AFA Symposium

Brigadier General Ellen Pawlikowski
Vice Commander, Space & Missile Systems Center

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General (Ret) Dunn: Ladies and gentlemen, we're going to start our second panel. The moderator of this Futures Panel is Brigadier General Ellen Pawlikoski. She is the Vice Commander of SMC. She has a PhD in Chemical Engineering and was the Director of the Airborne Laser Program in some of her past assignments.

I first met Ellen when she went through Capstone while I was the President of National Defense University, and I have to say that she was probably one of the most thoughtful general officers I saw in my three year tenure at NDU.

So without any further ado I'd like to introduce the moderator of this panel, Brigadier General Ellen Pawlikoski.

[Applause].

BGen Pawlikoski: Thank you. Boy, what a great panel that was before this. What do you think? That heritage panel.

[Applause].

I don't know about you, but I was fascinated as I sat there and listened to all those great statesmen talk about their experience and some real lessons there for us not just in space but also a little bit about leadership.

But at the end of it, as I was watching them, I thought to myself, well, they and General Schriever, would not be very satisfied with us if we were to rest on their laurels and just kind of sit back and admire that new statute as opposed to following that arm and those fingertips out to the horizon that General Schriever was pointing to, and looking towards where we would be in the future.

So for the second half of the symposium we want to focus on the future for space, building on that legacy and all that hard work.

We had General Kehler start off the symposium. I think he did a pretty good job of outlining a vision for the future when he talked about the integration of air, space and cyberspace, but I think he'd probably agree with me if I were to say that it's a great vision but it's not General Kehler that's going to make that vision a reality, and it's not me that's going to make that vision a reality. It's going to be the young men and women that are in this room that are below the rank of general officer, the

captains and the majors. That vision, or whatever their vision is going to be is what's going to make a reality.

That may scare you. I know for lots of parents of teenagers the thought of something like that does, or it could excite you. But what General Dunn and I said might be a great idea is to go out and see if we've got some volunteers from that group of young officers to talk about what they see as the future of space. So the young men that you see before you are those volunteers, with the exception of one, and I'll get to that in a minute. [Laughter]. Are those volunteers and as I talk to you a little bit about each one of them and you listen to them, I think that we have a choice of being afraid of the future or being excited about the future. I think you'll see from listening to them that we ought to be excited about the future. They certainly have a lot of great ideas and a lot of ways that we can approach achieving that vision that General Kehler laid out.

We've got a wide spectrum of things we want to talk about, everything from the operations to what are we doing in what is our youngest mission area from an Space and Missile Systems Center (SMC) perspective which is the space situational awareness, although certainly not the youngest mission area when it comes to space. So we kind of go full circle.

I do have one change. If we can put up my first chart, you see that the lineup there, actually it's been changed. Up until about a minute ago our fifth speaker was a Major Clive Page who was supposed to talk about future space launch. I guess we can get 54 consecutive launches off but he was in an accident on the way to our symposium. So we can make our 54 consecutive launches, but we can't make it to the symposium. But not to fear, because his boss, Colonel Ken Allison, has volunteered to fill in for him. So we have, as you might say -- [Laughter]. Right. One of our bridging generation in there.

So to start off, without any further ado, I'd like to introduce Lieutenant Colonel Chance "Salty" Saltzman. He's the first of a line of what you'll see is a truly impressive group of individuals we have up here, especially when you think about how just a few years ago most people that were involved in space came from somewhere else in our Air Force. Well, Salty is currently the Commander of the 1st Space Control Squadron, and he's dual-hatted as the Chief of Combat Operations for the 614th Air and Space Operations Center at Vandenberg Air Force Base. He has nearly 16 years of space operations experience ranging from Intercontinental Ballistic Missile(ICBM) operations, satellite command and control at the National Reconnaissance Office (NRO), and duty as a space weapons officer. He served as the Joint Space Operations Center Chief of Combat Plans and commanded the 614th Space Operations Squadron, providing mission ready space ops to the Joint Space Operations Center. In his current position Colonel Saltzman commands the nearly 180 personnel of the Joint

Space Operation Center's Combat Operations Division and is responsible for conducting 24/7 space command and control operations.

Colonel Saltzman?

[Applause].

LtCol Saltzman: Thank you, General Pawlikowski. It's truly an honor to have the opportunity today to address such a distinguished audience.

For those of you that may not have previous experience with the Joint Space Operation Center, the JSPOC, as we call it, is the 24/7 operations center for the Commander, Joint Functional Component Command for Space who happens to be Major General William Shelton. It's always good to have the boss in the audience, sir. We execute the United States Strategic Command (USSTRATCOM) joint space mission from Vandenberg Air Force Base, just a few hours up the road.

I think it's fair to say, at least to assume, that the future of Joint Space Operations Center's warfighting operations will flow from monumental changes and trends that we are witnessing today. Therefore it's important to understand where we are now.

The next slide starts with, as I'm sure most of you are aware, the dependence on space is growing exponentially in all arenas. From civil applications like weather, scientific research, commercial applications like financial transactions, wireless communications, everyday dependence on space is growing by leaps and bounds.

From a military standpoint, space does not merely enhance operations, it enables them. Military operations of the future cannot and will not occur without integrated space operations. Through space-based communication, navigation, weather, intelligence, surveillance, and reconnaissance, space operations are now inextricably linked to success on the battlefield.

