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Teleprompter Script for Dr. Wade Pulliam, Program Manager, Tactical Technology Office

IMAGINE: Operate with Persistence

» **WADE PULLIAM:**

As Mr. Welby said earlier, in tomorrow's battlespace, our military must operate with a new degree of persistence.

What does this mean?

Well, given the nature of our current conflicts around the world,
it's apparent that getting there fast is only part of the strategy for success.

We also must persist within the battlespace,
on land, in the sea,
and in the air -- over extended periods of time-- giving our soldiers, marines, airmen, and sailors the resources they need to truly endure and dominate our adversaries until the job is done –
no matter how long
it takes.

Imagine the ability to give them continuous and overpowering surveillance and communication tools for weeks... for months... or even for years --
an uninterrupted eye, ear and voice on the front lines that ALWAYS can be counted on to perform.

Such capabilities are key to overwhelming battlespace superiority.

We've made great strides in these areas, but a new strategic environment has placed unprecedented demands on our armed forces.

As mentioned by Dan,
no longer are we concerned just with monolithic state actors, whose key centers of power can be mapped easily in advance and struck quickly at the beginning of hostilities.

We're now operating against a faceless web of non-state and sub-state actors, who are challenging to find and even more difficult to dissuade.

They aren't
going away easily...
and neither are we.

Such long-term engagements require immense national resources – human, political, financial and technological.

We must use all of these sources of national power wisely if we are to outlast this type of foe and
defeat them.

What sort of force will provide the flexibility and capability to maximize these national resources?

As we have seen during the last few years,
long operations strain the human dimension
of the force.

We cannot continue to deploy systems that require a large human

footprint to operate.

Increasing tooth-to-tail should be a goal.

We have also entered a period of flux in the international environment caused by the end of the Cold War;
an environment around which our historic force structure has been designed.

We must remain strategically nimble in this new environment, especially in unstable regions of the world.

Reducing our reliance on forward-basing should be a goal.

We also face a future funding environment that will put strain on our ability to continue operations indefinitely in the same manner as we have in the past and which will reduce the resources available for expanded missions,
such as those envisioned for UAVs.

Making the most out of our force structure,
fleet sizes and reducing O&M tail should be a goal.

Finally, the fight against this new type of enemy requires new capabilities.

Surveillance capacity and speed-of-operations is even more important against the hidden and fleeting targets of this
new fight.

No longer can we maintain the historic mindset of operating
a few queuing sensors to identify a surge in
enemy capability.

Now, we must operate continuously –
providing persistent platforms that allow maintaining a consistent surveillance picture and producing for the warfighter the battlefield picture and targeting information necessary to act quickly and precisely.

Developing these new capabilities must be a goal.

Leveraging our immense technological capabilities toward these ends is the key to success.

And persistence is a vital part in achieving each of these goals.

Although,
as Dan mentioned,
we should explore the complete mission space, a central mission for such persistent platforms is surveillance and communications.

Historically, much of this capability has come via aircraft and satellites.

Typically, manned aircraft operating from carriers or forward bases have provided the tactical recon and surveillance information necessary to support the warfighter.

Conversely, satellites operating in LEO and GEO have provided strategic surveillance and theatre communications.

This paradigm is
resource intensive and operationally constraining.

Moving forward, we must find new ways to operate and new ways to think.

Our long-term goal is to expand the persistence of aircraft to handle such critical missions and supplant the current mode of operation.

Currently, most of our focus toward providing this persistence is through unmanned,
ultra-endurance
aircraft systems.

Imagine them circling over our forces in combat, providing the warfighter with all the ISR, targeting, and communication capability necessary.

Imagine them flying over other regions of concern, constantly monitoring communications and movement much less expensively than currently possible.

Imagine them circling for years at a time,
just off the coast of an enemy country,
waiting for orders – an aircraft carrier in the sky.

How can we enhance our capabilities to the point where maybe only one aircraft is needed for such missions – even if those missions last for years?

If such a capability were possible, from where could we operate?

What missions could we pursue that are now impossible or too costly?

We recently announced a program for the development of such a multi-year endurance aircraft.

To be successful,
we must revolutionize the way we think about aircraft and aircraft operations --

changing our current paradigm of take-off, operations, recovery, and maintenance and instead move to one similar to satellite operations – just launch and go.

To get there,
we will have to break out of our current design mindsets.

We aren't where we are by accident.

One feature of aircraft operations that stands out, as opposed to other systems, is that aircraft tend to return to their logistics base after each mission, where there is an opportunity for maintenance.

Although reduced maintenance has been viewed as beneficial,
it has not been worth the investment to achieve this additionally reliability if the need to refuel the aircraft remains.

Conversely, if the system must be maintained, there is little reason to push the time between refueling beyond a certain point.

To achieve our vision, both the energy management and reliability hurdles must be worked in tandem.

If we're successful,
the power of persistence will take our ISR and communication capabilities to an entirely new level.

To put the problem in perspective, our current Global Hawk aircraft, which is very capable,
can stay in the air for up to 40 hours at a time.

Now compare that to
five years, or more than 44,000 hours,

which is the operating goal for the new system.

Such an ultra-endurance aircraft would provide the persistence necessary to answer the challenges we face with regards to the size and cost of maintaining and operating the UAV fleet, the forward-basing and distance obstacles that current aircraft face, and new capabilities that are not currently economical.

For example,
consider monitoring a single spot on the Earth with a Global Hawk whose base is 3,500 miles from the target.

