth of data. We need to use toolsWe need to use tools [Indiscernible] separate secure environment to utilize open source secure environment to utilize open source data and tools. Data sets are getting larger and there are different tools are getting larger and there are different tools to analyze them but the analytical process is the same.analytical process is the same. We were doing big data before it became up buzzword. I remember using before it became up buzzword. I remember using Excel and we would bring in a large data set and clean the datain a large data set and clean the data [Indiscernible] and use database function as a way to useuse database function as a way to use [Indiscernible]. Microsoft for example has [for example has [Indiscernible] plus now you have all of these fancy front end display toolshave all of these fancy front end display tools we don't have to worry about selecting data for secondary access and about selecting data for secondary access and so forth. Plus the data has gotten larger so we has gotten larger so we need stronger faster ways to analyze the data.the data. The cost community needs to start using new tools and techniques.start using new tools and techniques. A lot of folks have totally embraced this. They want have totally embraced this. They want to get into data and understand and do their analysis. and do their analysis. We have a lot of folks that are very strong in this area. folks that are very strong in this area. The question is what data don't we have? We lack software we have? We lack software cost data for major platforms. Software [Indiscernible] on a

[Indiscernible] on a weapons system. And cost data for businesses like the cost to develop and for businesses like the cost to develop and maintain software and the appropriate metrics to track software cost. Historicallymetrics to track software cost. Historically industry doesn't measure in that way.way. It doesn't matter how it is developed or maintained is developed or maintained but the conversation is how do I quantify that? I quantify that? How do I feel these estimates for programs that have never been developed before.for programs that have never been developed before. The companies end up having [Indiscernible] [Indiscernible] . The existing code and a starting point that they went off and startedand a starting point that they went off and started working in some of their areas. Understanding how areas. Understanding how estimate the workload and how I get the metrics.
I get the metrics.
  One of the challenges this we do have a lot of data.we do have a lot of data. We don't speak the same language.language. There are budget analysts and auditors and auditors and processing information and we all use different structures and account for we all use different structures and account for cost difference. We are looking at the big weapons systems such as specific aircraftlooking at the big weapons systems such as specific aircraft or tanker or ground vehicle or a ship.vehicle or a ship. The budget might be at a portfolio level so it doesn't give us insighta portfolio level so it doesn't give us insight or we can't see the cost because it is rolled up into the cost because it is rolled up into one line. For auditing, they are looking at individual accounting level transactions they are looking at individual accounting level transactions and that is too detailed for us to know they paid this person for us to know they paid this person this much to buy a computer or something.computer or something. We have and will continue to work together but we have different use cases and customers.to work together but we have different use cases and customers. That was a little bit of a summary and who we are and of a summary and who we are and what we don't have so I would turn it back over to Christine.
 I would turn it back over to Christine.
  Thank you Jennifer. That was exactly what I expected fromexactly what I expected from CAPE cost analyst, you live the data and you understand the means in the tools.live the data and you understand the means in the tools. Now we have a little time for some questions.time for some questions. I'd like to turn it over to Rebecca to kick us off with the over to Rebecca to kick us off with the questions.
 Certainly. Thank you to all of our panelistss for joining us today.you to all of our panelistss for joining us today. That was interesting. Speaking as an academic data scientist it has been fascinating to hear from the as an academic data scientist it has been fascinating to hear from the acquisition standpoint. I actually had two questions I wanted to ask two questions I wanted to ask but I'm going to let Christine cut me off so I will start the first one.Christine cut me off so I will start the first one. The question

is prompted by something Bruce said but by something Bruce said but open to panelist the be. Bruce, you said you were able to have a culture shift.Bruce, you said you were able to have a culture shift. We are hearing culture shift quite frequently is a challenge or quite frequently is a challenge or something to be thinking about when trying to update or modernize within the defense acquisition framework.when trying to update or modernize within the defense acquisition framework. Can you look back and see anything specific that help with that culture shift or were there see anything specific that help with that culture shift or were there specific positives or actions that were taken you felt support that were taken you felt support that culture shift?

Rebecca, here is what I believe. I is what I believe. I am in the sustainment business, and what is this typical stereotype caughtand what is this typical stereotype caught a mechanic turning a wrench or something like that. The mechanic is only or something like that. The mechanic is only going to move as fast as the mechanic is going to move in the culture shift as the mechanic is going to move in the culture shift was about the systems approach that takes big business to work.that takes big business to work. What I had to do was get the leaders we were typically hiring,was get the leaders we were typically hiring, field level maintenance officers that may have gone up to the O that may have gone up to the O 6 level and generating aircraft on the flight line and on the flight line and teach the business processes and operational excellence methodologies as well as the operational excellence methodologies as well as the cost culture. What we had to be able to overcome, to be able to overcome, it is not the mechanic, it is our ability to put together all the it is our ability to put together all the systems that make the mechanics work more efficiently and affect. more efficiently and affect. That is why we had to go after the senior leadership piece and it to go after the senior leadership piece and it is why I opened up every class by saying you can do more to screw every class by saying you can do more to screw this up then you can to be able to make a positive improvement to be able to make a positive improvement until you learn the other methodologies that go along with it. that go along with it. My view, I really wasn't a sustainment guy growing up in the Air Force. a sustainment guy growing up in the Air Force. I happened to move into it late in my career but I took a systems late in my career but I took a systems engineering approach and by taking that approach I got to see all the elementsapproach I got to see all the elements that have to come together for success and ultimately had to build the trust for success and ultimately had to build the trust and confidence at the center of the maintenance person,of the maintenance person, but also supporting structure that makes that happen.makes that happen. One of the things I would say I was very proud of is when we were standing would say I was very proud of is when we were standing this up, I took in a lot of the junior folks to be a part of the cadre that helped a lot of the junior folks to be a part of the cadre that helped build it and now the three star who is running it

was one of my folks that wasthree star who is running it was one of my folks that was a mentee at that point in time along with the other general officersin time along with the other general officers and they brought up in the Colonel ranks they had a chance to grow this organization and now the Colonel ranks they had a chance to grow this organization and now they are running it.

 I just wanted to jump in and echo what I just wanted to jump in and echo what Bruce said. From a requirements perspective it is the same dilemma within the services and perspective it is the same dilemma within the services and the joint staff doing this key function that feeds into the acquisition process.function that feeds into the acquisition process. You are taking operators as senior points in their career as senior points in their career and asking them to do athletic and business functions because of the streamlining of and business functions because of the streamlining of those staffs at the service headquarters and the joint staff. I would say headquarters and the joint staff. I would say we pushed for years to grow a cadre workforcea cadre workforce that would include data analysis skills for the requirements function. I thinkskills for the requirements function. I think [Indiscernible] was helpful in partnering with me when I was on the joint staff to start that helpful in partnering with me when I was on the joint staff to start that but another places [Indiscernible]. I pushed for war colleges to have a block I pushed for war colleges to have a block on analysis to teach those officers coming from operational career fields, coming from operational career fields, they don't have to be the analyst, how to take data and apply the analyst, how to take data and apply it to decisions. I don't know what the status is but that might be one place to look know what the status is but that might be one place to look with the war colleges are doing.

 Thank you very much. That

 Thank you very much. That is helpful.

 I'd now like to turn it over to Philip.

like to turn it over to Philip.

  I was wondering following up on that what kinds of practical criteria have on that what kinds of practical criteria have you seen in the past for sustained investment in data collection and governance given a lot of for sustained investment in data collection and governance given a lot of the challenges and budget Tory priorities and cuts and headquarters. If priorities and cuts and headquarters. If you train the workforce on literacy and techniques, is that enough? Or are there other and techniques, is that enough? Or are there other larger aspects?

 Who would like to take that one first?

would like to take that one first?

  I would just simply say this, Jennifer mentionedthis, Jennifer mentioned that she collects all kinds of data, but I would of data, but I would say there is no common understanding or common methodology across or common methodology across the Department of Defense, I'll expand that to industry on what the data should look

like, what I'll expand that to industry on what the data should look like, what is important, the priorities and how it should come.it should come. I would make a goal to prove to Jennifer you can reduce the cost to to prove to Jennifer you can reduce the cost to sustainment in the long haul. What it is today doesn't have to be what it is tomorrow. What it is today doesn't have to be what it is tomorrow. In order for us to do that, not only with current systemsdo that, not only with current systems but in prior systems, you have to have a common understanding you have to have a common understanding of what you're trying to achieve and how you are trying to achieve it. and how you are trying to achieve it. I don't think we have that baseline across the department in her industry right now.

[Captioners Transitioning baseline across the department in her industry right now.

[Captioners Transitioning]

I have a question from a participant I would like to throw out. When expertise is critical to looking at something like Covid but that's not the only participant I would like to throw out. When expertise is critical to looking at something like Covid but that's not the only example. Organization the main knowledge with the critical data science expertise. If I could I would like to start, Gary, do you have a view on you're expertise in the Department?

Am I on? Yes. This gets to this point I was mentioning about functional fields. Obviously I spent most of my career in career in the cost analysis field. Where really there is quite a bit bit of public private sector consensus about the structure of the data and what it means. We don't typically have, for example, a negotiating DBMS, CPR submissions an element that ends up in the [Indiscernible] system. We don't typically have a great deal of difficulty negotiating those with the private sector. Similarly, the Systems Engineering community, in particular areas, you know, with properties, et cetera, doesn't really have that kind of problem across the community. What is a problem is cross community. The other area where it is a problem is actually in software development. We were talking about earlier. I actually think the root cause, that familiar term alike so much, of that is that software development managerial models and they're associated tools have continued to evolve rapidly in the last four years, so metrics, measures of content and of progress that were applicable in one c ontext, Art in another. Obviously, the most recent one is Agile, which has evolved into something that goes by whatever it is, Dev Ops, metrics, et cetera, and those context that have been used previously are been used previously are really misleading. So, you do have the case in that field a real problem. I think in most of the other fields you are stable enough that within the fields they our will u nderstood. Across the fields, no, not so much. That brings of this whole issue of governance. That's all.

Thank you. Jennifer, I like to ask you on domain expertise if I could.

Jennifer, could you unmute?

Am I good now Rex thank you.

It's really a great question and something we deal with and the Covid example I gave, we're still working with the medical folks that have the expertise because we need them to guide us. We know historical oh and F for the services, and, you know, we are going out for contract on this effort. My focus to my focus is to make sure we hire the domain expertise folks to understand how the to make sure we hire the domain expertise folks to understand how the services to business where they can help guide us to make sure we are making provisioned on when we pull all of this information and data together. Too me, expertise is the most important thing, because you have a lot of math and Computer Science folks that can take a bunch of data and put it together, but they could falsely be putting things together. So, things together. So, we really need to rely on folks expertise to really guide the analysis. I can't stress that enough. You definitely need to have those domain expertise.

Thank you. Anybody else, Lisa?

I was going to jump in, the Joint Staff the requirements process what would it is part of the Ops research and Systems Engineer analysts with the operators as they cycled through into the requirements. That worked for a while until the staff cuts, to your question, became such a problem that we ended up developing a team of pros from Dover. They were the go to when none of the operators who had the tasks, and they would set the formats, help define the data, manage the tests and let the operators plug-in, if you will. It was a perfect, but that is how we sliced it. We reached out and leveraged but that is how we sliced it. We reached out and leveraged FFRC, the [Indiscernible], my doors, APL, too come in and help.

Thank you. I think we are out of time. I want to close by saying that this is a fantastic panel and I thank you all. What we all. What we learned from you, or at least what I have heard and and learn from you is, yes, data analytics can help. I think the other thing I have learned is that data are not equal, and so we need sometimes to much and sometimes and had to little you do need the data to be right for the problem, so we can does to the big net which adds to the c hallenge. It needs governance processes. And we need domain expertise too make sure we are analyzing the data properly and learning the right things, so it's not just the question of data, getting data and the culture, but getting the right data and using it appropriately. I think I heard a lot of you on the panel speaking. Thank you very much for all of your help. I really appreciate it. I believe believe I now get to inform everyone that we are breaking for lunch, and we will resume again right at 1300. Unless there is anything else from the panel chairs, I think we can break for lunch. Is that good for everybody?

Good. All right, thank you very much. Thank you for a great panel and a great morning.

[The event is on lunch break to reconvene lunch break to reconvene at 1300 hour.]

[Captioner Standing By]

Good afternoon, everyone, and welcome back to the National

Academies of National Academies of science, engineering and medicine workshop sponsored by the Committee for improving defense acquisition workforce capability and that he is. Our second panel this afternoon we are excited to welcome Chief Data Officers for the Navy and the Air Force. We will be speaking about the vision for data in their respective services, [Indiscernible] and some of the ways data has been used successfully within their various organizations. With that I would like to introduce our opening speaker, Mr. Thomas Sasala. Mr.Sasala is Navy Chief Data Officer responsible for leading the Department's efforts on data management, information resource management, data governance, and they will data policies are key is responsible for the Naval workforce training on data and data a nalytics, and ensuring high quarterly timely data is available to decision-makers and warfighters. We are just delighted you are able to join us this afternoon and looking forward to your remarks.

Thank to join us this afternoon and looking forward to your remarks.

Thank you, Alyson. Hi, I am 1011. Working at data space now for for a number of years Rick I can't even begin to express how long it's how long it's been but I have spent about DoD and Intelligence Community as well as spending time in the in the private sector at eight.com start up in the K to 12 market. I have a fair breadth of my experience across the data environment, what we have done here in the Department of Navy, the first Chief Data Officer for the Department of the of my experience across the data environment, what we have done here in the Department of Navy, the first Chief Data Officer for the Department of the Navy. I previously served as the Chief Data Officer for the Department of the Army as well, so I have a I have a little bit of experience with DoD level doing this. When I got to the Department of Navy, had no CDL, no data management practice. They had very little data level material, so the first process was to stand up the data program. We did was we put together what we call placemat chart, which is what you see here. I will walk through this quickly then turn it back over to Allison so I link do her opening remarks. What you see here in front see here in front of you is really kind of our high level lines of effort in how we structured our we structured our data management program. Or visit for data minute is exploding exploding data for Navy purposes at the speed of mission. It's important for us to tie all of the activities we are doing for data management perspective back to some sort of either business or mission function for the Department of either business or mission function for the Department of Defense. Data management is not an IT function. Data management is not just data management for data management purposes, in our our opinion got it so we want to start with are key questions that we are answering. Those key questions will then lead us to the data that we need to answer those questions, the algorithms to analyze that data and ultimately the answers to the questions. In the top right-hand side our information domains. Rather than structuring our data management program around our organization or how we how we are structured as department of baby which good U.S. Navy and U.S. Marine Corps instead we're structuring our data management around

information domains. That is categories or information or classes of information. You can see them there in front in front of you. Acquisition, enterprise operations, management, financial geospatial, HR. The big information domains what we have done is we created a pointed data stewards for those domains to shepherd that information. Whether your information, whether you are a Warfighter or a back-office person working at headquarters, or whether you are someone doing support if your dealing with say your dealing with say financial management information, which nearly everyone in the Department does that Data Store would be responsible for managing information whether for warfighting warfighting function, business function, readiness function or intelligence function in the Department. The weather we are getting after that management is establishing data management program. Are lines of effort next to the commission of domains for the five lines of of effort we established at DoD level. I believe Eileen is chairs these lines of effort within the Department of of Air Force as well. That is setting the foundation involving workforce can positioning a Protecting Data, a Protecting Data, building optimizing environment and ultimately managing and governing the data environment. Kind of in the middle of the the chart is really where he or, or problem statement for lack of a better term. The initiatives in the middle were engaging another the lines of effort to lead us too on the right inside, or action around data to support the Warfighter. Ultimately, the goal is on the far-right inside from my perspective, or the visible, accessible, understandable length trustworthy and secure. Our are objectives or mission statement from the DoD data strategy, which will be released at some point in the future. [Indiscernible] is what we settled on for the DoD data strategy. You can see that in the lower-left inside. And then in the DoD [Indiscernible] leads to Department of Navy implementation plan which we will be publishing in a few short months. That implementation plan which we will be publishing in a few short months. That is our placemat. That is how we are approaching data management, and we will engage in for the dialogue on that on that as we move on. I will turn it back over to Alyson.

Great, I appreciate it. Thank you so much for that introduction. Now I would like to introduce our second panelist, Ms. Elieen V idrine, Chief Air Force data Officer responsible for developing for developing and implementing data for enterprise data management got analytics and digital transformation to optimize drive vision across all missions and operations within the Air Force. She began her government career as an enlisted member of the US Army and receipt are commission of the transportation Officer, letter joined Army acquisition c orporation. She has also served in the Office in the Office of the Director of National Intelligence the Office of Management and Budget, Office of Personnel Management, and joint military intelligence College. With that I'd like to turn it over to Ms. Vidrine to get perspective from the from the Air Force side.

Thank you for including me t oday. And thank you, Tom, for showing us your placemat because I think that part of our story is that Air Force

and Navy have been working hand-in-hand to actually make sure that we are working working hand-in-hand to actually make sure that we are working together. I like to tell my team that that we don't fight alone anymore, so it's really important that we don't have an Air Force solution, but we are really working together with our colleagues within Army and really important that we don't have an Air Force solution, but we are really working together with our colleagues within Army and Navy to make sure we're moving forward. One of the bumper stickers that I like to use when I talk to my team is that our goal is really to make data part of every airman's core DNA. Some career fields have grown up being data-driven, but our goal is really to make sure that every airman, active guard reserve, full-time/part-time, civilian, that our total force is really having data to informed decisions, decisions, and we have been doing this really focusing on the same principles, visible, accessible, understandable, trustworthy, interoperable and secure. That's DoD terminology. We have really focused in the Air Force over the last few months to really make sure that, one, we're building the foundation. In fiscal year '19, we built our first cloud platform for impact level five. Now we are into level six so we so we have a cross-domain solution to support data, and part of that is making sure that we have the right tools for each airman to use. It's really a partnership. I like to say in the Air Force we use the term digital Air Force were talk about its CIO, [Indiscernible], I like to say in the Air Force we use the term digital Air Force were talk about its CIO, [Indiscernible], the Deputy, the Deputy CIO, Deputy CNO, Richard Lombardi, and myself. We work together to streamline the technical, the data, the business processes so that we can work together, because it's not just about having the data or having the technology. They have to have those smart business processes, and then all of us are working corporately to optimize or Air Force, and very soon we will be launching what they they call digital University. We have been investing in our workforce in small pieces. Different people learn different ways, but we know that we have to upscale our workforce, and trying to hire talent external can be very challenging. We are competing with the top industries, and so, really, the one thing the Department of Defense and Air Force, specifically, has is we have some of the best problems to be solved. That is really attractive to the workforce, but it's really about having a platform with tools and having the right skills to move forward. That optimization piece of the best problems to be solved. That is really attractive to the workforce, but it's really about having a platform with tools and having the right skills to move forward. That optimization piece is really are attempt and it needs to be crosscutting across all of our workforce, all of our workforce, all of our different competency areas. The last piece that I will say that I agree with Tom is where working on data strategy and governance. It's not always the exciting project that people want to work o n, but it's a critical foundational component. This week we will be virtually conducting are first GO SES data level counsel to really make sure that we have Senior Leader insight in the decision-

making, how we move forward and and data moving forward. It's really about the tools our workforce and overarching governance and strategy, molding it together. I like to say that data is kind of like an at home we had the nucleus of the atom the new have all of the spheres spheres that run around it. We are really working hard to make sure that sure that we have that cross colonization between mission and business to push it forward. I think that the other piece is, if we have not learned the importance of data-driven decisions the last three and a half weeks since we came weeks since we came home, we definitely are learning that now.