This trend in space dependence will drive an increasing demand for space effects and a need to protect those capabilities. These warfighter concerns will be the prime responsibility of the JSPOC. In this role the JSPOC will build space situational awareness, or SSA, and execute command and control to create integrated space effects and protect our space capabilities.

While space assets around the world generate these critical effects, it's the JSPOC that builds and integrates SSA into a command and control system that the commander of Joint Functional Component Command (JFCC) Space can task defensive and offensive

counter-space activities, assuring the right space effects occur at the right time to meet joint warfighter requirements.

So where are these trends taking us? As the next slide shows, the future of the JSPOC is an evolution into a space operation center that pulls in the red, gray, blue space pictures and data from sensors and fuses all of this space situational awareness in real time. This fused SSA will be visualized in the ops center in a way that supports real time command and control of all space assets and puts real time intel into context so that multi-agency space partners have decision quality knowledge. The result is space situational awareness that accurately assesses adversary capability and intent and factors important surveillance missions like conjunction assessment, reentry analysis, and space weather, all for the purpose of executing those defensive and offensive space operations that preserve our space capability and allow us to respond to the threats.

In order to fully realize this future some key changes do need to occur. So as the next slide shows, what is changing? First, there's an ongoing effort to expand the concept of space situational awareness. SSA is no longer limited to data cataloging but is transforming into something that creates collaborative decision aids for commanders. This is to say space situational awareness is not simply data from sensors, it is decision quality awareness that results from placing this data into context by fusing it with intelligence, the status of friendly forces, weather, and the military situation at hand.

We are also changing our mindset with regards to leveraging excess capacity. Recent successes with experimental and research and development systems prove that there is substantial operational utility in space craft well after tests and experiments are completed. One of the more dramatic changes is the revolutionary shift in data sharing and contextual analysis. Net centric blogging, chatrooms, and collaborative work spaces are all helping close the gap between the decisionmaker and the on-console operator who has the key data.

Finally, we need to explore unconventional options to increase space situational awareness. From all-source intelligence to scientific observation platforms, many sources of information can be synthesized to help build the needed space picture.

The second comprehensive change is driving a cultural shift regarding defensive counter-space. This means training personnel to think in terms of defense, not anomaly resolution. Or seeing problems from a whole system versus a component level approach. For example, if there is interference on a Satellite Command (SATCOM) channel we can no longer afford to presume the source is benign.

We need to enhance our ability, both technical and analytical, to assess whether space assets are under attack. For instance, how do we assess procedurally and determine with the tools that we have whether a SATCOM jamming is hostile or non-hostile?

Finally, we need to define, refine and enhance our defensive counter-space options from system design to crew procedures and techniques. We need to leverage American ingenuity to give commanders viable options to protect our critical space assets and preserve their vital effects.

So if we can implement these changes, what might that future look like? As the next chart shows, our vision of the future starts with a net centric shared, real time space situational awareness database as the foundation for effective JSPOC warfighting operations. This database will offer users the ability to define their own operational picture and tailor the SSA inputs, outputs and alerts to their operational needs.

The next build shows that from a JSPOC perspective real time inputs from intel, tactical units, space surveillance sensors, will all be fused, as the next build shows, into a modeling and decision tools that will help operators attribute events and determine hostile versus non-hostile activity, who the key actors are and the nature and impact of system failures.

As the next build shows, with this level of knowledge courses of action can be analyzed and selected at the appropriate level based on a multi-agency collaboration that assesses the appropriate playbook response, and as the next build shows there, allows commanders to execute the command and control necessary to implement a full spectrum response to achieve the desired effects.

Finally, to some degree the future of JSPOC warfighting operations will build on our history. The age-old adage of observe, orient, decide and act. And by expanding the data that is observable, using the technology to help orient the operators, and by providing collaborative course of action tools as decision aids, and finally, acting via a net centric C2 system that can synthesize a full spectrum response.

In conclusion, the future of the Joint Space Operation Center’s warfighting operations, as the next slide shows, requires a continued emphasis on the evolutionary efforts in building and enhancing decision quality space situational awareness, and space-enabled global and theater effects. But it also requires a revolutionary approach to building a defensive counter-space culture among our space operators and achieving multi-agency, synchronized unity of effort across the full spectrum of space operations.

But in the end, the future of JSPOC warfighting operations will always be, as it is today, about delivering the right space effects at the right time to meet joint warfighting requirements and national objectives.

Thank you.

[Applause].

BGen Pawlikowski: Thank you, Colonel Saltzman.

Turning from the focus on space operations, we're going to look a little now at some of those space effects that we bring to the fight. Our next speaker is Major Jason Eisenrich. Jason is actually a 1997 graduate of the Air Force Academy in Space Operations. Imagine that. I don't think anybody really thought much about having a Bachelors Degree in Space Operations back in 1953 when we started this journey. He also has a Master's degree in Aerospace Engineering from the University of Texas. He began his career right here at Los Angeles Air Force Base in 1999 in the Launch Programs Directorate where he worked on the Titan program first as a solid rocket motor engineer, and then as a mission manager. He then transferred to the NRO where he worked in the Signal Intelligence (SIGINT) Directorate in the Ground Systems Office. Prior to returning here to LA Air Force Base he was assigned as the executive officer to the NRO's Deputy Director for Military Support. He's currently working as the Deputy Chief of SBIRS, Payload Division, where he's responsible for the integration and testing of the Space Based Infrared System (SBIRS), Geostationary Earth Orbiter (GEO) and High Eccentricity Orbit (HEO) payloads.