To accomplish this,
we would need eight planes moving into and out of the area to maintain constant monitoring,
plus maintenance time.

That's EIGHT planes to monitor one spot.

We envision a future capability where only a single aircraft would be needed to perform the same duties, remaining above the area for as long as necessary -- then moving on to the next mission when done – maybe never even coming back to the base.

Such a system wouldn't be limited by range, allowing operation from the United States.

Now those eight planes could monitor eight areas instead of one.

Additionally, operating costs could be lowered to the point where additional missions could be undertaken.

Now consider monitoring that same spot with a surveillance satellite in

LEO.

One would need to line up a series of satellites to provide extended coverage, but this comes at a very high cost.

Additionally, satellites are very far away, requiring large apertures and advanced sensor resolution technology.

Conversely, a single ultra-endurance aircraft could provide an unblinking view -- circling indefinitely just twelve miles above the target, providing the warfighter with persistent surveillance and targeting capability for significantly less cost.

Also consider the great improvements in theatre communications possible through the use of such an aircraft.

Currently, communication satellites operate predominately in GEO, significantly farther away than an aircraft circling directly above a specific area, thereby limiting channel capacity.

Communications are made easier by significantly improving signal-to-noise ratio just through proximity,
greatly increasing the operational flexibility of the warfighter on the ground.

In short, ultra-endurance aircraft can take advantage of the power of persistence and proximity to the battlespace and provide a capability well beyond that of a satellite.

Clearly, there are technical issues that must be overcome to make this vision a reality.

How do we power such an aircraft for 60 months?

Energy harvesting solutions,
such as solar power,
are an option.

The Air Force has been working a satellite power solution that could lead to high-efficiency, low-mass cells, capable of direct transition to aircraft designs.

Automated in-flight refueling is also an option.

We have been developing such a capability over the last few years.

Both of these possibilities provide a starting point for further development.

In either case, more efficient propulsion is vital to capitalize on these developments.

Although mature technologies,
internal combustion and turbine engines are not as efficient as other technologies,
such as fuel cells,
at converting chemical to mechanical energy.

Combined with new ultra-efficient electric motors, fuel cells, especially solid oxide technology, provide a path to high efficiency and high reliability.

We also must look at new aircraft designs that lead to ultra-lightweight platforms with improved aerodynamic efficiency.

Extra weight means extra drag - so every pound counts.

Design solutions such as span-wise loading and joint wing concepts provide us possible exploration paths.

Mechanical reliability and maintenance is another major hurdle.

When you consider that the Global Hawk has a major service cycle every 400-600 hours,
a goal of five years,
or some 44,000 hours,
is audacious.

Obviously, this will necessitate development of new approaches to maintenance and reliability.

One approach may be to design the aircraft like a satellite, by, in part, increasing the reliability and redundancy of
sub-components and designing for inherent reliability.

Another approach may be the development of automated in-flight servicing technologies that currently do not exist.

Although the technology challenges that must be overcome are great, the benefits are likewise great.

By attacking both of these hurdles together,
a whole new paradigm of aircraft persistence may be possible.

But aircraft are not the only platforms needed to provide all-encompassing capability - land and sea systems also have their place.

We must address many of the same challenges when considering these systems.

Persistence is a key enabler here as well,
to achieve the same benefits of
fewer support personnel, fewer systems to acquire, and reduced basing requirements.

Beyond these benefits, persistent land and sea systems have an advantage over aircraft – that of concealment.

By eliminating or significantly reducing the rotation of systems,
the risk of detection by the enemy is decreased.

Such persistent systems could remain on station, unnoticed, performing their monitoring mission much more effectively.

Consider future land surveillance systems.

Beyond current systems, such as unattended ground sensors,
one could imagine a future of autonomous, concealed or camouflaged, ground robots,
slowly working their way into position, monitoring areas that have impermissible airspace.

These systems could report enemy force locations,
monitor possible weapon manufacturing,
or even be lying in wait to strike when ordered.

Mirrored in this vision is the one for sea surveillance systems.

Imagine the same missions for Unmanned Underwater Vehicles.

As with aircraft,
two major obstacles must be overcome to achieve either of these

visions – providing energy to the systems and building enough reliability into them so that they can operate for months or years at a time.

Although the reliability solutions for these systems are likely the same as outlined for aircraft, the same can't be said about energy management.

Because both land and sea systems do not need to continually move to support themselves,
their power requirements are significantly less.

Additionally,
these systems rely on concealment,
meaning that refueling is counterproductive.

Both of these reasons require that we examine new possibilities.

Beyond improved solar cell technology,
we are exploring the possibility of consuming organic material from the surrounding environment to power these systems.

One could also imagine a UAV flying over the system periodically beaming down power.

There is a myriad of other possibilities.

Let me close by restating the importance of increasing the persistence of all systems wherever we engage the enemy –
in the air, on land,
or in the sea.

By developing these capabilities,
we can achieve significant improvements in cost and functionality.

But more importantly, such persistent systems will enable our forces to be constantly engaged with the enemy –
not allowing them a moments rest,
not allowing them
an inch of space,
not allowing them
an easy breath.

I challenge you today to take these ideas and help us bring them to life and into the hands of our warfighters, as they confront the enemy
day-in and day-out,
and will likely do so
for the foreseeable future.

They deserve all of the mission availability and overall capability that we can possibly give them.

Thank you.

And now I would like to welcome Don Woodbury to talk about Delivery of Precision Effects