Great, thank you so much. I wanted to ask a follow-up for both of you but starting with something that the dream brought u p. You mention the idea of digital University, and the new have really been focused on trying to figure out the right way to upscale various parts of the workforce. If you could, share with us a with us a few more details about how you thought about the important skills, and how you are thinking about doing that that within your respective services.

I can go first, Tom, if that is okay. We are really taking a multi-pronged approach. The first piece is when oh different people learn different ways. I actually set up a business partnership with the Air Force Institute for technology out at [Indiscernible], and I really worked with them and challenged them them to think differently. Right now, and I think later on this afternoon Dr. Darryl Ahner will be talking this afternoon. He is leading the first [Indiscernible] graduate certificate in data science. What makes it really I think a little bit unusual is that we challenged them to say that it can't just be a face-to-face solution. So that is an online certificate where anybody got any Airmen in the globe have the opportunity to participate, and we hope to scale that out over the next year. We would like to eventually see a full data science master's degree. [Indiscernible] are always challenging but we also know that some people some people need to be upscaled n ow, so another part of [Indiscernible] has been working on what I call Lego block short courses where it's one to five day short courses on various topics to get people smarter in data, and associated topics. Digital University specifically is going to focus on online content, and because we know a lot of our young airmen what 24/7 access, and they also want, they learn differently. They may not want to sit in a classroom all day, and then the other piece is really pushing are Senior Leaders. Air Force as an AI Accelerator at Massachusetts Institute of Technology that was started last year. Right before everybody had to go home for about a month or so, we actually ran MIT, the AI Accelerator ran a beta class of AI and machine learning primer for senior Executive leaders. Those are just what I would call the first steps of trying to build that capability. But it's really, I look at it in terms of people, processes and t ech, the [Indiscernible] attempt.

Yeah, thanks, Eileen. That's really great, and I want to catalyze on what she said, because the Department of the Navy in large part is a little further behind when it comes into our workforce education in creating literacy within the workforce space at the Department scale.

What I mean by that is there are pockets there are pockets inside of the Navy and the Marine Corps that are doing very well in terms of educating the workforce. What we the workforce. What we are trying to do is draw that expertise up to the departmental level. Example we have partnerships with some commercial companies who commercial companies who are focusing in on what Eileen said with a short little degrees or what we call micro degrees in various aspects of data aspects of data science, data engineering, and data exploitation. And then on the, I guess call it the flip side, flip side, we've also partnered with public universities, Old Dominion being one done in Norfolk, where they are actually, we've contacted with them to go out and have out and have them do on site on-premise training with some of our workforce as well. And then kind of in the middle as it were is we have our institutional organic institutional educational societies like the graduate school that are also establishing data science activities that are much more for a formal degree that it is for what characterized as basic literacy in terms of data. And so, we are just now starting to sample through, we established data governance Board and we had three of them now. We're just now just now starting to figure out what the best way is for us to for us to educate our Senior Leaders, like the Secretary of the Navy, the under, and the various whatever, Assistant Secretary's of the navies or Air Force and Navy have similar folks. As consumers of information, consumers of data, folks who had to make decisions on a regular basis today, those decisions are not necessarily based on facts or hard quantifiable data. In many cases those decisions are based off of the information that was given to them, or, perhaps, the conversation like we had this morning inside the Department which was more of a gut feel of what we think we need to do this but not this but not really sure why but the general consensus is is we need to do this. It will nice to take the gut decisions and move them into more data decision based decisions across the Department. That is something we are striving for right now pick the Navy, the Department of the Navy the Navy is engaged on this thing were calling STEM to start review, in the private sector called role-based review. Because it's maybe we had to Navy five what we are doing here. The whole idea is to look at the at the entire portfolio of all of our investments got the $205 billion a year we we spend of taxpayer dollars in making sure we are investing in things that make sense. And so, the goal was to identify funding, appropriate dollars or authorized dollars we could reinvest in things we might not be investing in now they need to be bolster. And so, data management is one dollars or authorized dollars we could reinvest in things we might not be investing in now they need to be bolster. And so, data management is one of the activities that SECNAVINST has been looking into, as well as investing in some of of the core infrastructure. I think given the whole Covid situation most people our tracking, listening to the challenges DoD had in early days relative to teleworking, and this ability to have a discussion like this. We have used data to measure are, I guess our end user experience for telework, which wasn't terribly awesome in the first couple of days,

then use that to target infrastructure. We've done some targeted improvements in measure are, I guess our end user experience for telework, which wasn't terribly awesome in the first couple of days, then use that to target infrastructure. We've done some targeted improvements in not only bandwidth but also capacity in a variety of of different front, so we're getting data on a daily daily basis and using that analysis to drive are own will making investments. That's been a fairly enlightening moment for a lot of the IT people who historically, you know, did not have a lot of quantifiable data to make decisions with, so the kind of ballpark with a thought we need might be, and quite honestly, for the Department of the Navy for access perspective the numbers were very, very very, very small because we just did not know really how many people needed remote-access. And so, we have quadrupled the capacity on our own remote access because of the Covid situation. We have about, I think the numbers were just over one-third of the entire workforce is teleworking on a teleworking on a daily basis for the Department of the Navy. That obviously does not include the folks that are deployed, on a ship, and I guess essentially teleworking all the time in that ship, and I guess essentially teleworking all the time in that regard. But there in the disconnected, disadvantaged pool of users. That is a dramatic departure from just a few weeks or so ago where we would where we would average somewhere between one-half percent to pull percent of our workforce which is teleworking. That's a dramatic increase pick that is an example of some of the power of using data and allowing the data to educate the Senior Leaders over to make make better investment decisions. I did that is a good news story, s o, [Indiscernible].

I appreciate it. There are lots of questions coming into the Committee so I'd like to turn it to to turn it to some of my fellow Committee members. Hello.

I wanted to have one terrifying thing. People are using the word data literacy, and I have been using the word, data acumen, because I have had people ask me if I am not literate and data, and, you know, I am not going to say anybody is not. It's really about building capabilities. It's not like I took took a course and I am done. It kind of has has to evolve over time, so I have been using the term, data acumen, too talk about it versus literacy versus the alternative. I just wanted to say that.

That's a good point, Eileen, because the inverse of data literacy would be be data illiterate, which is not necessarily the connotation we want to give.

[Laughter]

And I had a Senior Leader Senior Leader ask me that question. So, which was comfortable for me. The answer was, no caps or.

Noted for future reference.

Thank you. Let me turn it now to Wendy Masiello. If you would like to ask a question?

Thanks, Alyson. I loved the placemat Tom presented, and I presented, and I was especially glad to hear that Air Force has something

similar, not exactly the same placemat as [Indiscernible] partnered. Part of taking advantage of data and sharing it as broadly as possible, and I did notice that one of your top areas is in the acquisition environment, which is exactly what are chart is. Could we talk, could you guys talk you guys talk a little bit about how support for your data initiatives is being prioritized within your services prioritized within your services in terms of funding and resourcing?

Yes, I guess I will start. It's a little coincidental that acquisition is number one, but not really. [Laughter]

Recently the DON CIO created and disbanded for a while and Under Secretary acted as CIO then Regrexit. Two of of the four in CIO from private sector, in one of which has 0 public sector has 0 public sector experience in his entire career. And so, when he got here he was confused by the term acquisition because in the private sector acquisition and contract are the same thing. And so, I spent some time with them as did our CTO, Jane Rathmann, acquisition professional as well, educating him and bringing his acumen up there, Eileen, do you like that? On the differences between a big acquisition got Department of Defense [Indiscernible] 5075 acquisition, little a acquisition which acquisition which is the two's, three Scott and whatever they are called a now. Versus the active contracting or buying something transaction. And so, too get to you're point, it's a program it's a program or progress, not perfection what it comes to how we are planning for the data and things that need to happen. Some programs are much for the data and things that need to happen. Some programs are much further ahead pick we have a program they used to be called MPG enabled now known as my Navy HR, integrated personal pay system for Navy, military folks. I should say naval military folks, that includes some Navy and the Marine Corps. They're much further ahead. They started for Navy, military folks. I should say naval military folks, that includes some Navy and the Marine Corps. They're much further ahead. They started planning for these taking there 55 systems and integrating them from them from a data perspective years ago. On the flip side, ironically, the acquisition community does not have a good plan or how to bring all of the acquisition data together. There are pockets, like a rating system to kind of bring that together. There was an attempt, and Eileen Mike remember this in the DoD to have one contract writing one contract writing system for the entire Department of Defense, which turned out fantastically. So, we still have our three. Not to quote other [Indiscernible] that have failed but it's a good idea in theory, it's just much harder to pull off and practice. It's not like were not all using the [Indiscernible] for acquisition but we have our own policies and processes, different authorities. The Army's acquisition like were not all using the [Indiscernible] for acquisition but we have our own policies and processes, different authorities. The Army's acquisition is a sustainment command. The Navy's acquisition is part part of the Secretary it in the acquisition community, and Air Force is an is an acquisition authority as well, so it's different ways of implementing

things. We are starting to get the memo, which is the first step, which is a guidance memo that says we're moving towards interface specifications, and for systems to exchange to exchange information it's going to be done over interface the memo essentially directs the existing systems, otherwise known as systems or I will call the legacy but systems that are deployed today to identify what data they might have what data might need to be exposed via interface. And then, centrally, I cannot say directs but asks have what data might need to be exposed via interface. And then, centrally, I cannot say directs but asks the acquisition community, very specifically rDNA, Secretary Gerdes to provide guidance for future programs, future programs, write it into the acquisition baseline to say, hey, you are willing to you are willing to have interface communication. You will have standardized data models, data models, and you are going to make the data available through the VOLTICE sort of mechanism where visibility is the first Step two data NIRVANA, but not the last step in the process. It simply registering your system system in a catalog saying it's available isn't really going to get asked to sound data management, certain he died in to expectation. The third thing I will offer which in to expectation. The third thing I will offer which we have become a thorn in my side is artificial intelligence and machine learning rubric. We have a lot of people focusing a focusing a lot of time and energy on trying to bring AI and ml in and use data to drive a predictive thing to prescriptive things, and each and every single single one of them learn the single most basic lesson which is, are data is in terrible formats. It is It is not we'll integrated. You cannot cross for the data into systems, so they are finding they are spending most of their time and what I call Monday data engineering activities, not in time and what I call Monday data engineering activities, not in super informative artificial intelligence activities. That's a good learning experience. It's just the problem is we are still investing at the top of investing at the top of the pyramid which is AI, exploitation, and trying to turn data into knowledge, and we need to invest more of that money in the lower part of the pyramid. That is a program of of that money in the lower part of the pyramid. That is a program of progress right now. I meant to mention earlier because Eileen mentioned, we're spinning updated enterprise data platform as well where we, the DON to our investing in the platform and what I what I will call the Monday data activity which is getting data is getting data into the platform, and then essentially opening it up for no additional cost to the Navy and Marine Corps constituency too exploit the data that is in it. And I hope we can continue to essentially fund that capability for the Department, and allow them to use of the organic resources to make sense of the data. At the end of the day, that is kind of their data. It's not Secretary level data necessarily. There is some of there. Or Jupiter platform is called Jupiter is a partnership with OSD, and at that will continue to essentially fund that capability for the Department, and allow them to use of the organic resources to make sense of the data. At the end of the day, that is kind of their data.

It's not Secretary level data necessarily. There is some of there. Or Jupiter platform is called Jupiter is a partnership with OSD, and at that will go live on classified environment in two months classified environment a month thereafter, so we will have parity to a certain extent with Eileen on that side. I do not know, and I don't know if Eileen knows where the Army is in their story right now. They had stood on that side. I do not know, and I don't know if Eileen knows where the Army is in their story right now. They had stood some stuff up on the environment, but I don't know if it's been, how far it's gone in terms of its expansiveness and how the the program is working. I will turn it over to Eileen. Over.

Thanks, Tom. Tom and I got I could search on my trusted Partner. We are on this leadership journey together because for a while you think you are on the are on the Island by yourself, and you are not Rick I appreciate your support moving forward. One of the first things that we did in the acquisition umbrella was we actually published a data service reference architecture document, and that we took the time to do that. We went to the process of actually putting it through public release. It is available on Air force.male, and we did that because we recognize that we could not do this alone. Went to bring in our industry partners, and we needed to give them some sort of baseline or scaffolding to build from. Or intent of what I call data search for architecture 1.0, because we are already working on 2.0 is that we needed to have some sort of baseline so that will we put capabilities out there for a better proposal, that it was it was core foundational documents that vendors of all sizes could really Partner with. Another key component was really about what we call working smart in the Air Force. The Air Force Air Force is really trying to brand itself is a software company. We have We have these amazing young airmen that the platforms may be the same, but the tech in the platforms have changed significantly. Heart of that is having the absolute smart tools for Airmen at all levels to have access too. Some of it of it is open source, which, I would be honest but it was a challenge within itself. Some of them were actually better tools. I like to say it it is amazing what airmen can do with Excel spreadsheets, but it's like fixing the plumbing with a hammer, and if you give an airmen a ranch, like it would be so much more efficient. Part of of it right now is finding not just making sure we bring of the right tools and that it's easy access to get tools onto The Network. That is where my partnership with partnership with the CIO is critical. The Air Force Chief Information Officer signed a reciprocity agreement, which means of that if I have a tool that is AT owed to be on a level five platform, it can be put on other impact Level five platforms so that we can actually gain velocity in getting the right tools out to our airmen. And out to our airmen. And then that brings in my colleague from the Chief management office. It's really about smart purchasing of those tools, and so, in the past we might have had offices that thought onesies or doozies of these tools, some can be pretty e xpensive. I was very bold. I went out to a vendor that was in a visualization of business. I asked them to provide me a

heat map because that is the business they are in. Where is this in the Air Force enterprise? He came back with this very large, I won't say in public how many, but it was well more than one contracting office had done individual procurements for this. So, I had reached out to my CMO office to make sure that where possible we are using Category Management to make smart purchases so that we are being good stewards of the the U.S. taxpayer dollars. It's not just having the right tool and having it available to use on The Network today, but we are also buying it at a smart purchase price right tool and having it available to use on The Network today, but we are also buying it at a smart purchase price moving forward, and, more importantly, we don't have many, many, many contracting officers doing the same overarching work. There are certain tools that our office products that there is one office. There is one contract. Through Category Management you by that. We need to We need to have that type of capability. That is one step in the acquisition process, and I think the last piece that as a start up office in the Air Force I have a little tiny budget. I am frugal. My team will tell you that I'm very frugal with every Penny that with every Penny that I get, because I have to make sure that I'm using it to the best of my abilities. But I also found that sometimes an IT contract is not going to provide me the access to the data service companies that I truly need. And so, there I am Partner with my acquisition community to actually later this fiscal year, Industry Day in October, and we intend to actually do, not acquisition. That is not my job right now but IDIQ type of contact for data services that people in the Air Force can get access to the right tool at the right time so that that we not constantly having to do small independent. It's more about making sure that we have access to data Consulting Services, which can sometimes be different than IT Consulting Services. And of those AI and machine learning experts that may not be in those traditional IT companies, so it's really about making sure that we have the right contract in place so when people want to make that investment they had the right contacting tool in place. Those are three big acquisition focused efforts but I won't say they are the only ones, but they were three big investments that as a start-up, I felt really was going to show immediate return on investment to my team. Over.

Thank you very much. I would like to get the next question to Christine Fox, another member of the Committee.

Great, thank you, Alyson. I wanted to ask you both, you doing a lot of work on up Skilling, pardoning, capability within your services. This morning about the importance of [Indiscernible] data analysis and data techniques with [Indiscernible] too make sure you get the right analysis the right analysis done on the data and you find the right data. I was wondering if you are factoring that in a [Indiscernible] program and how you [Indiscernible].

I can take a swag swag at that first. This is Eileen. I run a small use case lab based out of the Jones building at the Air Force Base, and people across the Air Force propose topics, and we really focus on very small use cases that could have enterprise level impact. I cannot

solve every problem for every single organization, but in the last 20 plus months we have done about two dozen use cases, everything from condition based maintenance to pilot training next simulation data, and part of that is really what I call bringing together, we pulled together a team will be have a data scientist, a data architect, and that subject matter expert, so we do not lose that context. It has to be be a Partner, and I adopted the U.S. digital service philosophy where they talk about taking the nerd out to the field. We take the data scientist out to the field. So that data scientist, they will get that like data recorder. They know because they may have seen that take up on that particular day and time, but it gives them the context. We really a partnership, because we need a to the field. So that data scientist, they will get that like data recorder. They know because they may have seen that take up on that particular day and time, but it gives them the context. We really a partnership, because we need a context. The other piece that would tell folks is that in the Department of Defense, and specifically Defense, and specifically in the Air Force, we have these amazing experiential Senior Leaders that, that is part of their core DNA. And if we give them the power of data to inform and provide insights to that to that decision, that just gives them a whole new level of capability, and so, sometimes it's not the data is the answer. Sometimes the data provides that insight, and it's really taking it forward, so we can't replace the experiential learning at all l evels. I have branded a term, CDE, Chief data evangelists, because I need change champions out in the field that really understand that having that context to the mission is irreplaceable.