Major Eisenrich?

[Applause].

Major Eisenrich: Thank you, General, for the kind introduction and the opportunity to speak about our future missile warning systems.

To accomplish the missile warning mission we have traditionally used infrared phenomenology to detect the heat signature of a missile launch. In the future we'll continue to use space-based infrared systems to detect missile launches, however the capabilities needed to fulfill this mission inherently offer the ability to do so much more.

As these abilities become fully understood, the mission area is going to expand from missile warning to space-based infrared surveillance.

Before we look at the future it is definitely worth looking back at the past 37 years. As the next slide shows, since the

first defense support program satellite launch in 1970 to Saturday's successful launch of DSP-23, defense satellite program (DSP) satellites have accomplished the missile warning mission with distinction.

Originally developed to detect large intercontinental ballistic missile launches, the uses of this system have been expanded beyond just strategic missile warning through ground-based manipulation of DSP data.

The successor to DSP's tremendous achievements is the space-based infrared system known as SBIRS. SBIRS was developed to not only address the strategic missile threat, but also to detect a greater range of theater missiles and detect them more accurately than DSP.

SBIRS also provides taskable sensors which allow the system to accomplish many missions at one time.

Similar to DSP, the full extend of SBIRS capabilities will not be understood until well after the system is on orbit. For example, this next slide shows an image of Europe recently captured by the HEO-1 payload. As you can see, for a non-imaging infrared system, HEO-1 is able to produce some pretty good images. While this is a nice picture, you may ask yourself what operational use does this have? After all, I can go to Google Earth and get a much closer look at London. While this product may not have much operational relevance at this time, that fact that we're able to collect the data behind the image shows that the SBIRS sensors will be able to collect data for other uses that go well beyond the mission warning mission. It will be the manipulation of the data behind the image that will define other areas where space-based infrared surveillance can provide operationally relevant information.

The next slide shows a bit of a vision beyond our SBIRS assets. The missile warning threat has evolved since 1970. At that time we were primarily concerned with detecting launches of large ICBMs from known Soviet missile fields. Today the threat has expanded to include not only smaller, theater-level missiles but the potential launch locations have also greatly expanded.

In the future we need to address the threat that the smallest of missiles can be launched from any point on the earth. I can envision a scenario where a space-based sensor will be called upon to detect a missile launch and transmit precise launch location to an airborne asset for observation and/or destruction of that launch platform while simultaneously beaming the missile's flight trajectory to a missile defense asset for destruction of the incoming missile.

To meet this threat a number of technological improvements to our space systems will be needed. We need to move beyond the

revisiting surveillance that our current capabilities give us. To ensure that we have an unblinking eye on the world, the capability to provide constant surveillance of the entire planet must be developed. Constant surveillance of the entire planet is a bit of a dual-edged sword. On one side, we'll be able to capture an enormous amount of data, but on the other side that enormous amount of data has to be analyzed. In order for this data to be operationally relevant, it needs to be in the hands of warfighters and decisionmakers in a timely fashion. Using the scenario I mentioned previously, it does no good to provide the information to those two users 30 minutes after launch. In all likelihood the launcher will be concealed and the missile will have impacted its target.

To hit on what General Kehler mentioned this morning, we need to turn that loop into seconds to be able to truly have an operational impact.

To turn the collected data into actionable information, on-board processing and direct links to the lowest levels of the field are a must. While that direct link to users will be the pointy end of the missile warning spear, the real magic will continue to occur on the ground.

On-board processing will need to cull through that collected data, but we cannot allow the remaining data to just fall on the floor. To fully analyze all of this data, our ground processing capability will need to be improved to be able to handle this increased amount of data.

But we also need to increase our data sharing with non-traditional users. The increased detection capability will surely provide users for space-based infrared surveillance data that we cannot even fathom today.

In conclusion, I'd like to put forward a few thoughts for the future of this mission area.

First, any future system must prove itself to be operationally relevant as well as providing the best value to the warfighter. To this end, we must ensure that we develop future systems smartly, by making leaps in system development that are too large, we take a risk that we will not be able to deliver the promised capability, thus leaving a gap in satisfying the mission.

As I have mentioned, the transformation of this mission is going to be enabled by improvements in our space-based sensors. However, the exploitation and extraction of that data is what will make the transformation possible.

For this data to be operationally relevant we need to determine who needs to receive the data and how this information

is provided to that end users. Improved sensor capability paired with future global communications, which you'll hear later on this panel, will allow us to break any current paradigms that prevent us from getting information directly into the hands of warfighters.

To move to a space-based infrared surveillance mission area cooperation with our mission partners is essential. We must ensure our traditional partners that we will continue to provide first class missile warning capability, but we also need to cultivate new partners to enable the full value of such a system to be realized.

In summary, the mission success that the DSP system has proven and the SBIRS system promises are heralds of the transformation of this mission area from solely missile warning to a more global space-based infrared surveillance capability.

Thank you for the opportunity to speak at this forum.

[Applause].

BGen Pawlikowski: Thank you, Jason.

Jason talked about missile warning and what the future might be there, and I think you can see that missile warning is only just a small part of what space has to offer when it comes to space-based infrared. He also talked a little bit about the glue that helps to pull this all together in another traditional space area which is satellite communications.

Our speaker on that area is Major Aaron Metz. Now Major Metz has a Bachelor's in Aerospace Engineering from CalPoly Pomona. And he has a Master's of Engineering in Space Communication and Remote Sensing from the University of Colorado at Colorado Springs, so you can see he too has not just the operational background but the educational background. Kind of a testament, I think, to our education system when you listen to some of the degrees of the officers we have up here.

He served for four years supporting the command and control segment of the Air Force satellite control network; two years supporting space radar; two years supporting space-based remediation technology to counter high altitude nuclear detection threats; and in his last assignment he worked at the United Kingdom's Ministry of Defense for Science and Technology in the Laboratory for Information Management and Naval Systems. That gave Major Metz a very unique perspective on how coalition forces use intelligence and net warfighting capabilities to promote global stability. Now we're going to hear from him on how he sees all that melded together in the future of satellite communications.

Aaron?

[Applause].

Major Metz: Good morning. Thank you, General Pawlikowski for the opportunity to share with this very prestigious Air Force Association how the Military Satellite Communications (MILSATCOM) Systems Wing will deliver the transformational satellite communication system known as TSAT to enhance our nation's com defense for decades to come with increased bandwidth, for standards based, protected communications.

In this short briefing I'll present the strategic context in which transformational satellite (TSAT) is developed. I'll then show you the operational view of the TSAT system followed by a presentation of a TSAT space network operation center.

Let's start with a strategic picture for network centric operations.

In the next 50 years the United States must be ready to execute numerous global small scale operations and be ready to win in any major theater of war while maintaining our homeland defense. TSAT will strengthen operational ties with America's allies by enabling more efficient operational burdensharing through improved interoperability. Each branch of our military service has unique plans for network centric operations. Military experience has shown that networked warfighting units are more successful and efficient. TSAT, as a joint program, is very mindful of this reality and the services' network centric plans. TSAT works closely with the services' TSAT terminal program offices to ensure the TSAT network design is synchronized with the services' global information grid enabled operations intent.

TSAT's concept of use focus on strategic communications, airborne intelligence, surveillance and reconnaissance, and communications on the move will provide a powerful capability framework in which allied governments can better work together to achieve common goals at all levels of conflict.

Improved situational awareness combined with the responsive and flexible engagement options should result in faster and possibly cheaper target kill chains. Robust and secure GIG communications will enable sensor-as-shooter systems, creating diverse battlefield effects without putting airmen, sailors, soldiers or marines in harm's way.

This next chart shows how these joint and coalition network centric operations are enabled by TSAT's extension of the global information grid.

The TSAT era will begin with the launch of TSAT-1 in 2016. This Department of Defense architecture framework presents our MILSATCOM port folio satellites. TSAT will be the first DoD communication satellite with an internet router, enabling secure internet protocol communication services like e-mail, voice over IP, broadcast, streaming video, and numerous special communication services.

The continental United States (CONUS) gateway, teleport gateway and polar gateway will serve as ground connection points, stitching together the Global Information Grid (GIG's) space and terrestrial networks. Deployed users will interact on the GIG through their TSAT terminals which will be interoperable with their tactical communications networks. This enables assured, ubiquitous communications to our deployed high mobile users while supporting communications for homeland defense, the intelligence community, and our national command and control authorities.

Two space GIG net ops centers are envisioned. A primary, at Schriever Air Force Base in Colorado, and a backup at Vandenberg in California. In the event these two centers become inoperable an endurable control element will be activated to maintain continuity of operations. It's very important to note that TSAT will have a robust, autonomous capability to ensure the most important communication services are always available, regardless of the ground situation.

The commander, United States Strategic Command has combatant command authority over the GIG. Operational control authority of MILSATCOM payloads is dedicated to the Joint Task Force Commander for global network operations while the operational control of MILSATCOM spacecraft is delegated to the Joint Force Component Commander for Space. Unity of effort is most likely to occur with multi-disciplinary operation centers.

This next chart shows what we mean with a TSAT net ops facility design.

This facility concept will enhance the teaming relationship between the Joint Force Component Commander for Space and the Joint Task Force Commander for global network operations. The space experience and talent the United States Air Force has developed over the past 50 years will be combined with the national and DoD talent in managing defense networks to provide information superiority to our warfighting customers for decades to come.

Global communications, network situational awareness and common operational picture technologies will be employed to sustain optimal network operations in support of the global operations of the day. TSAT will proactively resolve network faults to assure users experience high communications availability.

Future adversaries are expected to continue their asymmetric attacks against our information systems. TSAT gives network operators many secure information transport options that should overcome enemy actions.

NetOps personnel will work closely with deployed commanders to give them local network situational awareness to support their networked force operations.

Now it's not shown here, but equally relevant is the transformational planning services that support U.S. deliberate and crisis action planning. It is Commander USSTRATCOM's intent for today's stovepiped, complex and time consuming MILSATCOM apportionment process be replaced with a more efficient, robust, automated planning capability. Seamless interconnection of networks will enable the warfighters to focus on command, control, situational awareness and maneuver and fire activities.

In summary, we have explored the future network centric strategic context for America. We explored how TSAT extends the global information grid to support highly mobile globally deployed joint and coalition users and we discussed transformational SATCOM planning.

Let me stress, TSAT is a big step to realizing the global information grid vision. Protected communications with increased bandwidth based on widely used standards will soon be an operational reality.

It's a great honor for me to represent Air Force Space Command's MILSATCOM system's wing. I'm certain that we will deliver the transformational communications capabilities America and her allies need.

That concludes my presentation, and thank you for your time.

[Applause].

BGen Pawlikowski: Thank you, Aaron.