Yes, I would just Echo what Eileen said. We are following following a very similar path. I mentioned Jupiter pick the goal with Jupiter, again, is really create that platform for people to exploit data. One of the things we are really create that platform for people to exploit data. One of the things we are trying to do is to bring data scientist, data engineers into headquarters, allow them to participate in the build-out build-out of the Jupiter platform, and then the way the Navy works in large part, Marine corps is a little different, but the way the U.S. but the way the U.S. Navy works is there is a lot of system command and engineering centers and expertise centers that have a tremendous amount of institutional knowledge about very of system command and engineering centers and expertise centers that have a tremendous amount of institutional knowledge about very specific things the Navy does. We have the Senolytics conference once a year a year down to Charleston. It was really an amazing experience for me to run into people. I met this guy guy who had been studying the physics of wave motion relative to an aircraft carrier for a few years now for the sole purpose to predict that where the where the aircraft carrier would be at a future time so they could land drones on it land drones on it so they could deliver equipment via drones instead of flying humans and planes in with equipment on it. That's a fantastically difficult problem to solve, but is domain expertise is required to make sense of the data he is getting from the sensors. And

then Partner in and paradigm up with a whole court, in this case, a whole team of them, a small team to Eileen support we don't have a lot of resources here. ML and AI experts that can write the algorithms write the algorithms to the Predictive Algorithms and train the algorithms based off of his domain expertise. That is very hard-core physics type artificial intelligence. It's not watched and protect the weather or whatever they are using Watson for now. You get the idea. That is one of the things we want to use the Jupiter platform for is linking people together. On the flip side we just hired hired a cheap analytics officer who is his sole purpose in life is to once we, the CDO, make the data available, clean it, curate it, his job is to build the workforce to make sense of the data and exploit to build the workforce to make sense of the data and exploit the data. He came from the functional side functional side of the community. Is a combination of what I consider a third lawyer, third IT, and a third spy. When I say spy I don't mean like [Indiscernible] spy but he loves getting information loves getting information and digging into problems. He is really great at making sense of data, and so, I am using it to marry the functional community to what I consider the traditional data management community, which is, and create that relationship and that partnership Communities of Practice and centers of excellence. We just started that.He is on week number three if I remember properly. That process has just started. Certainly, Eileen, what I might want to do is connect him with what you are doing over at Andrews. That will be pretty informative for him. And I will look them up with the joint artificial intelligence folks for the Department, as well as the Covid task force. OST has a Covid Task Force taking a lot of data from different sources making from different sources making sense of it. That created this Covid dashboard which is really quite compelling what they were able to do. It was from flash to bank four calendar days, which is for the Department of Defense, me that breaking the speed of light.

[Laughter]

Now I think think they on day nine or whatever and last Thursday DevSec said this is our dashboard. The The weather dashboard. We're going to look at this dashboard. That brings awareness, visibility and hopefully we'll increase the acumen on what it means to senior leadership. One other point because I limited or they got we as [Indiscernible] have contracted the process as will together domain expertise in terms of data management, and I will say that it on The Street right now. It closes in three weeks pick if anyone wants to bid on it, would be fantastic. We are looking for looking for truly unique capabilities in the data section of the RFP, there is a bunch of sections strategic management, Investment Management, a rchitecture, data management. But the whole idea around the data section is to get access to the nontraditional data section is to get access to the nontraditional things in the contract, although, because of Who we our it's being repeated on what I would consider a traditional IT contract venue. And the [Indiscernible] conference and data industry I think industry I think as a little more differently about the

problems. Over.
Thank you. I wanted to next have Philip Anton if he would like to ask a question.
In some cases we use the data, we knowledge and advanced we were going to use going to use it in certain ways also how are you using the integrity and data use when we are deciding what data to make available?
Yes,
Yes, it's funny. I live there because, I think Eileen was there a year and a half ago, almost two years ago now. So, that exact question came up at a CEO Council Meeting when we were writing the new data strategy about insulating ourselves from pigeonholing data for specific use. I don't have a great, we don't have a great answer for you. I don't have a great answer have a great answer for you. I don't know if Eileen want to weigh in. The whole idea we settled on is if on is if you make the data really available to the extent possible based on rules, regulations, permission, and empower people with tools that have access to the data, that will get innovative. And that we are seeing this now with this Covid dashboard, a ctually. They were entering data that I guess I would have never considered a requirement. And so, by way of example the Department of Transportation is making, providing access to some ways data, ways is they use like Google maps or whatever. But it's traffic data and they are doing an analysis of the impact of Covid on traffic patterns. Not only is the amount of traffic gone down dramatically, the where people are traveling to Dow has changed dramatically, and when they are driving has changed the medically. That is not only implications to the transformation transportation infrastructure, but it's having a financial implication to the tollbooths, the toll for-profit told companies where the roads were not really making any money anymore, because there's nobody on the roads and the average toll will go down. The question is for Department of Defense, is there anything we need to be concerned with in terms of Supply Chain risk, Supply Chain Management, and if there's going to be availability issues in terms of, clearly there is some availability issues with [Indiscernible], masks, and what not, but our their clearly there is some availability issues with [Indiscernible], masks, and what not, but our their things from inner commerce, interstate trade and international trade now trade now being impacted by Covid need to look for downrange from a supply chain problem? So, again, are goal is just maximize Accessibility a maximize access to tools and data and allow people to be innovative. I don't know that any control predict potential uses of the data. Again, I think Eileen was in the defense Board meeting and one of the Board members suggested the easiest way to protect ourselves from pigeonholing data from that way is stored data and make it available to everyone who might need it. I think we all laughed.
available to everyone who might need it. I think we all laughed.
I suppose for [Indiscernible] that might be possible or Twitter, I don't know. Just the notion of storing every radar track from every platform that is active forever is just phenomenal amount of data. I don't

think people truly understand how much data is generated, at least on a understand how much data is generated, at least on a ship or airborne platform on a daily basis, and how much of the data is useful immediately let alone in r etrospect. It's certainly an approach, not one I think we well do anytime soon.

Time top I remember that because I was brand-new and it was like, I think it was my first presentation I ever had to give to any Board, and I was first. That was like the first question. And I still to this day remember by answer, that every time I staff things, many times the Department of Air Force we have to stuff stuff the judge advocate in General Counsel, and sometimes you get different legal perspectives based on the mission perspective. I said many times legal doesn't agree on the response but response but that is probably one response that will agree on or not keeping everything. I'm sure there are legal reasons of what we were going to keep and not legal reasons of what we were going to keep and not keep, but I just remember that was one of my first days in the Air Force, so, thank you, Tom, for bringing that up. It was painful. Retaining is always, how much you make available and how much our strategy right now in the Air Force is to build a catalog of data and metadata, and when individuals come back and say, you don't need my data. My response is, all Air Force data, because you don't know what you need until you need it, and so, I know that a very difficult goal and probably well never reach it but the reality is that every single time we run a use case there are certain data sets that have come up over and over again. There are priority. Those are the ones we want to make sure people that need access to it can find them, it's easy, they're cleaned, et cetera. But we also find that there is amazing data that is generated cetera. But we also find that there is amazing data that is generated at the tactical level that is stored in some amazing airmen's spreadsheet on somebodies desktop. I would say that's about 20% of the secret magic of some of these use cases, and so one of the opportunities that the cloud gives to us is the opportunity to register that data and to register that data and make it discoverable, because the junior airmen may be collecting some really important data that they don't see the strategic impact of it or that upper-level significance of it. And so, I think that as we go down this journey we're going to find that certain data sets are absolutely critical to many, many use cases, and those have to be at the top of the list in terms of ease of to be at the top of the list in terms of ease of accessibility, what I call accurate, available, actionable. The need to be there, hands down down but the other thing were starting to find with some of our use cases some of our use cases is some of the data you thought was critical to certain use cases, actually, may not be as important as some of the other. So, as we go down this problem solving journey to really have data insights moving forward we are going to find as an enterprise that places where we really invested heavily maybe may not be the primary investment point moving forward, and that we need to and that we need to realign or rededicate too other areas moving forward. And it is possible and probable we may find with that we can have 90% with

a much lower percent amount of data. We have had a few use cases where if I could come up with a 90% solution very quickly a 90% solution very quickly using a very finite amount of resources, maybe I only do that second echelon of work on the things that flagged. It's really about trying to work smarter, and at that is trial and error. Sometimes you're going to do something and it's going to generate really great velocity and very quickly, and sometimes you think you have the answer and at the end of a certain phase you find out that it may not be what you truly hoped be -- hoped. I think the last piece I constantly talk to constantly talk to my Senior Leaders about is data gaps. I would say pre- Covid, when I talk about data gaps, I don't, some people like, what I think we are just in the last month we are collecting data on certain areas that we never thought that we would need data on immediately. Some of that is an open source, so one of the challenges I asked my team asked my team is that we need to make sure we are looking for open source solutions where possible, and scraping that data where we can and bringing that in. That's where having advanced tools and cloud-based platforms are really going to to show dividends in the long term. Sometimes the short-term you don't necessarily see it, but if we look at the long roadmap in trying to make sure that we have great situational awareness of where we get great value, where we thought we had great value, and where we have gaps that we need to improve on.

Thank great value, and where we have gaps that we need to improve on.

Thank you. So we do have a few minutes left. I would like to give what may be the last question, depending on the answer to Rebecca Nugent.

Hello, thank you, very much, to our panelists. This is been absolutely f ascinating. Such a window into what is happening. I want to kind of combine a couple of questions that we have going with our Committee. We have want to kind of combine a couple of questions that we have going with our Committee. We have been hearing a lot about the need to train something like 3 million people overall in data acumen, data literacy, whichever phrase you were using. Although, I have a small Affinity toward data acumen, personally. And then thinking about, how do you set priorities for 20 that workforce? In particular, would like to come back to Ms. Vidrine's analogy which I thought was a wonderful about these younger, the younger people in the military doing amazing things with Excel spreadsheet but they have been given a hammer from the plumbing and if they had a ranch they ranch they could do even more. When thinking about prioritizing your training, prioritizing your training, who gets the hammer and who gets the ranch? Like and thinking about how many, what percentage or what groups do we need to really be super technically data savvy, and what groups do we need to have kind of an understanding of data, interpretation, et cetera. I will stop there but quickly, probably thinking about priorities in training. Thank you.

This is Eileen. I will take a quick stab at it. The first thing I look at is I think a lot of it depends on where you are at the a lot

of it depends on where you are at the time. A young Lieutenant coming right out of college probably has a different need than a senior leader, so part of it is how we need than a senior leader, so part of it is how take some of the training that we already have and actually what I would call we've it into our learning objectives. So, it's not like this is our data is our data scientist block of instruction, but how do we inject that data site skill in some of our online and classroom training as it is, because some people are just going to check out when you out when you say this is the data scientist block of instruction. of instruction. It's kind of like you have to make it make it into everything you are doing tactical through strategic. The other piece, and I think that is where my partnership with [Indiscernible] is working us because we have Lego blocks where you can go take A1 to five day short course to get really smart on a finite topic versus a data graduate certificate class, which is 14 weeks and you do a little bit every week for a period of time to really grow that capability. The last piece that I cannot undercut is that as we move to more online coursework in [Indiscernible], cannot undercut is that as we move to more online coursework in [Indiscernible], the reality is the younger airmen will go out and selected piece of a [Indiscernible] too get smart on that they may not do the whole course. That That is not a traditional approach in the Department of the Air Force or even DoD pick we are used to finishing classes. Part of that is the that is the culture change to say it's okay to get this little nugget and get this little nugget and get smart really fast. If you don't do the other few few blocks because it's not as important to your mission said, and I think that's a little controversial. It makes the people I will call,, uncomfortable.

[Captioners transitioning]

We don't want to create a new data curriculum. I was doing my annual yesterday. The good news was of the 23, 2 of them have changed in the last 4 of them. So take that training and integrate why it's important. Let me give you the simplistic example of why we've got people who are in the field on the ship during maintenance activities on airframes and activities. And when they do maintenance activities that generally requires getting a new part or taking a part from inventory. You've got to order one or take one off the shelf. So the way in which they have to do that today is by typing a serial number. Somewhere between 12 and 21 digits. The probability is typing that in accurately that's exactly zero. So more importantly there's no validation on that field today in many these maintenance systems which means we get a variety of spirited input about how people feel about the Department of the Navy in that serial number field. So what we want to do is as we trade people in our business activities is explained to them why that information is important. And how it can be used. Or that pinnacle of information where it might end up. Looking at an individual part or individual record of an MRO situation. It's going to look at the aggregate of those repairs across an airframe and trends. If those serial numbers are wrong it will let us trace the airframe back to the part and to the fix and ultimately weed out

lemons versus you know the bad part in the good part. We got repeat offenders in our supply system. We've got the tendencies to take those parts out and it ends up in another plane and that part is failure routinely. We did this a few years ago where we can weed out the 5% of the parts that were broken coming off the production line to cause problems during the fleet. Causing problems for data to drive that. If we can get maintenance who's doing the swapout to understand that that part might be a lemon and to document that appropriately. In their mind it increases their acumen. People come to the Department of the Navy with various levels of data acumen. We should probably consider tailoring our training as Eileen mentioned to existing skill sets. If you know a lot about data and data engineering or data analysis maybe you don't need the 101 class. So if we've got 15 modules in our data PhD and you only take two of them. You take the test at the end and that's just a complete 180 how we do training today. Is going to be a center of our evolution from the workforce for the data management perspective we are integrating that with our civilian capital plan as well as our military training programs in the department to bring that theme out. It's too early to tell how successful we will be in my opinion but I have hope.
Thank you we appreciate this both of you and the contributions that you've made to the panel this afternoon. I think we could probably talk to you for the rest of the afternoon we've got still a lot of interest from people on the panel that in the interest of time let's close out now. So I will mention for those on the webinar that we will now take a break and reconvene at 2:15 PM Eastern standard time.
Why data is valuable to your business and using some examples. Also describing some effective strategies for educating the workforce about data particularly in the context of decision-making. Our panelists have a lot of experience in a lot to say on that topic. Similar to the other panels we will capture them on Google doc. After the panelists have share their thoughts. There's optimum strategy programs and directing often's college of artificial intelligence as well as how United health group technology in strategic partnerships including research and industry partners. Paul will get us started.
Thank you. Hello everybody as Ann mentioned on Paul Nielsen with often technologies. I lead the transformation program essentially. We are transforming our workforce from an IT culture that it has been for decades into an engineering product center culture where we look at usability and scalability as opposed to port solutions. As a part of that journey I established the college a I which is an institution with and that the organization there to take the existing workforce and build artificial intelligence skills so they can become practicing engineers in that field. I also launched the UH G Academy of technology that's after the IBM Academy of technology which is probably the most robust and oldest Academy of technology in the industry. I think they are 18 years old now and if you think about it that's a very exclusive members only community where it's the highest acknowledgment for individual engineers in terms of professional skills and how they applied it to the organization and how they apply

it to outside the organization in the societies that they are members of in speaking of the industry and businesses etc. And the other thing we launched was a part of this journey we call the technology leader career path. That's also a part of transforming our workforce so they feel like they are an engineer going through the stages of being a social engineer to a principal engineer to a senior principal and ultimately to a distinguished engineer and beyond that appointed a fellow and from there they are appointed into the Academy technology. All of this is a change in culture in the way that people think and how they approach their work. So these are some of the things that we started with and as a part of that we've got a lot of data and optimism members of the UH G family of companies. We are 350 companies are more and 3000+ employees around the world. So we've got an enormous amount of data we manage 120 million lives in Medicaid Medicare and our members. We have done this for decades. We store every one of these claims from the moment we have received them so imagine the amount of data we have. With that there are a lot of challenges in terms of access. I know this has been a big topic here today. Some of the practices we had to go through in terms of feathering the data at the same time adhering to a lot of the federal regulations that we have. I'd like to share these things with the group so please feel free to ask it's a broad subject as we've been hearing already today. I want to say lastly. I and jumped faculty at Carnegie Mellon in the college of public policy where I teach a rhetoric course for healthcare innovation. A lot of my approach is where I spent 25 years and started before coming to UHG . Is around have to do things faster and more efficiently. Were like no other large company we've got a lot of governance there's a lot of bureaucracy and a part of my role after joining was to try to show different ways of going about things. I don't know if anybody heard about that book, team of teams. It's the approach we take some of these practices that we have for our past engagements and military engagements. We practice that and it's something that we implement. Did you want me to go on any further?
That's great thank you. Let's move on to our next S here.
Thanks for having me everyone. As we kick off this panel. The two main questions I'm going to do my best to answer for you all is explaining at least to the eyes of MassMutual why we believe data is valuable and essential. Not only to how we do business but to how we compete in the long run. I will share some thoughts around effective strategies what for educating the workforce. But before I do that. The one thing I want, given that this is a broad depending on the audience. Invariably defined topic. I want to scope down what I'm about to share it just data science. When I say data science I also think it's important to specify what MassMutual thinks about from a philosophical point of view. We think of data science is an interdisciplinary field first and foremost. That is concerned with scientific methods. Processes. And systems that we used to develop and extract knowledge from data in all its forms. If you go to Wikipedia you'll see I just recited there definition but, I think it's a good one. Providing some clarity to

what this means to us. So in contrast, to MassMutual that means we don't about data science as doing big data or deploying technologies or creating business intelligent capabilities. It's really a science first methods first approach to essentially executing the scientific method in the context of a moving business. So why is data important as I said before or essential to us. Within financial services broadly I think data has been used since the beginning and continues to be used to drive all aspects of companies and in particularly to design products and services that are used to offer protection in the financial forum for individuals and groups and companies and the like. So data really is a fundamental aspect to how we operate the company. And the more data that we have. That best represents the processes that we execute and the markets we compete in and the consumers that are in those markets. The better of a job we believe were going to do in creating products and offering those services to all different types of consumers. So with that as the philosophy and the driving force. We've built up science capability. That capability has been deployed across all the major lifecycles in the company's. So policy lifecycle a revenue lifecycle and investment lifecycle and all the underlying business processes that drive those lifecycles. Starting from figuring out who's interested in purpose he and insurance product or a protection retirement process. More broadly from us. The data science is behind a lot of those activities. We focus on using data science to generate additional kinds of advice to help individuals think about the long run plan for retirement and things of that nature. One of the more important areas that we have made big investments in that's led to some pretty material improvements on how we run the company and how we serve our policyholders in underwriting. Providing a life insurance policy at the individual level there's some form of underwriting risk assessment that needs to take place. We have collected a lot of information that allows us to understand life insurance risk at a very high resolution if you will. Refused all of that information and turned it into systems that we used as a forecast risks and offer products and services at different prices depending on who's interested in purchasing that. We have deployed data science and we use it for things like predicting defaults. We estimate changes in credit ratings for downgrades and upgrades. Those tools are used to allow the investment team to use more decisions for the general investment account that is behind all the insurance policies that we hold. So hopefully that gives you a rough sense of what we do. In the beginning we essentially used the method to do this work. Everything we do starts with a question or problem statement and has a measurable outcome but before we start anything. To go along with that we've also got a business partner in the company that works with us. I think partners is the key word here. It's not a stakeholder it's literally somebody who works with us to build a system that answers that question or solve that problem. So when we think about how we train and develop a data science capability. Maybe before we do that we had MassMutual think about educating the workforce quite broadly. I know I'm talking about data science your we created a dichotomy of

information producers and information consumers. We think that the way you educate these two is a little bit different and needs to be well-versed in methods and consumers need to be much more focused on how to make decisions. So within data science that squarely a producer type of category. In order for us to develop the capability that we now have in place when we started this back in 2013. We realized that we did not internally have much of a framework at any level for attracting and developing talent. So the strategy we took to solve for that was one that was a mix and academic partnership and then we applied practical experience. We did that in a couple of different ways. So that at the undergraduate level we formed some relationships with some liberal art institutions for MassMutual and we used those in the tuitions essentially as a candidate pool generator if you will of top talent that was interested in learning data science methods as we see them at the company. So we would take individuals in from those institutions and over the course of 3 years, expose them to a structured development program. That leads to the second relationship that we had formed at the graduate level with UMass. We have a house in Massachusetts and we gave them some funding to allow them to establish a college of data science to develop a master's degree in data science. So we would target that higher performing smart junior individuals coming out of our undergrad institutions bringing a handful of them into MassMutual and immediately have them enrolled into the grad school at UMass to pursue a Masters degree. In parallel to pursuing that Masters degree we've also got them working for us a full time. They get men toward under senior data scientists and for the purpose of this audience. These are essentially PhD's having research on an independent basis and mentoring juniors as well. So those senior people would mentor those junior individuals through structured projects that we implement that are tied off to some of the outcomes I described at the beginning of our talk. That's risk assessment and management sales. So on and so forth. So they go through that process at the end of it they believe the solid fundamentals that a data scientists needs to know quite well to work effectively and consistently and they've learned how to apply those fundamentals and the context of a business which sometimes looks like a lab that other times is a bit messier you've got to learn how to use heuristics and make compromises and estimations in cases where you otherwise may not liken them. So I can stop here and pass the virtual Mike

Next up is Luis Stevens from Stanford University. He's a cofounder fall within the areas of high-performance computing for data processing. His last startup company where he created optimal solutions for retail operations in the areas of neural computing and stream processing. Over to you Luis.

Thank you for having me. There is a slide here that we can bring up. So I'm going to talk a little bit about what we learned what we were putting together these teams were working on for data science doing data and data analytics. There's two important concepts I want to convey here. One of them is, the matching of the workforce that we

have to the stack of technology that we need. And the other one has to go and deal with communication between the layers that we find in the stack for data analysis. So first matching this once really obvious. In terms of doing data analysis you need the analysts and you need the data scientists. And to do all the processing and to set up data. One of the important items with this target they acquired the company to take care of this details is not that easy to scale the double process especially when you're dealing with data every couple of days. So one needs to think about the workforce that you're dealing with for the optimization of how your process and move this data. Moving data, technically speaking figuring out. Moving data when you're dealing with data analysis. Here is when we start to immediately run into the issue only that not only everybody understands that moving data is the problem. Not everybody understands the issues at the different layers. Normally that's what it comes with. So, the people and the engineers working at each one of the levels normally needs to understand not only their own layer but also understand a little bit of the layer below and above. In order to communicate. This leads to optimal solutions. So data scientists need to be available this real dissonance. They need to understand a little bit of the data engineering. To understand a little bit of the science. The type of data that needs to understand understanding the resources that you're going to be using in order to execute this analysis. So there it is. So just for clarification. Using the terminology for's dad. Can you define that a little bit?
When you're running applications when you're solving problems and you got an application if you're doing something. Use got a tool that is classifying certain types of data. So in order to do that to execute those applications. You need several layers of processing. All of these layers run one on top of the other. And normally within the context of computer science or data analysis. We call this a stack. For data analytics it's normally a very high level and you have layers that include high level tools such as art or Python or languages that allow data scientists to specify the type of algorithms they are going to use to solve the problem. Below that you got layers where all your doing is dealing with the databases you're moving data around forming on what you're executing how you're going to get data from here to there. Are you using the network or just memory in order to move data around. And the type of hardware you're going to need like will you need purpose, those are the layers that I presented in that stack.
If you've got questions please add them to the Google Doc Melvin Greer is responsible for building data science platforms through graphs analytics. Machine learning and cognitive computing to accelerate transformation of data for public sector and commercial enterprise. Over to you Melvin.
Thank you very much. Today on focusing on two primary topics the first is what's up with this discussion around Intel most people have realized that Intel is in 2016 it will become a data company. What Intel has on how to develop and deliver world-class AI and data science capabilities. Especially as it relates to their cousins of

cloud and 5G and autonomous vehicles and cyber. So in that discussion the best way to understand that is, instead of having Intel, be focused on moving customer data to the silicon architectures as soon as possible with as little power as possible. And Intel is now going to be focused on what the context of this data returning from exhaust into fuel. This data will now fuel all the capabilities that Intel is focusing on in terms of research where we spend about $13 billion or in terms of the 100+ universities globally that we are responsible for. And the acquisition of and the merger of the 27 or so AI companies that we bought in the last 27 months. It's changed the focus so that every single individual at Intel now needs to have a basic understanding of how data and data science works. This second thing I want to talk to you about this while we certainly have a larger focus on science and engineering. And I love the way they describe the scientific method. These are not the people I'm interested in talking about. The people I'm interested in talking about are not data scientists. The people who have to have a data document at Intel whose primary job is something other than data science. For this example I will share with you this sales team. It's really important to think about because the motivation of a data scientists professional or AI developer is much different than a salesperson. They've got a commissionable job they get paid for making sales. If you layer another job on top of it you better have a really compelling reason otherwise nothing's going to happen. So the first thing we did was help able to understand that not only in our company but our large ecosystem of OEM companies. Our large ecosystem of software development companies or our large system of university partners. Why data science is important to do development of Intel revenue. This is a chain. This is not about trying to figure out how to be better at data science is about upscaling and existing workforce. To have a basic understanding of data and a basic revenue. We identified what every individual needs to know around data we took a roadshow across the country and China to help the entire sales team understand the connection between understanding of data science works and driving it into a revenue. We had a few day courses where we had role model and role-play and some deep discussions not necessarily about technology but how data drives decision-making for the development of revenue. And now every salesperson in the U.S. and China has gone through this class and it's had a material impact to have meaningful conversations with our clients. Most of you guys are our clients so when you're trying to generate insight from data. The first person you're likely to have a conversation with is not owing to be the data scientists like me. The first person you'll have a conversation is the Intel salesperson who's responsible for your account. And that person is to be able to translate your needs into a sales opportunity. So we take upscaling and rescaling of the Intel workforce extremely serious. So not only do we track what courses people are taking as a part of that initial foundation activity. But when you find salespeople who want to grow, now we have a new set of curriculum around how algorithmic manipulation works or how algorithmic warfare works. How do we apply

data science to oil and gas or to financial services or energy. These advanced courses not only help you appreciate how data science works but how you can apply it in your job. That's what I ink this panel and this entire study is focused on. What the motivating factors that we can use so that people who have a completely different job than data science can be incentivized and can feel comfortable using data science in their day job.
Thank you Paul, thank you all for your comments they are very informative. There are a few questions. Both from the committee as well as the participants. So let's start off with questions and Rebecca if you'd like to start off with the question you have around upscaling questions. Perhaps we can start off with Paul in providing a response.
Thank you to everybody that was very helpful. One thing I'd like to dig a little bit deeper into us. Today so far we have heard a range of daily and approaches from doing fully online courses to doing shorter modules and micro certificates versus complete courses and degrees to in person courses and on premise training. We've heard quite the range and what I'm curious about is. Given so many different options and so many different levels of data that your employees might need depending on what kind of role they have in your enterprise. How do you decide what groups of employees need and how you deploy that content to them. In the manner of delivery. How do you build that system. I'd love to hear from Paul among others.
Some of the facts we have came from some other teams. There's another captain, Captain Abner Shaw, both of them came and spoke to us as a leadership team. Breaking down the silos. Allowing military. And for us. We are very large corporation they are deployed in the U.S. and India and in Ireland and Brazil. So you can imagine there's a lot of cultures there just in the U.S. with the time changes and separation it's a lot of work that happens that others don't know about. A lot of work is repeated so the same function is created hundred times over. We took that team of teams approach to write down the silos and first allowing shared practices. We built up to developer which is the repository for API that were created across first we started it's almost the worst ship operating in the Navy. We started by the sailors on board. So looking at that so we have ongoing programs we have self paced and time box. The more advanced programs require prerequisite exams so make sure you remember your linear algebra they've got all the foundation skills to take that course. It also becomes an MBO and a self-paced one. But in all cases we created cohorts they start as a team even though they are online and they meet weekly. We created a director who essentially manages the curriculum the cohort starts and ends at the same time. They go around a table and your put on the spot did you do your lab. Did you do your homework because everybody has good intentions but let's face it day job can consume all your time and before you know it months have gone by and you've taken maybe one online course. So make sure it's moving. We created the concept of coaches. So for every cohort we took engineers who are already advanced well-known and skilled they volunteer to be coaches to each

one of these cohorts. So they get a few people and help them through the program. Some of them are very rigorous. Then the other thing we did. By bringing in the managers. First you make sure they want to do that. I mean are they really in a position where there motivated. That's how we addressed the initial question. How to issue with the right people. And if they don't have the skills for the course that they wanted to take. We have individual skills like basics of machine learning or Python or things like that so that they can get the foundational skills then come back to the course. We aligned them with business needs so our teams are usually aligned to businesses or products. AI is used for us for healthcare that's our path forward. Healthcare is a few decades behind any other modern industry like banking or telecommunications in terms of automation. So we realized we have to make this investment and we have to transform these teams to go from manual processes and healthcare where claim and simple wellness business visit is run against 1000 rules. The turnaround is like 58 days before is actually settled. So you think about that tremendous latency and the cost of the manual part of that. So we can and are working on converting those to AI. So making sure that the teams that are trained are focused on businesses that have the greatest impact not only for the business but also for our customers and our customers for United healthcare are both providers and members. So hopefully I answer that.

And then we have courses for executives and those are nominations by sea level person. They take this and they spend a few days for the cohort and then meet with professors for other aspects of being a manager and how to apply it. There's six weeks of remote education where they break up into teams and they have a capstone project they were going the capstones are all related to healthcare but these teams are across the enterprise. So there's participants with plan management companies they are from optimum care which is our care delivery organization. So they are cross multi-disciplines and they come together as teams. That's another way to build that familiarity. Everybody starts to share in get to know each other and builds trust. So everybody trust each other.

While thank you for that detailed response. The next one comes from a participant I will handed over to Sears for a response. The question is how do you promote public-private partnerships.

What one thing that we did when we set up our relationship at this point, a handful of academic institutions It's, first looking for common ground that's probably the wrong word here. I think. But a common philosophy and a common set of shared interests is maybe at the highest level the best way to think about it. From there we dug in and understood from the capability point of view what each one of our respective organizations expect to contribute. Based on the outcome of those discussions we ended up with what we thought were really terrific relationships that go both ways in terms of helping one another from MassMutual with research relationships and talent development. From a university point of view there's new problems to think about from a research perspective they've got continuous

feedback from a learning and feedback point of U.S. development members go in and out of the course and share what works in practice and what does not. So I think from our point of view it's all about common shared interests and complementary capabilities that allow those partnerships to really be better off when you add these together.
So do you want to ask your question about workforce training strategies and approaches?
Thank you. Getting this full panel as well. We are very interested in lessons learned and how do we avoid making mistakes that the organization has made in the past. If you could mention the strategies or approaches that didn't work at the past or at least thinks that this committee should be vigilant about following those recommendations. That could be very helpful.
Yeah I think we try to customize our capabilities. One thing we thought was going to be helpful is to train senior leadership with their staff. That's a good idea it's always better to chain or train. So it's usually a one on one activity with the senior leader they can ask the questions they want to ask without everybody knowing about it. They can drill down where they want to drill down and move away from topics they don't find interesting. So at sea level there's always one-on-one. For senior technical leaders from principal engineers all oh to fellow these people have the widest latitude in terms of how to upscale and rescale so all the actions that you named are in play. These are senior technical people who have a fundamental desire to enhance their data science and AI capability and they are motivated to do say because they are working on new chip design or software capability and they need that skill to be the best in their field. For people whose primary job is something other than data science. In my initial example I used the sales team. And the next example I will use is the government policy team. These are people who are not responsible for being data scientist they are responsible for advising legislators and other stakeholders on AI. So if you go to the web you'll see Intel's documentation on ethics and privacy are you'll see algorithmic warfare you'll see one coming out in the near future on concentration. So how do these people and policy acquire this knowledge so they can advise legislators policyholders and other stakeholders as well. Generally we do that in a group and almost always we do it face-to-face. The first foundational capability we are building is face-to-face. We do it in a group because we want there to be interplay between people who are in the exact domain space. Being able to hear and share lessons learned so they can take away things they might not have thought of like the person responsible for lobbying is going to hear the person that's responsible for international affairs. And so on. From there we start doing more and more flexibility adding on the face to face foundation. One lesson learned that we found was don't try to start the foundational activity with people who are not supposed to be doing data science is a part of their job in online fashion. Goal is to get these people into the room and help them appreciate what's going on and from that foundation you

can allow them to build on top of it. Where at least they have the basics.
Thank you. Any other panelists who can offer some thoughts on that question?
Here's an important lesson that we learned that's connected to what I said earlier. Avoid islands. We tend to have a group of data scientist that do their data science and engineers the dude data engineering. And the data scientist go there and create these monster models and these monster programs that do analysis then they tried to execute them and they are not executable. There's no hardware that will run those models. So they become useless. The only work for a year putting this together now all of a sudden we've got a year wasted in order to make this production level or utilizable. So, we learned that data scientist need to understand a little bit of what it takes to do computation and at the same time the engineers need to know about the issues the data scientist are dealing with a certain level. So create some intersection across the knowledge field that your dealing with.
One of the things you know I agree with all these comments. I think they are all in additive to one another. I've got two additional things to contribute. The first one is. To get the kind of transformation and impact that I've ink everybody is hoping to get out of an initiative like this. It does take time. It took us a couple of years to get to scale and to get things pushed into production from a systems point of view. And more importantly from an educational point of view to get those systems accepted and used truly at scale. I think time and making sure you've got the right orders of magnitude in your head from an expectation point of view is important. And to make even more effective use of the comments that have been shared. I think when it comes to training it does help to think very carefully about who needs the training. Going back to Melvin's comments about what type of roles are these individuals doing and what impact does that have on the company. We have broken it down on a few different dimensions. Once you get down this tree there's natural ways in which you deliver the training or you don't. And that might sound a little surprising but here's a few examples. Back to my original comments. We start with our you producer of information or are you a consumer. Does pending on how you branch you're going to need different skills. If you're a producer. Going back to what Luis was talking about. You need skills that go up and down that stat. Depending on your role. If you're a consumer you need to know how to interpret and make decisions off the information that is being shown to you through data scientist or through a report. The training that you need to do that level of work. I think you can map onto a spectrum of on one end things are deterministic so a worker is disputing the process. And in that case perhaps the data science is embedded in the workbench that they use and it's almost a prescript of if then, then else kind of scenario. So imagine somebody in a call center they aren't looking at a score and trying to decide in real time how to branch a customer. Perhaps what they get is a recommended decision from the data science model that tells them to do something and on the other end of the spectrum you're

working with managers interpreting data and making decisions related to strategy. In those cases they perhaps need to know more about the methodologies and how to interpret certain results and vice versa with producers. They need to understand who the consumer is. Is it an analyst making a decision and if it is there's going to be a set of skills that those people indeed to alert. And to frame out more and to specify those skills. You can start to say are those fundamental skills? And if they are there's probably institutions that can deliver training across a modality to fit individuals that like Melvin was referring to. Or are these things idiosyncratic. In which case you're going to want to have company specific training embedded into your HR process. I think though in order to get it right you have to get precise it's not a one-size-fits-all kind of approach works
I think a good example of that might be in one space from a different lens in which you can look at it. So data science might look at bias and ethics and will be looking to reverse the data sets that were selected driving training model looking for reflective of an accurate depiction of what the data says but somebody at who is a sea level won't be doing it with ethics. They might be determining whether or not the line of business they were trying to apply data science to, is ethical. So do I want to be in the business of tracking every individual on their cell phone and then reporting it to the government. Someone's looking at that same problem from a very different lens.Thank you Melvin you want to make a comment.
I do. I agree with all my colleagues and all those points. We have created a crisis called accelerate. From IBA to production and from the start making sure you thought out what you're attempting to build. Who's your customer and one of the benefits. Is it and MPS target or is there a cost of reduction and operations. Identifying all the people who are stakeholders. Then there are gate the team would go through. It's meant so you don't make mistakes. If you run into blockers there are executives on that committee who will immediately be told about it. So by the time you get to and NPP. You've got everyplace to go. You can train the end-user to go to production. So it goes through quickly and smoothly. I'm not a huge process person because I like doing things quickly but where you're dealing with a lot of cross functional partners you do need some of the structure.
Thank you all for your comments. Next I'm going to ask you to ask your question. I think this applies to all the panelists in one way or another. So to start us off in terms of providing a response Sears. You can jump in and I will allow Christine to ask her question.
Thank you all for your comments we've learned a lot from you about how did Alec applies to this. How you pick people to train. You haven't talked about how or whether it was easy to get the whole concept of data analytics it's a big hurdle for the department for supporting. I just curious as it easy to get your organization to accept this analytics to support decision-making and if so why do you think it was easy for you and what did you do to inspire them?
Depending on who you ask. I think when we started on our building out for board level and executive team support. That was an initiative

back in 2013 that was deemed critical to the organization. Funding and all of those important mechanisms were put into place. But, when it comes time to actually implement a capability. There's of course change involved. Regardless of where you are if it's public or private or little always be challenging and difficult. Sometimes when you talk about pretty substantial changes things can be more complex. So that is where in my opinion a lot of the bottlenecks come into play winning over the hearts and minds of people who are going to take advantage of these things. We've done a lot of these things to address that. The first one from a process point of view. Like I started off with some of my opening remarks. The way that this work is done within MassMutual is through partnership. So this is never one team forcing another team within the organization to use something that's been built. Ever. That's just not how we do it. We followed structure that lends itself to winning over hearts and minds. Scientific method and we go through a process to answer this question and map it on to the business process they are ultimately going to change in a positive way. And along the way the individuals were responsible for overseeing that process and some individuals to a response for executing it. Participate in that analysis at some level. The process itself has meant and is set up in such a way for organizations baked into it. To address that. We created some pretty simple speaker series events. This is where we allow or where the data organizations make time and space. For partners they've worked with to talk about the success they've had by using the process in the data organization that was built for them. What this ends up doing is motivating other leaders and managers responsible for embedding this kind of work and when they hear it directly from other people in the organization it goes a long way. Letting people hear from a third party. What it's like to do the work.