You've heard from three speakers who have highlighted how space effects are envisioned to become a critical and an integrated part of space operations, just as General Kehler had laid out. They highlight how important it is for us to maintain our space superiority, our ability to, if you will, to own the space domain as we talk in the same sense about air superiority.

Our last speaker is going to talk about what he and the Space Superiority Systems Wing see as the future for our ability to maintain that upper hand in space and to defend our assets.

Brian Vesey was commissioned through ROTC at Angelo State University in San Angelo, Texas, where he got a Master's degree in Business Management. He is an acquisition program manager and he's currently Chief of the Surveillance Branch in the Integrated Space Situation Awareness Division of our Space Superiority Systems Wing. His previous space experience includes a year as the project manager for the Space Situational Awareness Initiative as part of our sisters product center, the Electronic Systems Center. He also had two years as the Deputy Release Manager for the Combat Commanders Integrated C2 System or CCICS, for those of us who are familiar with it, for space releases. Two years as a project manager for Cheyenne Mountain Operation Center Laser Clearinghouse. I'm very familiar with those guys. And one year as a program manager for the Offensive Counter-Space Command and Control.

Brian?

[Applause].

Capt Vesey: Thank you very much, General Pawlikowski. Like the General mentioned, I'm from the Integrated Space Situation Awareness Program Office in the Space Superiority Systems Wing, and I'm honored here today to talk about my assessment of the future of space situational awareness.

Next slide, please.

Just a brief overview of what I'll be discussing today. I'll be giving a brief definition of space situation awareness and talk about the background itself with highlights regarding the Air Force Space Command Commander's vision for space situation awareness. Talking about how space situation awareness really forms the foundation for overall space superiority. Talk about how SSA is a critical piece to the Joint Functional Component Commander for Space's concept for joint space operations, and then talk about some of the key, because there are many, of course, challenges that face the space warfighter right now. Then finally, of course, talk about the future of space situation awareness.

Next slide, please.

The definition of space situation awareness, and you will hear many different but similar definitions out there, and I pulled this one from the Air Force Space Command Functional Concept for Space Control Operations, and I paraphrase. Knowledge of space events, threats, activities, conditions, and space system status to enable commanders, decisionmakers, planners and operators to gain and maintain space superiority across the spectrum of conflict.

This vision shown on the screen here gives a very good picture of what is required to fully enable space situation awareness. This really amounts to inputs from space intelligence, reconnaissance, surveillance, and environmental or space and terrestrial weather data.

Next slide, please.

This next chart is a build chart, and I'll build it slowly. But I wanted to mention, and has been briefed here this morning, that as our dependence on space grows we naturally become more vulnerable and thus must require more protection of our space assets.

Next slide, please.

SSA, as I've mentioned, space situation awareness, forms the foundation for space superiority which really is freedom of action in space.

Next slide, please.

SSA gives commanders the ability to know what is happening in space.

Next slide.

This knowledge is used by commanders, decisionmakers, for appropriate decisionmaking in the form of both defensive counter-space and offensive counter-space. Again, within the realm of space superiority.

Next slide, please.

Or simply the ability to act.

Next slide, please.

I borrowed this chart, 14th Air Force developed chart, to show how SSA again is a key part of the Joint Functional Component Commander for Space's concept for joint space operations. If you highlight and look at the top, really what we're looking at is the inputs to enable space situation awareness. The first block on the top left hand side, the space and terrestrial weather. This amounts to the environmental piece I described earlier. The status of our own friendly assets represented here on the slide as the blue space picture; the status of enemy or hostile or other countries' space assets, represented here as the red and gray space picture; and then finally of course, space debris tracking, to be able to understand what is out there in space and catalog it appropriately.

To achieve SSA the JSPOC, the Joint Space Operation Center mentioned previously today, up at Vandenberg, has the need to gather and fuse all of this information and able to effectively support the tactical operations shown at the bottom. Again, from my perspective, the Space Superiority Systems Wing to highlight the defensive and offensive potential operations.

Next slide, please.

As I mentioned, of course there are many challenges that the space warfighter faces today with regards to SSA, and I've highlighted three key, what I determined to be three key challenges, the first of which is an insufficient ability to adequately fuse space intelligence, surveillance, reconnaissance, and environmental or space and terrestrial weather data into one picture.

What is currently happening is that very smart, capable, experienced space warfighters at the Joint Space Operation Center are forced to do what we call gray matter integration -- pulling information from disparate systems. From one system they can pull [catalong] information; from another system the pull space intelligence; and from another system they pull space weather data. Being able to put that together in one picture is challenging and doesn't really give a fair advantage to the operator to put together the full space picture, the big picture for space.

The second challenge I see today is the inability to share critical information in real time with the entire joint space mission operations enterprise. When I say the enterprise, it amounts to, of course, not only the Joint Space Operation Center, but subordinate units, mission partners around the globe.

What is being done right now to share this information amounts to, for the most part, old methods of using phone calls, fax, and a myriad of collaboration systems that exist.

The third major challenge I see right now is the inability to quickly process and analyze space events to enable defensive and offensive counter-space actions if necessary. Some examples of these space events are new foreign launches, satellite breakups, and maneuvers.

Next slide, please.

Of course to talk about the future of space situation awareness I have divided, as you can see here on the slide, between the near term within the next five years roughly, and then some of the long term characteristics.