Any additional comments?

Just one thing that we do. Having a motivated group of engineers giving our employees something challenging then they get rewarded. When you put out a challenge a lot of these run over weekends is there another name for this. Not only do you get some great solutions from problems. We keep our employees engaged. Because if they don't do it with us they would do it was somebody else. They do it not only to learn but also to recruit so keeping that in mind we are constantly repeating, we do that as a means to motivate people.

I would say we have had mixed results. It's very difficult to take a 50 your company focused on silica architecture and then turn them into the data company. We've got people who work here who have spent 20 or 25 years focusing on something other than data science and AI. Providing them and inspiration to come down to senior leadership and the reward system. When senior leaders who don't have the data science acumen. They don't get the influence and the ones with the data science get it and send a strong signal to the corporation that maybe we need to get on board with this. For people who are not on the data science community or in the technical community but have to acquire document around data science. Tweak the reward system a little bit

such that their ability to get the maximum benefit of their efforts in terms of compensation is directly related to their really to internalize the basic foundational elements associated with AI. So there's no one exempt in our company from learning the foundation. So those people who decided for whatever reason are not interested in that. Then they're not going to be able to maximize their compensation it's going to be helpful to provide context. One way we do that is for Intel and if there's any one thing for the data science, they all come to Intel and try to get, well they come to others as well. But they certainly come to us to understand what we are doing for capabilities of minds what we can do to help them lead their objectives. When people who don't have the skills that are asked these questions it puts them in a very serious disadvantage. For driving and inspiring people to get the training and to get on board with this.
We've got some great questions I want to get to. Wendy asks a few. That spans the perspective of the panelists so go ahead and ask a question please.
Thank you I'm enjoying this conversation looking across the sizes of your conversation. Applying data science. When you think about the organizational structure that's enabling the partnership and the collaboration. It sounds like you've created a central data expertise and you've tapped into your partners line of business whatever it is you're helping to embrace, can you talk about the organizational structures you have in place to facilitate and apply your data science across the whole organization to improve your returns.
We have groups of analysts that are placed and working together with regarding the data they are understanding. Now these analysts that are placed there at the department. They come to a simple group of data scientists. So they are further subdivided on different types of analysis or different subsets dealing with. That connects with the data catalog and so on that's more centralized. Then below the data scientists and of the engineering another high-performance for the centralized. It's very organized and very process. It flows from the leaves to the final production.
Are you responsible for all those people to develop their skill sets. Where does your responsibility for data begin and end.
I'm responsible for the more direct responsible centralized part that actually does the data movement and execution of these models. And the data scientists are completed in a different group within the context of data science. So got chunk of the team that does the actual data processing and movement.
Successful data science is driving the development of these types of solutions. The response for understanding the nuance of the business, the one that Exxon and Mobil and a shell do data science has [Indiscernible] How others do AI and data science. The domain experts in the scientists that support them are in the same group. None of them report to me but my primary responsibility is to look across all the five business unit. So I can tell them here's something we've done in data science and financial service and healthcare. Maybe we ought to think about how we do that and apply it to oil and gas and

retail. The reporting structure isn't directly to me but my job is to act as the matrix that allows them to maximize their ability to build solutions specific there domain states.
We are a big organization with a group that's responsible for maintaining the data and some of the individual data storage areas. Depending on datatype. Making the data available to the teams that are needed. We've got a data governance committee dealing with HI and PII. Even these teams have to have data agreement because the data can come from UHC and we are highly regulated on who can look at data even if it's within the UHG. Some optimum care can't use any of that data because of the types of businesses they are in. So then we have multiple data analytic teams and global services and the optimum analytics and enterprise. There's UHC analyst team. That is because of the regulations that they can operate within that group and do the work for that line of business. So it's pretty complicated. And we need to have that kind of structure in place. We've got one group in place that manages the whole datalink and makes it available and gets the data if needed from someplace else. To create the data streams or whatever format the team needs.
If somebody identify estate like to be able to tap into somebody else's data. Do you work that for them? They will go to the data solutions to say I need this. Tell me where it is. Because it's not always known where it is. Take with the depositories then they will normalize it. Normally they have to go to the governance committee to say we want to use this for this process or we've got a consulting organization called the advisory board that consults to hospital systems and providers across the country. What we offer outside the enterprise they might use our data to train models that they would then deploy outside the company. But again they still have to follow the data governance process
So did that come in standardized or did you have to create that.
This has been a long journey it's probably been 4 years and we are still in the journey. Some people will call it the data swamp. Because there's people going back and forth whether it was worth the effort or do we go back to if it's structured. Put in a structured database if it's elastic put it in dupe. There's a lot of discussions back and forth they put out a middle layer and then that layer makes it transparent. We've got a little bit of all of this in our company. The jury is out as to which one is better.
Let's just [Indiscernible]
These answers are curricular to the data science team. Because the people's who's job is to not be a data scientists test their own organizational structure the network organizational structure is one we need to influence as a part of this committee.
Philip. Another question for you to provide a response call a you'd like
Clarify your corporate investment approach to data science. It appears from what you're saying that your organization uses data science analytics as a core investment to continue to get increases elsewhere rather than a short-term investment where you'll get savings and

efficiencies. Can you clarify if this view is correct and what you see in other kinds of companies does it vary from other organizations whether this is an efficiency investment or if this is a core investment and you get the value elsewhere by getting other kinds of business or revenue or benefits out of it versus just an efficiency.

>We see this is a capability with no and it's a core part of the organization intended to deliver value frontline or bottom line and the one thing we make sure we do is start anybody of work with a question or a problem statement with a measurable outcome that can be translated into value. There's a few different ways we can do that depending on the part of the organization your working on.
It's claims and prior authorization and lab results all data it's core it's a part of our company and our process on the care delivery side we are getting more and more into care delivery and data is all about how you and I are participants in our healthcare system how we better treat our members to get a greater outcome so data provides better insight for care pathways. If you're diagnosed with an illness using all historical data looking at the outcomes and treatments what's the best path for this individual. You can't get that anywhere else. But it's going to be a huge part of our business and the transformation health care. This whole thing we are in now X accelerating and I think we all know we are in our homes and telemedicine is being practiced though it was never really allowed but we had to. Need is the mother of invention I think it will permanently change how we receive our healthcare. For the better. Going into the waiting room if you're just on a wellness visit yet there are people in the waiting room who are ill as well it obviously causes potential for you getting infected with whatever you have. Having a communication like this and other AI keep elegies from where you're sitting could be a doctor who is hundred miles away. That's all data driven so it's a quarter of our business.
Intel is all the time. I mentioned it's 2000 16 returning to a data focused company every individual has to internalize it every product create from now on will be focused on data analytics and AI and Intel capital is the largest enterprise in the planet which buys and invests in artificial intelligence and data science so it's being used for efficiencies and supply chains and partner relations. Every one of those protocols and of course all the innovation we are predicting going forward. It's based on our understanding of data science and AI. The same goes for target. It depends on predicting where products are going to be needed and what products are going to be sold. This core part of the business.
Thank you to all of our panelists provided really important information in the use of data science and data analytics. So this is available to the committee's work. Thank you and also remind everyone that we are taking a break right now and we will convene again at 4 PM East Coast time.
[Captioners transitioning] [Captioner standing by]
Welcome back, welcome back to our final panel of today's workshop.

Panel 4 educating and building data science teams. Before we get started with the introduction of the panel on the panelist I would like to remind the committee members to please put any questions that they have in the Google Doc, and to everyone joining us on the webcast, please feel free to enter your questions on the web cast website, we will incorporate those as much as possible in our moderated Q&A after the panelist speak.

The goal of the panel is to learn about additional efforts to educate and train data analyst and scientists. In particular how to build teams with data capabilities. When we were preparing and talking to the panelist we asked them to think about the following questions. Where can the Department of Defense go for help to upscale their acquisition workforce and data analytics? What data signage training and education models exist for employee training and upscaling X what are the characteristics and portfolio skills of successful data science and how can supervises who have non-technical backgrounds effectively manage data science projects?

We have joining us for the last panel a diverse set of analyst with really rich experiences with respect to those three primary questions. Each panelist will give a few minutes of comments and then we will open it up to moderated Q&A.

The first panelist is Dr. Marianne Watson. She joint defense acquisition University in 2012. She leads the directory charter to optimize user experiences and the DA platform. Most recently she led a project team for transformational initiatives, including wrapping prototyping of credentialing for critical acquisition skill areas. Thank you for joining us.

Thank you very much. I have an upgrade, I do not quite have my doctor yet. Not even close. Thank you for the upgrade, I appreciate that.

Our apologies.

That was wonderful. Everything else is true I want to thank you for inviting us to be able to hear the rest of the discussion. I am looking forward to the parts that I have missed, the recorded version. I was thinking about the context of going first on this panel. And it struck me that probably the best perspective is starting with the end in mind. And as the rest of the panel, I am generalizing here, they come from academia, I find myself in a humbler position of a corporate trainer. In defense acquisition. Even though we have the U we are corporate trainers. And it is the endgame of all the learning that one might do, and really thinking about how to apply data science and analytics, and the advancements with the integration of AI. Andy acquisition environment perhaps we are the book stops I will not say that folks do not jump from the academic environment right into problem-solving for the department, but we are at the point in our journey where we are looking at better ways to integrate what comes from university setting, especially now, I will use this discussion that I have an advance copy of, not everything has to be a degree. Training certificates, chunks of learning that can put people on a learning curve to appreciate data science, and factoring that into their work life. It is certainly a present way of solving some of our

business problems that DUA helps with and that is the context where I come from, how we curate perhaps where a lot of others already do.
What we are focused on right now, is providing the context and just a little bit of these comments focused on a transformation from an organization that has been delivering learning and development in a structured way with a three level certification construct for certifying and qualifying acquisition professionals, moving away from that, toward generation 2. And how we want to deliver talent and development, and we are doing this for a couple of reasons. For the data analytics told us this is the right thing to do based on feedback from customers and stakeholders. And it is ironic doing our own analytics got us to the point we need to do more.
And also the frost's of the national defense strategy pick -- focusing on greater performance and be more attractive. This is a quick carting that shows the way we currently develop our town, we train people with a lot of huge inoculation of learning upfront within the acquisition career. It is one-size-fits-all, three levels. This is a characterization that at year six you are at level III. I hope you remember all the stuff you were taught because you will need for your career. And so the next chart talks about the new concept. This is because of the feedback I mentioned from our customers I will use this as a segue to talk about analytics and when they come into play.
We are seeing more valid ways to think about today's workforce, more importantly tomorrow's. There's a very lean core that all acquisition professionals need. And so we want to dwindle down the mandatory upfront training to the core. And instead focus on preparing people to do their jobs weird and since jobs have variations in what is needed, one-size-fits-all training really has been a force to fit for the 15+ years we have been doing it. It has evolved over time but in its evolution, it has gone loaded. As we add more topics because we need more differentiated, we pile that on for everyone. This idea specialty learning is being enabled by our adoption of this idea of credentialing. Which Rebecca mentioned. We have been doing a pilot program for about eight months with a couple of credentials. Using that term fairly loosely. I think in the current one they are micro certificates, or micro credentials at least. We are focused on some of the critical skills and if added to a person's performance, could it make them excel and do better in terms of their acquisition outcomes.
That specialty learning may consist of courses, some experiences, and selectively some credentials. This is where we have been thinking there are some individuals, especially in the technical fields, where topics like artificial intelligence, engineering, data science and analytics, they could become things that we want to curate or offer, depending whether there is content out there. This is an example of the workforce today. Some of the topics that we see as being some of those areas -- niche is probably not the right word. Curated and specialized areas based on people's jobs.
We do not want to limit it. The screen box talks about the idea that folks want to continue to grow. You may be in our tequila job, I'll use myself as an example -- a particular job. I worked with program

acquisition before I moved to this active duty for 28 years as I got more senior I really did needed to understand systems engineering and contracting so fundamental to the success of the program managers. I needed to learn about that but I was never going to go deep and it was more to understand context. So that is where this idea of currency and breath fits in, and it's in terms of data science. I will ask as we have our discussions, think about not only building those valid science teams, but also building some cognizance and some -- I do not wanted to be superficial by some soup level awareness of the context of why you need to understand where data science fits in and analytics can help you in your program. That is where we might have some later level credentials are training certificates related to raw data scientist to know about it.

It all comes together on the next chart. This shows the model where the blue is a representation of that lien, basic acquisition and unique about it. And depending upon the job that you pick her take, you build your body of knowledge and skills based on that curated and tailored ability to learn what you need to learn. And so this will not necessarily be all and the class, more online learning, and DUA will not create it all. We use some for example as a platform to provide learning. Postgraduate school, Army logistic University. Sister organizations. Offering content that we can provide links or pointers. All of those small pieces together will build that body of knowledge and skill that folks will need across their jobs. That is where we are heading.

This gives you where we have been focusing more specifically on the topic of not just data science, but data literacy in general. Within our existing curriculum, there are a lot of courses, there are a lot of tools that we make available that use analysis. But not to the extent that I think these conversations have been about, what the universities are teaching in regard to this body of work called DS science. And I think this is important to show that we do have a work horse that appreciates the importance of data. The importance of analytics that get to the root of what the data can tell you about a program, or a part of a program, or re-situation. We can build upon that. We have folks that we teach critical inking. We have folks that we teach analytical thinking. Building upon that, means you do not need to do crawl, walk, want to get to this community. We can start the walk level perhaps. In some cases we can start with folks that are at a job, because they understand analytics. But there is some stuff they do not know and they build upon it. In that perspective, I think I can be factored into different dimensions that we can use to create the kind of content the community is looking at.

Where we are today, we are broadening the focus. Certainly data science would be the foundational learning. Again I mentioned course sir. We have had several program offices, DUA does not only instruction but we provide job performance enhancement tools that we have a website with a bunch of tools, and something that -- I am now responsible for that. Curating our content, providing links, and awareness of related content. So we do not need to be the inventor of

everything we provide. And certainly providing that basic training is something that we do. We also do consulting, and we have several large programs. [Indiscernible - low volume] they have come to us because they really want to advance their use of data analytics. So we have given them access to course sir, in touch with some subject matter experts to help them out. And that is a big picture of data science. Then I talked about some of the existing analytics we already have in our curriculum. So where we see opportunities, we have done some of the credentialing and some of the training certificates. We are using [We are using [Indiscernible] of engineering, creating a credentialing on engineering. A system of systems engineering. Looking at a mission level instead of always starting at a system level and working the requirement allocation. Things like cybersecurity are really important agile methods, and a study that is wrapping up in May, with circ, and we asked them to look at where you should be heading with content, either curated or created by us and we are we kidding content where things are unique in the environment, but we cannot find the content the way that we needed to be. So that would be the case when we create content. We have asked to get advice from from digital engineering, and data science. That will be culminating in May with the recommendation. I think it it's nicely with the timing of activity.

Already we have a draft of would like to include in a credential. We will marry that up with the circuit device, going on a credential analytics in the May timeframe. We have a lot going on, and this idea of credentialing sink ways well -- segues well with the topic the final piece I have, one of the things that we are trying to teach the work force today, more than ever, especially because the national security strategy, is to be adapted. I love the idea that data analytics, while it is nothing causes you to oriented the data is telling you. And then having that orientation. This data that I analyzed should cause either me to decide my current course as valid, it validates my strategy. Or it causes course correction. Either way, it is that adaptation that we are trying to bake into. And I think that it analytics fits. I am so happy to be a part of the conversation. Thank you.

Thank you, that is very helpful. Congratulations on the new role. I love the idea of the chiclet model. That should be a trademark phrase moving forward for DUA . Our next speaker is Dr. Darrell honor. He is the director of the Air Force Institute of technology, scientific test and analysis technique center of excellence. He is also the professor of operations research, program and curriculum chair, as a Danna analytics and science program for director of the center of operational analysis at Air Force Institute of technology. Thank you so much for joining us.

Thank you. Welcome. Thank you for having us talk in this forum. I have a unique perspective that I am a professor, but for the last 18 years I have run the scientific test and announce technique center for supporting major acquisition programs. It gives me a unique perspective as we were building the data analytics and data science

programs. Here at -- we have two different entities at -- AFIT. I am the professor within that. And so we have different departments. Why do I say six different departments hearing this forum X we believe that data analytics and that is sciences inherently and multidisciplinary subject. And so we approach it from that standpoint. We have had several different programs that we have been working on which I will talk about. But in addition to the graduate school we also have up rational continuing education school. So earlier today, the Air Force officer talked about her courses. Those are those one week courses that typically come out of the professional continuing education schools of which we have that three schools listed. I will focus on the school systems and logistics, because that is school but I collaborate most with data analytics and data science heard

The other thing, after 22 year career within the Army, I have an appreciation within OSD, and how we get educated out to the workforce. Military and civilian. I have had many opportunities for my career, and we are looking at the best modality to get the different types of education and training with continuing education out to the workforce. Again just giving you a sense of the lens that I am looking through, as we are developing these programs.

through, as we are developing these programs.