The first one under the near term category I see that we will be providing is an improved characterization and attribution

capability. So the space warfighters and commanders will not only have the ability to know where something is in space, but have a definitive, accurate picture of what exactly it is, and if there is an event that happens be prepared and able to contribute it to the correct and accurate source.

Secondly, the fusion of intelligence, surveillance, reconnaissance and environmental information, giving those operators, again, and the space warfighter, the big picture that they need with that fused information.

We will deploy all of the planned architecture to include all of the applications, the data, and the services we will be providing to the warfighter within the next five years, on a net centric, service oriented architecture. This really amounts to machine-to-machine interfaces, and again, a global picture that's all shared so that everybody across the globe dealing with space is looking at the same identical picture.

Finally, near real time event processing. What we're seeing today is perhaps a delay. If an event happens in space the operator is forced to go through a lot of the motions in process to gather as much information as possible, and it takes time to determine exactly what has happened. We expect I the near term that with this fused picture the warfighter will be enabled enough to look in real time and know what has happened to act appropriately.

Moving on to long term characteristics, we expect that this near real time event processing and detection capability will be now real time, enable the warfighter, again, in real time as something happens in space, to know what it is and exactly what has happened and be able to appropriately characterize the event.

I imagine that, and we're talking roughly 30, 40, 50 years in the future, a dynamic tasking, and really what amounts that I see to a decentralized cooperation between satellites and sensors. It will be a much more optimized space surveillance network tasking capability, as one example. For example, if we task a particular sensor to track a satellite of interest, the satellite itself will be able to determine whether it is not 100 percent mission capable, and therefore must re-task to another sensor without having to flow back up and start the process again.

One more, the ability to predict and determine intent. Not only will commanders and decisionmakers know in real time that something has happened, but there would be a much more predictive capability based on good fusion of that intelligence, surveillance and reconnaissance and environmental information that will allow them to know something before it happens.

Then the intent. For example, if a satellite maneuver is in the future, can we quickly determine is this in fat a hostile event or is it mere station keeping for particularly another country's satellite?

The last bullet up here really amounts to an organizational change that I can see, and I reference a recent OSD memo but I see that it really will enable SSA, that migration of the Joint Space Operation Center, it's really a national security space operation center, bringing in and being able to deconflict tasking among Air Force, and of course joint assets with the national assets will be much more beneficial and will really centralize the control for the entire country.

In summary, you can see by the bumper sticker at the bottom, I see that the future will bring full knowledge and awareness of the space domain.

Thank you very much.

[Applause].

BGen Pawlikowski: Thank you, Brian.

Our last speaker is Colonel Ken Allison. I saved Ken for last first so I could give him a little more time to get ready since he didn't have but the 30 seconds before he sat down to find out he was going to do this. But also because he's going to talk about the future of space, space lift or launch. I thought it was appropriate to bring us full cycle, back when we started our heritage panel about the initial efforts for the center out here was launch. So now to look at where we are in the future.

Ken is a Texas A&M grad. I'm going to do this by memory because I don't have a card on it. And has been in space operations for his entire career, both for the Air Force and the NRO. A wide breadth of experience. Just came from the Rand Corporation where he was on a fellow to study space, once again. And we've given him a pretty important job for the center. Ken works in our Development Planning Division and he has been chartered by General Hamel to reinvigorate and essentially reinstitute our development planning function within the Space and Missile System Center. I think it was General Katina who talked about how, or maybe it was General Henry, who talked about how the ideas that faster the requirements from the future kind of get started out here. It's kind of a cycle of which comes first, the chicken or the egg. The technical ideas that become the basis for those requirements, or those requirements.

Ken is the idea end of that. So his charter is to take those requirements that come from our space operations and from our warfighters and to translate those into future architectures and future systems that bring them into reality. One of the very

first of those road maps that his division has birthed is our space lift road map, and Ken's going to talk a little bit about that.

[Applause].

Col Allison: Thank you, ma'am. I would say until I guess about 20 minutes ago, what a great conference. [Laughter]. Then I saw General Pawlikowski go like this and I said uh oh.

Please keep Major Page, I don't know how he's doing after the accident, so hopefully he's okay, but please keep him in your prayers.

Space lift development planning. Let me kind of give you a little background. As General Pawlikowski stated, I've been here about four months. General Hamel hired me to reinvigorate development planning. When he brought me in he said, Ken, I want you to do development planning and I know I had the deer in the headlight look, because I didn't know what development planning was. He called me in and kind of gave me the background and what he thought it was. And as General Pawlikowski stated, I just came from the Rand Corporation so I figured I knew how to do research, so maybe I should get out there and do some research on this development planning and find out what really the boss has kind of signed me up to do.

So I spent a few days doing that and I started to kind of, I thought I had a good understanding of what development planning was, but after a week or so went by, General Hamel wanted to see me again. So he kind of gave me some additional thoughts on his ideas of development planning. Again, I thought I was kind of getting it. But every time I walked from General Hamel's office back to my office, I thought I would have it until I kind of sat down. Something happens when you walk across that El Segundo Boulevard. [Laughter]. I don't know if it's trying to dodge the cars or what it is, but somehow I was kind of losing the concept.

I went back and I found some old documents, old development plans that were written, I think the latest one I found was the 1976 timeframe. I found some development plans. After reading through those I think I'm kind of starting to get it. So maybe you'll be my test case.

The essence to me of development planning is how do we link warfighting needs to operational capabilities? That's kind of the essence of it. I know there's a lot of other processes out there that are similar to development planning, but if you get that link then to me you've actually accomplished development planning.