And so we have these different programs different programs from an academic side you would call each one of them a program. The first one is you would call each one of them a program. The first one is the rational continuing education effort. The short courses which The short courses which the Air Force officer invested early. Along with some early. Along with some of the headquarters personnel folks. And the logistics side. Again you are looking at the data analytics And the logistics side. Again you are looking at the data , the data science or in a different domain and in a different domain and so what they have done is to develop these short courses and you will see that to develop these short courses and you will see that we are looking at educating many with the short courses. with the short courses. And we are also looking at a very broad audience of data analytics,at a very broad audience of data analytics, or text and are -- these are these one-week short courses that fit the these are these one-week short courses that fit the need of just bringing them up to histhem up to his speed very quickly. Having them apply that to their current job.

The next one is apply that to their current job.

The next one is that data analytics certificate. In coordination with the chief data officer and thecoordination with the chief data officer and the headquarters studies and analysts folks. We have developed these other categories folks. We have developed these other categories of graduate education. Data analytics certificate is five courses. analytics certificate is five courses. We are on the quarter system here AFIT. Folks in a web-based design take these system here AFIT. Folks in a web-based design take these five courses, to cover the breath of the data analytics. Andof the data analytics. And if they so choose, if they do well with that program, they canthey do

well with that program, they can move on eventually to the Masters of data analytics.Masters of data analytics. Once resources catch up with us to be able to offer this again, it will be a web us to be able to offer this again, it will be a web based program is for the quarter Air Force.quarter Air Force. Those two programs you will notice that we are not focusing on the scientist and engineering community, but the border notice that we are not focusing on the scientist and engineering community, but the border Air Force who have had fairly good college algebra grades fairly good college algebra grades when they went to get their bachelors degree. And they want to go off and get a Mastersbachelors degree. And they want to go off and get a Masters or a certificate in Masters in data analytics. in data analytics.

The fourth column is the data signed certificate. data signed certificate. Let's say you will notice most of our programs at AFIT of our programs at AFIT engineered base. As for the engineer, computer engineer, those types of folks that come for those degrees here AFIT, , computer engineer, those types of folks that come for those degrees here AFIT, but also want to get a little bit of a flavor of data science before they leave. They take these little bit of a flavor of data science before they leave. They take these four courses and in data science, in addition to their original degree. in addition to their original degree. They also have a data science certificate when they leave. And so again certificate when they leave. And so again it will not make them data scientist, but it will give them a good sense for where data sciencescientist, but it will give them a good sense for where data science fits into the larger picture.

Finally the Masters of data science and PhD

Finally the Masters of data science and PhD in resident programs. Signs and engineers are the ones that were focused. and engineers are the ones that were focused. Much more theoretical and algorithm-based programs that we would do in-house -based programs that we would do in-house as opposed to the tools andtools and not violating the assumptions of using those tools that we do on a web-based learning. using those tools that we do on a web-based learning.

And so unlike many of our programs will we get a requirement from headquarters, you can go back one. When our programs will we get a requirement from headquarters, you can go back one. When we go -- unlike many of the other programs will we get a requirement from the Air Force, and that of the other programs will we get a requirement from the Air Force, and that requirement flows down we create a program to meet that requirement, based on the national defense strategy and some indications from program to meet that requirement, based on the national defense strategy and some indications from senior leaders, we were asked if we can develop a data analytics data science program. we can develop a data analytics data science program. Will that present some challenges. Who are your stakeholders? Who are your stakeholders? Who decides what is in it and what is not in it? What are theand what is not in it? What are the part of the Air Force

that you are working with then? So that you are working with then? So this slide captures the data analytics ecosystem within data analytics ecosystem within the Air Force. We have different kinds of analytics. We throw that word different kinds of analytics. We throw that word analytics output varies greatly depending on who is doing what, the problem they are trying on who is doing what, the problem they are trying to solve. The inner part of this triangle is basically the chief of this triangle is basically the chief data officer, up top. The chief information officer usually controls the networks and the transfer station, and storage chief information officer usually controls the networks and the transfer station, and storage of the data. And the chief analytic officer which again measures chief analytic officer which again measures the analysis that is conducted within the Air Force.

within the Air Force.

The one way to look at it, is to look at those stakeholders and it, is to look at those stakeholders and collaborate closely with them, which we did. But also we want to go did. But also we want to go to the outer fringes of the triangle to say, what is the greater community?triangle to say, what is the greater community? The personnel community within the Air Force was asking for this capability. The Air Force was asking for this capability. The logistics part of the Air Force was asking for this capability.Force was asking for this capability. The intelligence and of course obviously the acquisition part of the Air Force obviously the acquisition part of the Air Force was asking for this capability. What are the similarities andWhat are the similarities and differences of those stakeholders, and what kind of analytics do they actually conduct? And how do you what kind of analytics do they actually conduct? And how do you create programs that can adequately support what they adequately support what they are doing?

In the Air Force we are capped at Air Force we are capped at a certain number of military members. We only have so many civil servants. And soWe only have so many civil servants. And so to think that we are going to go out and just increase our going to go out and just increase our numbers drastically, in hiring analytics, andand data analyst and scientist off the street, and compete with the previous panel companies, probably is a stretch.the street, and compete with the previous panel companies, probably is a stretch. We need to look at maybe increasing some and having internal organic data science maybe increasing some and having internal organic data science programs for mostly military members who come through AFIT. Also datacome through AFIT. Also data analytics distance learning programs to capture the capture the career agnostic data analyst, not enough beta analyst job per se. They are theenough beta analyst job per se. They are the personnel -- they are whatever that career field is. Who would also like are whatever that career field is. Who would also like to learn more about data analytics.analytics. And so that is how we looked at the stakeholder analysis, and decided to come up with the programs that we looked at the stakeholder analysis, and

decided to come up with the programs that I showed you on the previous life.
Finally from an academic sense,life.
Finally from an academic sense, we are already having an operation research program.operation research program. Isn't data analytics and data science just operations research X that is a waste and we got science just operations research X that is a waste and we got many times from senior leaders. And so from an academic standpoint you can step back and think about And so from an academic standpoint you can step back and think about that. There are very strong similarities.similarities. And many operation research analyst out there in our Air Force that do great work as data scientist. out there in our Air Force that do great work as data scientist. But typically as classically trained data scientist they are not classically trained to be a data scientist. trained data scientist they are not classically trained to be a data scientist. And so we have done the commonality and the difference that we will create new the commonality and the difference that we will create new programs and what is the differences in those programs. This helps differences in those programs. This helps us to focus on what we are doing.
For instance in the data analytics are doing.
For instance in the data analytics program which is the best web-based program that goes out to the larger workforce, we haven't program that goes out to the larger workforce, we haven't emphasis on introduction course on the the DM model. And how to frame a data analytics problem because many folks do a data analytics problem because many folks do not know how to frame a problem word you need to have a this is understanding,problem word you need to have a this is understanding, they have that process knowledge because that is what they typically work in. Now you have a senior because that is what they typically work in. Now you have a senior leader who has an issue that they would like to address, and how do you go about methodically putting that that they would like to address, and how do you go about methodically putting that into a study framework, building 18, and attacking the problem?and attacking the problem? They need to know how to use certain tools, and they need not to violate the assumptions of using to use certain tools, and they need not to violate the assumptions of using those tools. Whereas the data scientist, they have a little bit more of the first principles scientist, they have a little bit more of the first principles of the mathematics of data science, teaching them a little bit more aboutscience, teaching them a little bit more about the theoretical optimization, being able to builtable to built analytic tools on their own, as opposed to using off-the-shelf analytic tools. as opposed to using off-the-shelf analytic tools. We would like both of them to be able to do programming and Python. That is a change.to be able to do programming and Python. That is a change. But we want them to be visualizing data, and understand be visualizing data, and understand how they can go through the process. But we still need the operations research community to process. But we still need the

operations research community to do the modeling and simulation, the economic and cost analysis,economic and cost analysis, the decisions analysis, the probability models. models. As we went out and looked out the stakeholders, especially the acquisition, and what does a dataout the stakeholders, especially the acquisition, and what does a data analyst or scientist do within the acquisition world? the acquisition world?

It is helpful to look at what we do as of government, with an acquisitionat what we do as of government, with an acquisition we do a series of assessments. assessments. We have the planning assessment, which we also do budgeting. We have the development assessment we also do budgeting. We have the development assessment where we decided to create a program and now develop that acquisition program to program and now develop that acquisition program to an end result. And then we have an operational assessment.we have an operational assessment. All of those have feedback loops. In the earlier loops. In the earlier panel I was very pleased to see from the D.O.D. side, each one of those see from the D.O.D. side, each one of those three things up assessment were actually captured. That captured. That goes to what type of analysis you are doing. And the needs of the stakeholders. I will stop you are doing. And the needs of the stakeholders. I will stop there. Thank you.

Thank you so much, very interesting. Very nice.you so much, very interesting. Very nice. Our third speaker for this panel is Dr.panel is Dr. Jackie Sung, progressive sung department head of information systems and quantitative science. And the head of information systems and quantitative science. And the endowed professor at the Rawls College of business, at Texas Tech University. HisRawls College of business, at Texas Tech University. His primary area of research is innovation and information systems.innovation and information systems. Specifically research issues include the development and diffusion of information technology, and social and economic consequences as well development and diffusion of information technology, and social and economic consequences as well as statistical and confrontational techniques of data science. Thank you so much for of data science. Thank you so much for joining us.

Thank you. I am from the different background, I am from the different background, as mentioned. It is my honor to speak today. honor to speak today. Let me give you some background on my education background on my education my department as we discussed so far, has accumulated big data.so far, has accumulated big data. The research center and business intelligence from 2008. business intelligence from 2008. We started with a Masters of science degree in 2015.of science degree in 2015. All of our process developed to make the program. developed to make the program. Our department is marketing area consisting of information technologies, area consisting of information technologies, operation management. In the program many of our information faculty membersmany of our information faculty members have been involved in teaching our courses. Some professors like myself have our courses. Some professors like myself have economic

backgrounds. Others have computer science, industry engineering,science, industry engineering, or psychology backgrounds. Collectively we have different delivery.we have different delivery. Face-to-face, and online. It is a one-year intense program, however is a one-year intense program, however many of the online students have full-time jobs, therefore the program can be extended for 2 years have full-time jobs, therefore the program can be extended for 2 years for online students. Our program rated the 13th of the most program rated the 13th of the most -- in the Masters program. In the current cohort we have about 80 students. In the current cohort we have about 80 students.

We also offer certification programs for someone not in the program heardcertification programs for someone not in the program heard to get the certificate, student needs to take the five courses, database, datastudent needs to take the five courses, database, data and management, [Indiscernible] big data strategy and decision] big data strategy and decision theory class.

I want to talk a little bit about the education for employee training.to talk a little bit about the education for employee training. The education program at the college is in line the college is in line with we discussed so far. We are emphasizing to increaseWe are emphasizing to increase data, technology, and communication literacy in order to improve the quality of the decision-making based on in order to improve the quality of the decision-making based on ethics and leadership. We offer 12 different courses and three different categories. 12 different courses and three different categories. To increase, we offer database languages, languages, agency intelligence and big data security courses and security courses and analytics. Machine learning and simulations and optimization. As simulations and optimization. As I mentioned I am from -- we have courses related to -- we have courses related to management. Including big data signs, management, signs, management, big data strategy and decision theory course. Students are improving theory course. Students are improving to have competencies of data science by not only taking the courses we are offering, but alsodata science by not only taking the courses we are offering, but also participating in various events, including [Indiscernible]. [Indiscernible]. We are in the process of building a capstone with some companies. Andof building a capstone with some companies. And they will be our strategic partners. Every one will have partners. Every one will have real data, and groups of our students will develop projects and present to their projects our students will develop projects and present to their projects to those companies.

In the process, each group will continue to process, each group will continue to communicate in the company. And through the process students will And through the process students will learn how to interact with their clients. I believe this will createtheir clients. I believe this will create having partnering education. As I mentioned one of the keyAs I mentioned one of the key different things from other schools is that we are including management security

courses.is that we are including management security courses. The reason why we are doing this one isdoing this one is related to the question, that we waste at the beginning. How can supervisors with non-technical backgrounds that we waste at the beginning. How can supervisors with non-technical backgrounds effectively manage data projects? As we know, most of those data scientist haveAs we know, most of those data scientist have heavily relied on technical and analytical precursor.and analytical precursor. Yes obviously we cannot perform any data related project without havingperform any data related project without having it. The question we have having such a -- is it have having such a -- is it enough to be effective? To manage data team, manage data team, does it mean that all supervisors should be programmers? Or statisticians?should be programmers? Or statisticians? Let's think about who are the consumers of the data, or are the consumers of the data, or analytic monitoring. From our standpoint, again from the college of business standpoint,again from the college of business standpoint, they are managers. Many managers are not easily able to givemanagers are not easily able to give technical details because many of them are not training data science. them are not training data science. What are the outcomes?
They are not able to determine benefits of outcomes They are not able to determine benefits of outcomes of analytics. Therefore we think supervises of think supervises of data science team should have some other non-technicalother non-technical securities in order to clearly communicate with managers, as well as managecommunicate with managers, as well as manage data science team. Because in many case, the supervises in many case, the supervises will effectively
[Indiscernible].
What
What are the skills the supervisor needs to have one way we can create the most to have one way we can create the most effective team. We think supervises should be initiating data science culture.should be initiating data science culture. To do so, supervises need to create and integrate a to create and integrate a diverse team. As mentioned, data science can have a silo.data science can have a silo. We do not want to hear that.hear that. What do you do with the team after spending billions of dollars? At the end you want to see much the team after spending billions of dollars? At the end you want to see much value realized and created. Therefore supervises and data science team should jointly decide whichsupervises and data science team should jointly decide which problem to focus on. Supervisor or focusing on building teams of people,Supervisor or focusing on building teams of people, who can work together to serve difficult problems, and alsoserve difficult problems, and also explore opportunities. As we know many study shows that diversity trumps the know many study shows that diversity trumps the ability and [Indiscernible]. As mentioned, As mentioned, data creates transparency and delivers insight that can be insight that can be unexpected, uncomfortable, or -- so supervisor needs to fully appreciate andso supervisor needs to fully appreciate and

inconvenient outcome, and treated as the -- rather than simply the -- rather than simply thinking or in academic concern. Even though supervises a not savvy to Even though supervises a not savvy to dash she they should be able to create effective solutions. The key point is thatbe able to create effective solutions. The key point is that supervisors should be excited by what they're team members can do.what they're team members can do. To do so supervisor needs to build and engagingto build and engaging environment make it possible that team members are comfortably sharing their best ideas. All team members are comfortably sharing their best ideas. All those things, the supervisor data science team creates a culture data science team creates a culture to connect the team, and design most effective teams and develop high and design most effective teams and develop high performing teams. Under this kind of understanding, that is why we are emphasizing of understanding, that is why we are emphasizing to provide and offer non-technical courses to the data science team. courses to the data science team. Thank you.

Thank you very much. That was a great inside happening you very much. That was a great inside happening in the business college for data science. That is a very interesting and data science. That is a very interesting and valuable perspective. The last speaker for this power before we open to the moderated Cascofor this power before we open to the moderated Casco -- Q&A. He is a member of the teaching faculty of information and computer sciences, at the a member of the teaching faculty of information and computer sciences, at the University of Massachusetts. He also serves as the technical directory of community initiatives for the center of data scientist.serves as the technical directory of community initiatives for the center of data scientist. Before joining, he cofounded data intensive social media startup focused on data intensive social media startup focused on serving social good organizations. Thank you so much for joining us. you so much for joining us.

Hello, thank you for having me. I me. I have kind of a strange resume for academic, I havefor academic, I have ping-pong between the private sector, and academia throughout my career. Actually and academia throughout my career. Actually can I get the next slide? I think the one common link between some I think the one common link between some of the different chapters, has been the goal to sort of data science isbeen the goal to sort of data science is noses in other people's business in a way. The common in a way. The common thread is there is a lot of different sectors and industries that have been undergoing this kind of lot of different sectors and industries that have been undergoing this kind of data revolution. Throughout the 90s we learned how to collect data, and at some point we learned how to collect data, and at some point we collectively woke up and realized we collect data but did realized we collect data but did not really ever do anything with it. There has been a push for a data driven it. There has been a push for a data driven decision-making, some industries quick to do with others not. And my do with others not. And my goal is to find ways to apply what we call data science.

And in different apply what we call data science. And in different areas. areas. Just a little bit about that. The UMass ,that. The UMass , College of information, for data science. The college itself has aboutdata science. The college itself has about 1500 undergrads, and undergrad major Sensex undergrad students.undergrad major Sensex undergrad students. And then we have a PhD program as well. PhD program as well.

One of the things that I do at UMass, I do at UMass, from teaching data structures and AI, I am involved in a number of programs that are I am involved in a number of programs that are doing outreach, and working with organizations that do not traditionally have a data centric focus. Iorganizations that do not traditionally have a data centric focus. I run a program that runs in the summer for graduate students in which we pair with some outside organizations.in the summer for graduate students in which we pair with some outside organizations. This can be a public agency, a nonprofit. Actually attempting to do agency, a nonprofit. Actually attempting to do it this summer in a virtual and distributed action.virtual and distributed action. For instance we are working with the VA on a natural language processing project that will with the VA on a natural language processing project that will take medical records, and help clinicians summarize what they have clinicians summarize what they have seen, finding trends in different patient populations, the sort of thing. Working with the appellation patient populations, the sort of thing. Working with the appellation Mountain club, and they are really interested in how they can possibly model really interested in how they can possibly model the carbon footprint with people using their different lodges and facilities acrossusing their different lodges and facilities across the eastern part of the U. S. We are doing a project with a U. S. We are doing a project with a small startup, doing what is called controversy detection.is called controversy detection. The project we do with them is focused on looking at publishthem is focused on looking at publish -- things like the phrase break news. Can we detect the value phrase break news. Can we detect the value on the validity of information through a number of sources and take weeks? These all through a number of sources and take weeks? These all projects with UMass is reaching outside of the university, we are trying to get students some experience working outside of the university, we are trying to get students some experience working with these organizations. I am also API for a similar program that is fun for undergrads. This is also API for a similar program that is fun for undergrads. This is a consortium of five colleges in the immediate area around Amherstthe immediate area around Amherst . We got together and have teams of undergrads. Working with outside partners teams of undergrads. Working with outside partners and things like that.