So how do you do that? The first thing you need to do is you need to understand actually what the needs are. Those for us

in XR are normally provided by Headquarters Air Force Space Command. Then once you identify what the needs are, you need to understand what are your operational capabilities? Your current systems of records, and those enhancements to those systems of records that are available to meet those needs.

Then you perform a comparison. You say okay, I understand what the needs are, I understand what our systems of records are, are there any deficiencies there? You document those shortfalls and deficiencies.

The next thing, you say okay I've got needs, systems, and I also have these shortfalls and deficiencies. What are some concepts we could bring to bear that will basically meet those shortfalls and deficiencies? That is primarily my job in the concept development division. We identify what those concepts are that are needed to meet documented shortfalls in deficiencies.

Another thing we have to do is to determine what is our acquisition strategy to basically fully develop the concepts that we have and bring them to an operational capability. So as you see, we've gone full loop. We've gone from what are the warfighting needs, to what are the operation capabilities needed to perform those needs?

So today I'm going to really talk about space lift development plans. That's the development planning side of it. Now I'm going to kind of cover some of the space lift portions of that.

Next chart, please.

Here are the primary objectives of our space lift development plan. These are pretty consistent with all development plans. We've actually tried to establish a standardized format for all development plans. So if I was here talking about another mission area, you would see pretty much the same type of objectives except for those that are really specific to space lift.

The second bullet there, to establish new capabilities to profoundly improve cost effectiveness. You've heard that a lot today from the previous panels. That to me is also realistic cost. We don't want to promise that you can launch for $30 million initially, and then once we go through our system engineering process we really find that it's going to cost you $300 million to launch that system. So it's not only determining from a cost effectiveness standpoint, but realistic cost estimates there.

Also to unify the efforts of the different organizations who are responsible for providing mission capability, including our headquarters, the research lab, and also the industry partners.

As you know, there's a lot of people in industry who are basically developing space lift capability, so we want to be able to bring in their efforts into the fold and do a comprehensive development plan that not only documents military capability, but also civilian capability.

Next chart, please.

What does the space lift development plan contain? As I stated before, it contains not only the current system of record, our EELV systems, but also upgrades to those systems. Small launch vehicle, expendable stages. Also the next generation of space lift stage which is a reusable system that hopefully will provide us low cost and responsive launch.

Next chart.

Here's a pictorial of the concept itself. Again, it has a reusable stage and expendable upper states. The reusable stage is basically just that. It takes off and then lands back and the additional launch capacity is provided by the upper or expendable launch stages.

Next chart.

In the near term, our goal is to basically develop a small launch capacity. As you can see there, about 5,000 pounds [to leo], and that's using a small, reusable vehicle with the small expendable upper stages. Then in the future we look to expand upon that by having a capacity up to about 56,000 pounds [to leo] and that can use from one to several large expendable boosters with a combination of small or large expendable upper stages.

Now you see a picture that shows a booster, a reusable booster with wings. That is just our concept. We're actually exploring what that actually should look like. So don't take it that it has to look like what's shown in the picture. That's just the initial hey, here's an idea. Here is a concept. So if it ends up looking more like an expendable launch vehicle and we can reuse it, then by all means that's what we will employ.

Next chart, please.

What is brought to us by the next generation of space launched vehicle? As you can see here, cost and operational databases. Basically being able to lift off and return to base. Autonomous flight control system demos. Upper stage technologies there.

To me the next generation launch system definitely, if you think about over the last 50 years of launch, we basically have reached our ability to significantly improve upon expendable launch vehicles. In other words, now it's time to do something different from a cost standpoint, from a performance standpoint. Yes, we'll continue to turn the crank and trying to be more efficient. But to gain wholesale or a complete new way of doing business, we think it resides in using a reusable launch vehicle.

That's pretty much all I have for you today. Thank you.

[Applause].

BGen Pawlikowski: What do you think? Excited or scared, right?

Some pretty good ideas. My hat's off to the panel here. This was, as I said in the beginning, this was a 100 percent volunteer panel and I think they did a super job of giving us some thoughts and some things to think about, as I can tell, because we have a number of questions that you all have presented. So I think we, General Dunn, we do have time to go through some questions.

I'll start out. This first question, Aaron, if you might be able to take a shot at this one.

Please describe any initiatives or ideas you might have to integrate space programs with air and cyber domains, particularly in the context of TSAT and some of the others. How are we integrating space and air and cyber together?

Maj Metz: That's certainly a growth area for the future. I've given it thought myself. I think perhaps in the entertainment area, in the gaming area, in the simulation area we may have some interesting opportunities there.

Just last month, I've got an 11 year old boy and he bought this game Halo. So he was real excited about it. Then I got him the wireless thing for his Xbox 360. I go into his room to check on him, he's got a headset, he's dialoguing with a partner in New York, and he's doing this operation. Here he is, an 11 year old kid doing this military coordinated action. There's a little bit more of that on this gaming server. There's over a million people worldwide on average playing this Halo game.

If we can, I guess in the military community, leverage some of these concepts that are taking place in entertainment and employ them in the military dimension effectively, I think there's a great opportunity to really take our country forward, to have the edge. That's, I guess, an area I'm looking at. How do we apply that in the military world? That's something I guess we need to think about and perhaps figure out.

BGen Pawlikowski: This one is for Salty. Can you describe initiatives to jointly develop and define new concepts with the warfighter? Any warfighter. Open ended question.

LtCol Saltzman: This is what we wake up every morning and try to do. It's both the gift and the curse of being the single stop for all space operations.

We have to stay in communication, both collaboratively as well as get out and see the other AOCs. That's where our direct support relationships are defined. So as we explore new ways to provide space effects, we have to do it in lock step with the battle rhythms of about nine different combatant commanders. That's one of our key challenges, is how do we establish that battle rhythm so that they can get the space effects and timing and tempo that works for them.

Collaborative tolls have certainly helped us redefine some of the new ways to provide support, but in the end it comes back to two people have to link up in some method and say this is what I need and here's how you can provide it for me. So a lot of that hasn't changed. You still have to have smart people trying to solve problems and communicate their requirements, and we work hard to try to keep that going. It's not always smooth, but as we explore new ways to do that it gets better and better.

BGen Pawlikowski: This one's for Brian, for Captain Vesey. Is it possible to really know everything that's going on in space? [Laughter].

Capt Vesey: Yes, ma'am, that's a very very good question. [Laughter]. I think we have a great opportunity from this point here, and again I'm speaking from some part from my program office that I support, the Integrated Space Situation Awareness Program Office, to really leverage a lot of the capabilities that exist out there today. I think there is a good deal of information that, for lack of a better term, and somebody else described it today, falls on the floor. A lot of the sensor and different information that flows into the sensors, falls on the floor and is not truly exploited. So I think we have a great opportunity with our program in the near term, and of course in the long term, as we expand out for the base line we're building in the near term to gain a much better picture of what's out there.

When you say everything in space, that is a much bigger thing to tackle. I think we can come very close and I think it's going to take integration not only with sensor integration that I've previously described, but making sure we are in complete concert with the air side to fully exploit the data for the warfighters' needs. I think in the future, and I had mentioned before about centralizing at the national level. I think we

could expand even further out to be more a worldly picture in concert with our coalition partners in the future.

Kind of a long answer, I understand. To know everything that's out there in space I think will take a much longer time, but I think in the near term we're taking very good steps towards exploiting the information from the capabilities that exist today.

BGen Pawlikowski: Jason, space technology is constantly expanding its combat potential. What do you see as the biggest threat from opposing countries to thwart our maximum warfighting capability?

Maj Eisenrich: Another good question. [Laughter].

Our space systems obviously have many different segments that a potential adversary could try to get at. We saw with the Chinese ASAT that all of our systems are not safe up in space any more. However the biggest threat I think lies to those systems that are the easiest to get to, and those will be our ground systems.

Adversaries have the ability to get damaging capabilities close enough to our ground stations that if -- sorry. If they can get some sort of destructive capability close enough to those ground stations, that is the simplest way for them to do that, and I think that is the thing we need to worry about most. We have seen, especially since 9/11, stepped up force protection of our facilities and I think that will probably need to be expanded even more because of how open our society is and our ability to get close to those systems.

BGen Pawlikowski: We have time for one more, and I'm going to take a little bit of a step outside of the subject, but I'm going to take a little risk here and I think it's probably a question that maybe some of our younger officers in the room are thinking about. Any panel member can answer this one, but not Colonel Allison. [Laughter].

Col Allison: I probably don't know the answer, ma'am. [Laughter].

BGen Pawlikowski: The reason why I put it that way, in these days the Air Force is offering members a significant amount of money to leave, in order for us to be able to recapitalize our force and to meet end strength requirements. I'm wondering if any of you would be willing to comment about what makes, what would you say to a junior officer that would make him want to stay in the Air Force space business.

Col Allison: Unfortunately, I have to have these conversations all too frequently right now. The conversation

always goes something like this. It's the smart ones, it's the good officers, it's the good NCOs that have opportunities on the outside. And what I tell them is they will probably always have those opportunities but you only have a small window in your life to serve in the military, and what usually strikes a chord with the guys who I'm successful with is chasing that bottom line dollar figure, while interesting, time consuming, challenging, doesn't have the same rewards as serving your country. I think when it comes back to that, it's the patriotism. It's not trying to hold up to a corporate model, but leveraging those strains of patriotism, and that there's something beyond a bottom line figure that wakes you up every morning and gets you into the office to do good things. That usually, I think, will keep some of the better ones in.

[Applause].

Voice: I'm going to take a shot at this too. I've been in uniform for 12 years. The separation bonus is pretty significant, so there is that money enticement. But we're just the sum of our life experiences, and I think all of us want to make a difference, we want to make an impact. We want to leave the place better than we came to it.

Here, service in any of the armed services, really, offers a unique opportunity to really make a difference. Here we are, mid-grade officers, and we're out here to potentially architect the future of space power and that is going to have an effect on world history.

So yeah, if you really want to make a difference, the armed services is where to look and where to stay.

[Applause].

Gen Dunn: Ellen, what a great panel. I don't know about the audience, the rest of the audience, but for myself knowing that the future is riding on these shoulders is going to let me sleep really, really well tonight. So I'm very happy.

I do have to make a comment on one of the presentations. I've seen a lot of complicated slides in my Air Force career, but Chance, you win. [Laughter]. I think that maybe you ought to give some of the old heritage guys a lesson on how to build those kind of slides. I'm just joking. [Laughter].

This has been a wonderful session, and I want to thank everybody for their participation. Lunch is next. We've slipped lunch to 12:40, so you've got about ten minutes before you have to make your way in there and get settled. Our luncheon speaker is General Chilly Chilton.

Thank you very much.

[Applause].

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