As far as my role, I do things like limited -- I As far as my role, I do things like limited -- I am the committee. Financial certification and another group which certification and another group which offers financial certifications for people, so directed learning. You take

apeople, so directed learning. You take a an examinee get a credential. In terms of discussion, In terms of discussion, I want to focus when I think of some of the necessary skills to I think of some of the necessary skills to be focused on. And for different practitioners.different practitioners. We have this little line here, this gets back to what Jack said about here, this gets back to what Jack said about the idea of what supervisors need to know, versus the doers, versus the overseers.to know, versus the doers, versus the overseers. The things that I put here, real cursory, here, real cursory, high-level view. My experience working with different groups, I have seen things likewith different groups, I have seen things like at the very least, often times datatimes data wrangling, data handling skills. Many groups getMany groups get held back. The finance team do things using team do things using this spreadsheet. But the sales and marketing team coming out of database. We do not have and marketing team coming out of database. We do not have a way to share data. Often times having someone coming inOften times having someone coming in that can manipulate data and transform it can be extraordinary helpful. So thosetransform it can be extraordinary helpful. So those practical skills, how to clean data, how to handle data, how to handle data coming in in different formats. And to poke around. A lot of the And to poke around. A lot of the organizations that I have been, often data stores with deep dark sellers.data stores with deep dark sellers. And often institutional memory gap. So I am not sure So I am not sure what is on the table, Bob used to look at that but he has been gone for Bob used to look at that but he has been gone for 5 years. Being able to come in and look at data, try to understand what is there, what is not come in and look at data, try to understand what is there, what is not there. That is really important. And then you get to the more interesting things.And then you get to the more interesting things. Building predictive models and other machine learning techniques. Even machine learning techniques. Even if you do not know the ins and outs, you will not be coding, you are not building the the ins and outs, you will not be coding, you are not building the statistical model. But as a manager people need to understand at least have manager people need to understand at least have -- having a basic knowledge of the kinds of techniques and what is possible and what is not the kinds of techniques and what is possible and what is not possible. That translation is often what is missing.often what is missing. I have worked with groups that think they need some cutting-edge like deep learning solution, but what they really that think they need some cutting-edge like deep learning solution, but what they really need is someone with good python skills to manipulate data. I havepython skills to manipulate data. I have people coming from the other side,side, they think a very simple task would be to program some models that essentially istask would be to program some models that essentially is [Indiscernible] making decisions for them. for them.

Understanding how to ask questions of data, how to answer questions,

how to interpret different statistical results, of data, how to answer questions, how to interpret different statistical results, this is important for supervisors and managers.and managers. The basic idea about the scientific method and how you go about using data to answer questions. Coming up with scientific method and how you go about using data to answer questions. Coming up with a hypothesis of falsifiable hypothesis to explain something you see. And see if the datato explain something you see. And see if the data bears that out. The last piece I think is really important. The piece I think is really important. The knowledge for everyone involved, and the assumptions, limitations, and the assumptions, limitations, and things that can be baked into different techniques. This is an ongoing areadifferent techniques. This is an ongoing area research in and of itself as we have some credit models and machine learning. as we have some credit models and machine learning. But how we explain what they do. And there are some practical reasons for this.do. And there are some practical reasons for this. People do not tend to trust a black box of the model or trust a black box of the model or things coming out of it. And then we have some ethical reasons. How do then we have some ethical reasons. How do models work, or how or assumptions made? Are they assumptions made? Are they feeding back to undesirable feedback loops X understanding feedback loops X understanding the issues is important for everyone involved. I am coming from a computer involved. I am coming from a computer science background, and people in my field too long think of themselves as a builder of the platform. my field too long think of themselves as a builder of the platform. They do not think of the other things. I think that will and it didother things. I think that will and it did not that I want computer scientists are technologists asking Branson questions, scientists are technologists asking Branson questions, but they should provide information. And informing. And letting policy makers And informing. And letting policy makers and deciders figure things out, coming from a place of knowledge.
, coming from a place of knowledge.

  I just listed out a few touchstone examples that few touchstone examples that I have personal experience. Maybe not the first one. Maybe not the first one. They made a movie about it and I wanted to included and I wanted to included this is the theme I see over and over again in my career. Different industries are starting to get over and over again in my career. Different industries are starting to get data driven, or even if not, they feel the need.not, they feel the need. The nonprofits I work with, the private sector. They often come to me with the the private sector. They often come to me with the same stir. Our board really wants us to use data science. Or they want us to wants us to use data science. Or they want us to use data driven decision-making. We are really not sure what that means but we need to get some. So are really not sure what that means but we need to get some. So I think this is the story that I am seeing over and over. Politics is story that I am seeing over and over. Politics is increasingly dominated by statisticians and machine learning experts

doing Marco targeting.and machine learning experts doing Marco targeting. Whether this is a good or bad thing, I have my own doubts. or bad thing, I have my own doubts. Certainly the financial sector is always something that is one attentive.something that is one attentive. But as a colleague of mine who works in finance, he said to me a few months mine who works in finance, he said to me a few months back, we used to keep all the computer science machine learning people down in the basement. And now all the computer science machine learning people down in the basement. And now they have the office on the same floor with the regular analyst. I guess the same floor with the regular analyst. I guess that is progress. Other aspects of businesses, insurance sector.of businesses, insurance sector. Helping with sales and marketing. And they are really changing the And they are really changing the way they operate using data to make decisions as opposed to this is the way we do it.to make decisions as opposed to this is the way we do it. Echoing the previous analyst. Often times you come up with things that times you come up with things that are inconvenient. When I worked in insurance when I first had in insurance when I first had my project, my conclusion was that I can make the company $1 million per quarter they I can make the company $1 million per quarter they asked how. Cancel your direct marketing activities for the next few months obviously that marketing activities for the next few months obviously that was not going to happen. But these things come up. And as I mentioned her,But these things come up. And as I mentioned her, a revolution of mama -- nonprofit. Even groups who were-- nonprofit. Even groups who were directly helping people, funders increasingly wanting more data collected. increasingly wanting more data collected. More proof that what they are doing this actually having and having an impact.are doing this actually having and having an impact. It is one thing to tell a good starting on an annual report, but increasingly people want numbers to make tell a good starting on an annual report, but increasingly people want numbers to make sure the stories true. And I think these groups are trying their I think these groups are trying their best to find ways to do that.

That is all I have.

that.

That is all I have.

Thank you very much so we have several questions that are coming so we have several questions that are coming in from the adjustments on the committee members. I the committee members. I am going to start us with a committee member. From the University of Oslo.a committee member. From the University of Oslo. Would you like to ask your question?

Sure.your question?

Sure. Thank you very much for the panelist.for the panelist. My question is, having a different population of students.a different population of students. , Panelist perspective, how many students have taken a career in acquisition?students have taken a career in acquisition? Has the program equipped with sufficient knowledge?

with sufficient knowledge?
I can give you a quick quick top level, based on the number of decisions that are coded as working in of decisions that are coded as working in defense acquisition across all the services and the agencies. services and the agencies. 175,000 physicians that touch acquisition in some form or fashion. acquisition in some form or fashion. Contracting ecologists, system engineering, things like that.like that.
Thank you.
I believe what has happened historically in the I believe what has happened historically in the 90s, where a lot of analytic capability with an acquisition, especially down analytic capability with an acquisition, especially down at the program level, it was saved if you will. Those decisions were done was saved if you will. Those decisions were done away with. The -- there has always been a strong there has always been a strong -- operation research, the way I showed in my slides for there is way I showed in my slides for there is always been a strong operation research presence at the planning,presence at the planning, the OSD Cape office up in the Pentagon. Those types office up in the Pentagon. Those types of elements. But I think as you get further down the acquisition, I as you get further down the acquisition, I think you see less and less of the data analytics capability currently.of the data analytics capability currently.
And to answer the other part of the question.other part of the question. Most of our students at AFIT or military members. And many of them are engineeringAFIT or military members. And many of them are engineering elemental disciplines. Which go straight into the acquisition field.go straight into the acquisition field. And typically I would say wall they are very strong engineers, they usually do wall they are very strong engineers, they usually do not have a very deep understanding of statistics, understanding of statistics, and the data analytic signs elements that varies from person to person.elements that varies from person to person. But we do not really get as many within that data science certificate get as many within that data science certificate as we would like. And so with the removal of that element in the with the removal of that element in the bin 90s, and that not changing over time, and with changing over time, and with the engineers not really being strong in statistics, I think there is a gap that we as in statistics, I think there is a gap that we as a service need to look at.

> Thank you very much. Our next question -- I am going Our next question -- I am going to combine the two committee members interested in hearing about data members interested in hearing about data acumen, in contrast to holding more specialized skills are technical skills. specialized skills are technical skills. I am going to have one person asked the question. Allison one person asked the question. Allison Wilson, if you can join us and ask a question.
Thank you.and ask a question.

Thank you. One of the topics that came up across the panelist, is that desire to came up across the panelist, is that desire to -- data acumen across the workforce. I am distinguishing workforce. I am distinguishing theft from a really deep set of technical skills. Maybe not of technical skills. Maybe not someone that he would call as a scientist, but someone engaged with a scientist, but someone engaged with data as they are doing their job. I am job. I am hoping you can talk to how you think about that in the context of your respective institution. Which are you think about that in the context of your respective institution. Which are somewhat different. And to add on a little bit --on a little bit -- one thing that is a particular interest is is there a way to think about the development of data particular interest is is there a way to think about the development of data acumen skills, as it is linked to the development of other expertise? As opposed to puttingto the development of other expertise? As opposed to putting [Indiscernible] a very specific data science curriculum.specific data science curriculum. Can that be integrated as well?
well?

Allison I will start with corporate training or defense acquisition perspective. corporate training or defense acquisition perspective. I would say that we are sort of facing a squeeze right now, in are sort of facing a squeeze right now, in terms of the desire to deepen skills, spit go in this area. Combined withskills, spit go in this area. Combined with a very practical pressure from the business, but department,from the business, but department, to move as much as we can add a resident experiential learning in a we can add a resident experiential learning in a residence setting, to online learning, virtual learning within a structure. , virtual learning within a structure. It is a step away from the resident training. We are being the resident training. We are nudged to look at online learning, e-learning. What I have foundlearning, e-learning. What I have found , in this area when we talk about using data,talk about using data, we teach critical thinking in one of our capstone management courses one of our capstone management courses that I have been involved. I was also a student. Andwas also a student. And where I think the critical thinking about using data, versus falling back on your her wrist.thinking about using data, versus falling back on your her wrist. -- It is practice that really makes the dip Scott in terms of that ability that really makes the dip Scott in terms of that ability to get folks to record is that they need to step back and see what the data is that they need to step back and see what the data is telling them not just one dataset but data that might seem conflicting. You maydataset but data that might seem conflicting. You may be able to resolve and get a third or fourth dataset. That is get a third or fourth dataset. That is the challenge we are facing. Our curriculum where we do that deep learning,Our curriculum where we do that deep learning, and sometimes take five or six weeks, at least four weeks just for practice.six weeks, at least four weeks just for practice. Using a case method. And so we are really looking at how to And so we

are really looking at how to fight that fight, to keep the kind of training we the kind of training we need to get the effects we want. And still be efficient as a university.want. And still be efficient as a university. I hope that answers your question.
question.

  In my opinion, the time to get that brought level acumen within the time to get that brought level acumen within the officer corps is and that intermediate level education, after they have been level education, after they have been lieutenants and cap is, and now mages. Not yet senior leaders, but yet developing into more and now mages. Not yet senior leaders, but yet developing into more of the leadership role. Of course the challenge is always there. You have a course the challenge is always there. You have a finite of curriculum, in which to insert that. End of course we are competing with to insert that. End of course we are competing with cyber folks, competing with all the other elements to get into that finite curriculum. the other elements to get into that finite curriculum. It is a challenge but in my mind, it is the best my mind, it is the best way to get in is on a intermediate level education the officer.a intermediate level education the officer. So that when they grow into senior leaders, they are already thinking about it, and growing that thread.into senior leaders, they are already thinking about it, and growing that thread. By the time they get to be senior leaders, I do not want to see they are set in their to be senior leaders, I do not want to see they are set in their ways, but it is hard to adjust how to do data driven decision-making. Rather thanadjust how to do data driven decision-making. Rather than my previous knowledge. If you get in early on I think it is key.
you get in early on I think it is key.

  Matt or Jackie, would you like to add something?
 I agree. I like to add something?
 I agree. I agree with the opinions. One more thing is based on my experience.more thing is based on my experience. Our target students, somebody having 3 to 5 years having 3 to 5 years industry experience. And as we know, it is not enough anymore to apply the machine learning technique know, it is not enough anymore to apply the machine learning technique using the database. It does not work that way anymore.not work that way anymore. The question that I have, that I struggle with with the students, is whether you can come up that I struggle with with the students, is whether you can come up with one sense, one sentence clearly stating what is problem statement?stating what is problem statement? Many are of them are struggling with challenges to are struggling with challenges to come up with the senses. Therefore I think that the challenge we have I think that the challenge we have is how we include the communication skills.communication skills. As I mentioned before, whether machine learning, or optimization.machine learning, or optimization. They need to communicate them many different stakeholders. many different stakeholders. It can be verbal communication. It could be body language.It could be body language. Communication with visualization heard whenever I enact

with my student, and I get the feedback from the industry, we whenever I enact with my student, and I get the feedback from the industry, we are challenged to to communicate in written form. How are we going towritten form. How are we going to increase literacy and capability to communicate with other stakeholders, based on their finding communicate with other stakeholders, based on their finding and written or other form of munication?
of munication?

I was going to add one thing that I tried to tell my students to keep in one thing that I tried to tell my students to keep in mind, even senior people. They may be old and set in their ways not thinking in terms of it They may be old and set in their ways not thinking in terms of it is sticks. Some of them for the domain, they have tremendous expertise and tremendous fine tune guts.for the domain, they have tremendous expertise and tremendous fine tune guts. And often the challenge is, not picking between being data not picking between being data driven, and/or do we just list this person's off-the-cuff instinct.list this person's off-the-cuff instinct. But it is finding that between the two. between the two. When to ask questions, went to question assumptions, and went to go with question assumptions, and went to go with the expert really knows the domain well.
well.

Thank you very much. I like that idea aboutlike that idea about balancing when to ask questions, when to go with the data, etc. That is definitely when to go with the data, etc. That is definitely a skill, I am speaking from personal experience, personal experience, we are trying to get that developed. Much appreciated. Would you like to developed. Much appreciated. Would you like to ask a follow-up question? Since you will also asking about data you will also asking about data acumen?

Just to follow-up with Matthew. 10 years Matthew. 10 years from now, do you think that the universities will be training folks and finding that basic data sciencethat the universities will be training folks and finding that basic data science acumen understanding statistics and so on, it is something that any college graduate needs to have? Like algebra.on, it is something that any college graduate needs to have? Like algebra. Or is that a bridge too far? And I am just a technicaltoo far? And I am just a technical engineer and I wish everyone can speak what I speak and understand. Do can speak what I speak and understand. Do you think that this is becoming mainstream? Is that the vision?

I think mainstream? Is that the vision?

I think it is becoming mainstream. Basic datadata manipulation collection, storage, understanding skills are becoming or have come what are becoming or have come what statistics is. Most college graduates, weather engineers, graduates, weather engineers, or a sociologist, they have had to have sums to school training. had to have sums to school training. And being able to work with data,with data, and to use those statistics but maybe have a little bit more

computer science, exploratorybut maybe have a little bit more computer science, exploratory data analysis skills will become the new normal. The evidence of this as a computer the new normal. The evidence of this as a computer science, or sorry [Indiscernible].]. There is a continual pressure to offer these service courses through campus.to offer these service courses through campus. People in Econ they want to be able to code where it will help them.want to be able to code where it will help them. People in psychologies want to write code where will help them.to write code where will help them. Data literacy, and acumen to use that term again, it is acumen to use that term again, it is becoming or has become what students are seeing as required skills coming out students are seeing as required skills coming out of college. In the same way, everyone is going to know how , everyone is going to know how to look at a distribution. And the E score from us And the E score from us that class. They will learn how to do basic predictive modeling as well.
 to do basic predictive modeling as well.
  Thank you.
 Thank you. I am going to turn it over to the cochair of I am going to turn it over to the cochair of this study I will ask a couple of questions. Wendy please join us.
a couple of questions. Wendy please join us.
  I appreciate your insight. It is good to understand what is going on in academia, and how is good to understand what is going on in academia, and how we can apply it cross our defense acquisition workforce, defense acquisition workforce, and improve them. I have a couple of things that I am interested. Matthew you really a couple of things that I am interested. Matthew you really raised one of them. You guys are day scientists and you should have some evidence of what the data shows guys are day scientists and you should have some evidence of what the data shows in terms of your classes and put. Are you seeing increases? put. Are you seeing increases? You said the different academic colleges, for coding, colleges, for coding, rather than understanding how to understand data. understand data. And make decisions from. Can you talk about the talk about the and what it looks like and why they would focus on coding rather than learning how to ask the right and why they would focus on coding rather than learning how to ask the right questions to get to the right decision?
 I think for me, my feeling it is decision?
 I think for me, my feeling it is almost like the culture of the discipline. the discipline. The sociologist does not need to come to us to learn. come to us to learn. Learning about experimental design. They are really good at being trained in that.They are really good at being trained in that. Economists do not come to the computer science department to learn about cause of modeling as opposed the computer science department to learn about cause of modeling as opposed predictive modeling. But what they lack is some of these getting your hands lack is some of these getting your hands dirty technical skills. It is not to say that it is not important. It is important. The other side of not to say that it is not important. It

is important. The other side of computer science. We create students that are good at building models, and manipulating data and software and systems. But they that are good at building models, and manipulating data and software and systems. But they do really not know how to ask questions well or tell stories with data. They to ask questions well or tell stories with data. They do not really know anything about anything. But they know how to manipulate anything. But they know how to manipulate data really well. That is based on technical skills that other on technical skills that other disciplines are not getting from within their culture. And that is where they their culture. And that is where they come to computer science. Understanding problems, asking questions I think problems, asking questions I think many of the other scientist have really done that very well.really done that very well. They do not need our help on that part.
help on that part.

Has your student input increased over the last year?
over the last year?

I forget the statistics. Our undergrad population Our undergrad population is doubling every 5 years or something like that. We have a something like that. We have a dedicated Masters program at Trent read that did not exist 10 years ago.that did not exist 10 years ago. And we have 500 students now.
now.

I want to ask you a question. You are bringing the question. You are bringing the business perspective to us but when we look across the acquisition workforce, they are engineers we look across the acquisition workforce, they are engineers and categories. Astrophysics, nuclear, a variety of technical engineering skill variety of technical engineering skill that our desire is to learn how to apply this in a business environment, which is the acquisition environment. That learn how to apply this in a business environment, which is the acquisition environment. That is what they are doing, and you shared you are not the only university doing it. It is you shared you are not the only university doing it. It is not my [Indiscernible]. When you talk about your program, for data When you talk about your program, for data science ha teaching them how to ask the right questions, is your target audience 3 to to ask the right questions, is your target audience 3 to 5 years? Are they typically data scientist with that data scientist with that experience coming into learn how to talk to the business world? Or is it the business worldtalk to the business world? Or is it the business world better engage and ask the right questions of the technical world?
right questions of the technical world?

Basically the current population we have, most of the students come we have, most of the students come from various industry. And their background is very from history. background is very from history. Computer science. The basically what they are looking for is that what they are looking for is that first time when they joined the program, they are looking for data science.program, they are looking for data

science. In the middle of the career, when they join the program,career, when they join the program, they are satisfying what we are driving to the more likely management are driving to the more likely management aspect of data science. Which is emphasizing as I mentioned how you are going to communicate with people who Which is emphasizing as I mentioned how you are going to communicate with people who do not really understand data science?science? As mentioned, and you mentioned, does the CEO mentioned, does the CEO need to know coding? Yes. From a different perspective. And how willFrom a different perspective. And how will the student communicate with these people? Do they really know?these people? Do they really know? Please do not get me wrong, I am not saying right or wrong word engineers and computerwrong, I am not saying right or wrong word engineers and computer science do they know the process, what is the PP, engineering? We areprocess, what is the PP, engineering? We are emphasizing it so that our student, not only having that skill, but student, not only having that skill, but soft skills. That is really important. And preparing.important. And preparing. That is the kind of student we have. Did I answer your question?

Yes.student we have. Did I answer your question?

Yes. Today we heard that our objective is to train 3 million people.our objective is to train 3 million people. A cross of Department of Defense. At some level of understanding data.Defense. At some level of understanding data. From understanding basic statistics to being very sophisticated and how it applies. When you think about to being very sophisticated and how it applies. When you think about fat scope of responsibility from the Department of Defense, from the Department of Defense, and there CEO. There is a is a wide range of talent, skill and age groups that are going toage groups that are going to be involved in that process as we figure out how to tap into the talent, and how you prioritize as we figure out how to tap into the talent, and how you prioritize those ideas. And so, just as a sense, when you look at your population of students come through, are just as a sense, when you look at your population of students come through, are they typically young people? Are you getting middle level senior people interestedyou getting middle level senior people interested , and having a better understanding of data as you go forward?

In Texas, yesof data as you go forward?

In Texas, yes . Generally about 70% of our students are young people.of our students are young people. Early career. However some of the people who have been there for 15 or some of the people who have been there for 15 or 20 years. The reason why they go back to school is that they want to change their career. And they they go back to school is that they want to change their career. And they realize that we are in the industry of the revolutionary stage. Because industry of the revolutionary stage. Because of the development of technology. Unlimited data comes to the market. We need to data comes to the market. We need know the data. So they want to change the

career path. That is one they want to change the career path. That is one of the groups we have.
 Thank you so much. We only have a couple of minutes left.Thank you so much. We only have a couple of minutes left. I would love to finish on a question that is moreon a question that is more about the concepts of putting together data science teams.together data science teams. If you look several years ago are some of the visualizations of data scientist ago are some of the visualizations of data scientist look like, or the field of data science would look like, we have this diagram. If you learn all data science would look like, we have this diagram. If you learn all statistics in math, all commuter signs, and some subject matter that you would signs, and some subject matter that you would be this mythical unicorn. You are the data scientist. We have moved far are the data scientist. We have moved far from that now. Think about building data science teams and data science is much more of a process,building data science teams and data science is much more of a process, a problem-solving flow to involve expertise from lots of different people. Each of you haveexpertise from lots of different people. Each of you have talked a little bit about doing capstones, putting together teams, and I know at the defense acquisition doing capstones, putting together teams, and I know at the defense University courses where people bring together different disciplines. And walk through data bring together different disciplines. And walk through data focused scenarios. I am wondering if we can be respect full of the time, a very if we can be respect full of the time, a very quick answer. Does anyone have any lessons learned are best actresses for putting together any lessons learned are best actresses for putting together a data science team, bringing people in from different skill sets and backgrounds?people in from different skill sets and backgrounds? It is open to anyone. Thank you.
Thank you.
  I would say with my experience, not surprisingly the moreexperience, not surprisingly the more heterogeneous team you can put together the better. together the better. Our projects, especially with organizations that do not consider himself that do not consider himself directly involved with technology. There is a real need toThere is a real need to integrate a domain expert alongside, more technical people. I think we are more technical people. I think we are also learning there is funding, technical talent is important., technical talent is important. But also finding people who can manage project. can manage project. That is a specialized skill in itself. Someone who can talk to both sides.in itself. Someone who can talk to both sides. That often gets lost. Finding a domain expert, peopleFinding a domain expert, people who were good crunching data numbers, finding someone who can numbers, finding someone who can help manage the whole process. I think that is key.
 Thank you. I think that is key.
 Thank you. That is helpful. Any other quick perspectives? quick perspectives?

I think another perspective that the team needs to have intellectual curiosity. the team needs to have intellectual curiosity. People need to investigate -- we have discussed this -- we have discussed this several times. Data science is the main goal of discovery. With different types of data. Intellectualthe main goal of discovery. With different types of data. Intellectual curiosity is another key factor. And it comes into play.

And it comes into play.

Thank you.

I find sometimes having those folks with find sometimes having those folks with strong domain knowledge, even if they do not have any data analytic do not have any data analytic science background at all, it adds to the team by putting out those conjectures of adds to the team by putting out those conjectures of what they think they are going to see, or they think the problem is going to see, or they think the problem is depending on the type of analytics. Taking that analytics. Taking that conjecture looking at it through the data, and gain better insight if you were just exploring data, and gain better insight if you were just exploring data on your own.

Marianne, any closing words of putting together teams of working data any closing words of putting together teams of working data science problems?

I would talk about the prompt that the team is being pulled together to answer. And the context about the prompt that the team is being pulled together to answer. And the context I would give you is a lot of where we see the lot of where we see the need for data scientist and analytics. analytics. At the inflection points and various phases of the knee program.various phases of the knee program. If we have to do technology investments and maturation technology investments and maturation because it is defense unique, that inflection point between what we learned during thatthat inflection point between what we learned during that phase, whether or not we should go into a detailed development phase, is should go into a detailed development phase, is a great opportunity to bring together data analytics. And saying what the data tells about whether we should move data analytics. And saying what the data tells about whether we should move forward or not. Often times the prompt is whether your program should go forward or not. As opposed the prompt is whether your program should go forward or not. As opposed to what is the data telling us. And the telling us. And the other inflection points when we go from that detailed development, or detailed engineering design phase from that detailed development, or detailed engineering design phase into full out production. The same question. Is it really what same question. Is it really what the data is telling about whether we should produce the solution, whether we should produce the solution, or is it the question should your program go forward? It is a cultural issue.your program go forward? It is a cultural issue. If you asked the right question from a leadership point of view, you create question from a leadership point of view, you create that motivation to pull the right team together. Because you are asking the right

questions.team together. Because you are asking the right questions. In practice, this is a different answer. But I think in practice it is different answer. But I think in practice it is much about you as it is about the availability of the right players. And is about the availability of the right players. And of course if we build more data, and acumen into the workforce, data, and acumen into the workforce, certainly it would be easier. I think some of it is the pull and not push.I think some of it is the pull and not push.

That is excellent. A wonderful set ofwonderful set of perspectives. I would like to thank all the panelists were joining. We may do some follow-up questions. We cannot possibly thank all the panelists were joining. We may do some follow-up questions. We cannot possibly get to all the questions and comments in the short time we have you.and comments in the short time we have you. We really appreciate that you have spent time with us at the end of your Tuesday. We would have spent time with us at the end of your Tuesday. We would like to do now, is turn it over to one of our study committee members. She willturn it over to one of our study committee members. She will talk about final comments. If you miss Christine Fox earlier you miss Christine Fox earlier introduction, she is the current assistant director for policy analysis of the Johns director for policy analysis of the Johns Hopkins community.

Thank you so much everybody. I have theso much everybody. I have the task of trying to summarize this incredibly rich day in just a few moments.this incredibly rich day in just a few moments. Please forgive me in advance because I am sure that I'm going to miss some very important things that we learn because I am sure that I'm going to miss some very important things that we learn today. Here is a stab at it. We started our day hearing that the D.O.D. needs to move from it. We started our day hearing that the D.O.D. needs to move from got based decision-making, to data decision-making.decision-making. Some of the reasons for that. Congress is demanding it, that. Congress is demanding it, organizations globally recognized the value and importance of data, andand importance of data, and we also heard from the D.O.D. leadership at the beginning of the day, that that D.O.D. is not D.O.D. leadership at the beginning of the day, that that D.O.D. is not the leader in this area, and there is a growing view that it should be. To achieve and there is a growing view that it should be. To achieve that, the D.O.D. needs policies, changes in culture, and [Indiscernible]. changes in culture, and [Indiscernible]. Let's take it to those in turn. Policy development. As I said turn. Policy development. As I said earlier Congress passed legislation requiring evidence-based decision for acquisition. evidence-based decision for acquisition. That is a pretty clear policy signal. Inside the department we learned policy signal. Inside the department we learned that senior leaders are encouraging clear and open conversations about data quality and clear and open conversations about data quality and statistical approaches and the asked database decision making support. database decision making support. At the highest level. That is a good sign. We have also seen the is a good sign. We have also seen the

chief data officer position established and filled across the Department of Defense. And the office of the secretary and filled across the Department of Defense. And the office of the secretary of defense. And in each of the services. These are senior positions. And supported by the services. These are senior positions. And supported by the leadership and the opportunity to hear from them today. to hear from them today. It is clear they have a lot of responsibilities and making a lot of headway.lot of responsibilities and making a lot of headway. Changes in culture are clearly important. We have heard from important. We have heard from many of the panelists that the acceptance of the value and the use of data analytics acceptance of the value and the use of data analytics is not a given. And it requires leadership, attention,it requires leadership, attention, and we heard about the need for incentives, and need for incentives, and -- several leaders are setting up working to set up that culture. working to set up that culture. There needs to be a lot learned and how to do this well. We did hear lot learned and how to do this well. We did hear some examples of it, we heard that once it is set, it is important to teachthat once it is set, it is important to teach culture to the workforce, as well as the skill heard and it requires that they follow-up.well as the skill heard and it requires that they follow-up. We learned from industry that partnerships are key. partnerships are key. We heard that everyone is expected to work together collaboratively to produce high performing expected to work together collaboratively to produce high performing teams, we heard from the last panel that the ability to produce hype teamslast panel that the ability to produce hype teams is being taught in academia and sought by the student body. This and sought by the student body. This will allow everyone to be the customer how the data scientist together. The industry panels customer how the data scientist together. The industry panels told today that they see that those teams showed a value of datathose teams showed a value of data analytics and it is clear to everyone.to everyone. I would also like to point out that the lessons from industry may require a translation step as you get point out that the lessons from industry may require a translation step as you get to the Defense Department, and D.O.D. culture policy. In the D.O.D.culture policy. In the D.O.D. data silos exist, and sometimes because of budget competition.because of budget competition. But sometimes they exist for reasons that are much more difficult to break through, like classification, andreasons that are much more difficult to break through, like classification, and proprietary information. So there is a translation step that will be needed.is a translation step that will be needed. We talked a lot today about upscaling the workforce. I think it is very interesting that panelists about upscaling the workforce. I think it is very interesting that panelists would not aligned to the view of who all need to be trained, does everyone need to view of who all need to be trained, does everyone need to be trained? The D.O.D. leadership this morning expressed the view that everyone does a need this morning expressed the view that everyone does a need need to be having a

basic understanding of statistics, and data basic understanding of statistics, and data visualization. Some of the industry panelists agree with this approach. panelists agree with this approach. And we heard a lot about how the services are tackling the goal. Training 3 million about how the services are tackling the goal. Training 3 million people. Services creating internal programs like AFIT, postgraduate like AFIT, postgraduate school, heard about courses, certificate programs, and master degrees with certificate programs, and master degrees with their reflecting that not everybody needs the same degree of training, but everybody needs some amount of needs the same degree of training, but everybody needs some amount of it. We also heard about partnering with external organizations, examples of partnering with external organizations, examples of MIT and others. For acquisition in particular we heard from DUA in particular we heard from DUA and how they incorporate data analytics and providing support for the Florida acquisition community through analytics and providing support for the Florida acquisition community through their website, and consulting services. We heard the view that young people expect We heard the view that young people expect this, and it is becoming the new normal. They are used to working the new normal. They are used to working with data and data analytics and visualization, and as they come into the service of the Department of defense, visualization, and as they come into the service of the Department of defense, they are going to expect those skills and capabilities.skills and capabilities. A quote of the day was, young people in the military are doing amazing things with Excel,was, young people in the military are doing amazing things with Excel, but it is like giving a plumber hammer, and seeing him do amazing things with a plumber hammer, and seeing him do amazing things with that hammer, so just think what they would do if they had a branch?what they would do if they had a branch? Some industry discussed the need to form teams of teams. And the teams upto form teams of teams. And the teams up data scientist working with others will reinforce the point about the importance will reinforce the point about the importance of collaboration, to bring home the value of data signs across the organizationthe value of data signs across the organization . This is another example however where industry practices however where industry practices and lessons might be difficult to translate into D.O.D.. Collaborative cross translate into D.O.D.. Collaborative cross organization teams of teams is a good goal. One that should be pursued but could be difficult good goal. One that should be pursued but could be difficult to bring into the department on a broad scale. Everyone agreed in on a broad scale. Everyone agreed in the upscale, senior leaders need a deep appreciation of the capabilities of limitations of need a deep appreciation of the capabilities of limitations of data and data analytics. You cannot achieve these goals without the senior leaders being a part of and being somewhat cannot achieve these goals without the senior leaders being a part of and being somewhat [Indiscernible]. We also heard a broad recognition that there is a need for some to have more a broad recognition that there is a need

for some to have more in-depth skills. And to go deeper beyond just the basic data acumen.deeper beyond just the basic data acumen. That is more in addition to the challenges of getting the data,in addition to the challenges of getting the data, and the workforce for basic understanding of statistics and data visualization, setting that understanding of statistics and data visualization, setting that culture. D.O.D. needs to appreciate the need for some other things. They need to appreciate that the need for some other things. They need to appreciate that need to match the right reliable appropriate analyze data to reliable appropriate analyze data to the right question or issue. This is the scientific method. We heard This is the scientific method. We heard it mentioned many times today. The importance of framing the The importance of framing the problem, and having the question. A great statement we heard this afternoon, can you come up A great statement we heard this afternoon, can you come up with just one sends to convey the statement? I bet you the statement? I bet you that would be a struggle for many in D.O.D. trying to do this.many in D.O.D. trying to do this. We also heard about the importance of recognizing that that data supporting importance of recognizing that that data supporting auditing decision is very different than the data needed to work cost estimation. That is than the data needed to work cost estimation. That is different from data needed to do effective program management. do effective program management. We also heard of peace of data sets, those that data sets, those that are correct ones that you can count on that are right. And that can can count on that are right. And that can be useful for decisions and expected to be underlined that decisions.to be underlined that decisions. We understand the need for the right tools, to the right tools, to manipulate and use the data, and finally one that came up throughout the day cross all the panels was the finally one that came up throughout the day cross all the panels was the importance of domain expertise. Whether they have data skills or not. The ability to combine data they have data skills or not. The ability to combine data analysis and analyst with domain experts to properly analyze domain experts to properly analyze the data and the risk of not incorporating expertise of drawing the of not incorporating expertise of drawing the wrong conclusion or taking a long time to get there. Another example long time to get there. Another example where partnerships will be key. In conclusion, with all In conclusion, with all that said, everyone agrees throughout the day that data and data analytics are needed day that data and data analytics are needed and powerful. No one said incorporating data analytics into D.O.D. incorporating data analytics into D.O.D. acquisition processes was not worth pursuing. So even though it is hard, So even though it is hard, our analyst and the panelist rather, whether D.O.D. industry or academia whether D.O.D. industry or academia push forward. They gave us a lot of insight on how to tackle the issues to us a lot of insight on how to tackle the issues to achieve the promise. I found this to be a fast dating day. this to be a fast dating day. I hope it has been a useful summary.

useful summary.
Back offer to close out to our cochairs.
to our cochairs.
Certainly. Thank you so much Christine. That was well done. much Christine. That was well done. Wendy would you like to add closing remarks?
I could not add one thing.closing remarks?
I could not add one thing. That was absolutely phenomenal. Thank you so much Christine. Thank you so much Christine. I appreciate the notetaking and the delivery of the whole delivery of the whole synthesis of the thought process. And to the final panels, thank you so And to the final panels, thank you so much. I appreciate your anticipation and hanging out with us at the end of the day. The whole academic part and hanging out with us at the end of the day. The whole academic part typing -- the ideas from the academic community, this is important for us as we shape the future thank you the academic community, this is important for us as we shape the future thank you very much. I look forward to continuing dialogue.to continuing dialogue. Thank you. Back to you, Rebecca.
Thank Rebecca.
Thank you so much. I echo Wendy's thanks and appreciation for everyone's time.thanks and appreciation for everyone's time. Thank you for sharing your rich and diverse perspectives. We found this workshop to be rich and diverse perspectives. We found this workshop to be incredibly valuable for the study. I would like to thank the sponsors. Stacy Cummings, David and Mark. For would like to thank the sponsors. Stacy Cummings, David and Mark. For future updates on this study, please visit the website for the national academy of science and engineering and medicine. Search please visit the website for the national academy of science and engineering and medicine. Search for the project page on improving defense acquisition work force capability and defense acquisition work force capability and data use. You will find updates for the study. As well as opportunities to engage with our committee. In particular, updates for the study. As well as opportunities to engage with our committee. In particular, proceedings for today's workshop which will end up being about eight to 12 pages will be available for download in will end up being about eight to 12 pages will be available for download in a few months. So again thank you to all the speakers and panelists for joining.thank you to all the speakers and panelists for joining. Thank you to all those who joined us on the webcast, thank you for your participation and questions. We