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Teleprompter Script for Mr. Tim Clark, Program Manager, Virtual Space Office

Global Is Local

» TIM CLARK:
You've heard our goals for space infrastructure, situational awareness and asset protection.

But why are we so interested in space in the first place?

We want to support our warfighters, wherever they are deployed, with all the services and information they need to complete their mission — and do so as seamlessly as possible.

After all, our troops on the ground don't care if the information they need is generated from a network of satellites, or from a Predator just overhead.

They just want the information to be consistent—reliable—
and above all, useful.

No matter where they are located.

This was driven home to me by the experience of my friend, U.S. Air Force Colonel Steve Johnson, who recently returned from Afghanistan.

In that theater of operations, an airman like Colonel Johnson could instantly find his life depending on good intelligence, situational awareness and seamless communications.

As it turned out,
Colonel Johnson did have some real-time, seamless resources.

The handheld GPS navigation system he used in Kabul worked
just like the one he trained with in the States.

In fact, all the elements of a communications network — the phones,
email, pagers —
worked the same,
no matter where he went.

So for Colonel Johnson, when it came to navigation and
communications,
the best global resource
is a local resource — with absolutely no changes.

For him, communicating from the deserts of the old Silk Road was no different than from his commute to the Pentagon.

When it comes to supporting the warfighter from space, DARPA wants to be able to deliver the same simple consistency of sensor data in dramatically expanded forms of ISR—intelligence, surveillance and reconnaissance—
that will provide warfighters like Colonel Johnson with a virtual diorama of his battlespace.

GPS and the assured communications of MILSTAR have transformed global systems into a local resource for warfighters like Colonel Johnson.

Now, it is time to imagine a global network of ground and air situational awareness.

FROM DREAMS TO REALITY

But how can we turn such a dream into reality?

Consider the example of DARPA's Innovative Space-Based Radar Antenna Technology program, better known as ISAT.

By March, 2000, DARPA imagined a globally persistent, space-based radar system that could perform Ground-Moving Target Indicator Radar,
or GMTI — and do it with the precision of a Joint STARS, or better.

Then reality set in—
in the form of radar physics, Keplerian laws, and the constraints of modern launch assets.

So DARPA determined that the ideal solution was to base radar assets in MEO, Mid-Earth Orbit, with very large antennae.

By June, 2001,
DARPA had begun to develop the technologies to make global knowledge from MEO assets possible.

Our goal was simple: remove the technical excuses in order to make real-time, automated tracking of individual vehicles nothing but a matter of national will.

Our dream was to develop that national resource, and to seamlessly integrate it into international commercial infrastructure, much like GPS navigation and communications satellites.

By December, 2006,

we had developed and demonstrated the technical solution for precision global tracking of ground-based vehicles — technology now available for use in a future system.

BUT THE DREAMS REMAIN

Our dream remains—
to give the warfighter access to persistent global information that is as easy to use as my Blackberry.

But how to convert this dream into working hardware?

In thinking about this,
we draw an analogy from the five senses.

You could equate global sensing to “See, Hear, Smell and Taste,”
in order that the warfighter can “Touch.”

What would this be like?

Let me draw another analogy, this one from life.

In December,
my Mom called to say that she and Dad were moving to a house in North Port, Florida.

After a short celebration—that I would never again have to visit Detroit at the height of winter—
I typed the address into GoogleEarth and watched the screen zoom from a point above the earth down to an overhead image of my parent’s new house.

Without ever having visited North Port,
I could instantly tell my Mom which way to the nearby alligator holes.

Using Google's integrated directions tools,
I plotted turn-by-turn street directions with
GPS waypoints.

I virtually "drove"
the route.

If you are familiar with traffic gridlock here in Southern California, or back in D.C.,
imagine real-time, automated traffic-management that can optimize the flow of traffic on the 405 or the Beltway.

And if you are from Boston?

Sorry, no amount of remote sensing can correct for Boston drivers.

Now, that's a DARPA hard problem...
which is why we have Urban Challenge.

But, if you coupled the transparent simplicity of a capability as in GoogleEarth, with timely, worldwide information—you would have everything you need for our soldiers.

It would also help the DOD reach its objective to reduce the logistics chain and move faster,
with a lower profile.

A space-based,
real-time GoogleEarth-like capability would do this by allowing a soldier sitting Stateside to continually reroute both manned and unmanned resupply convoys snarled in traffic across the theater of operations.

So why don’t we have such a capability today?

In a word: Cost.

Using current approaches, we would have to literally darken the skies with optical sensors to enable this real-time capability.

We need a better way.

Over the last decade, DARPA has broken new ground in the field of computational imaging.

We can take images from multiple small, low-resolution apertures and combine them to fill in the blanks—making for much higher resolution images.

Programs like MONTAGE, ISP and LACOSTE are blazing technical paths for computational imaging, combined with wide-angle, electronically steered optical pathways.

Unlike traditional optics, the optical gain from the refractive properties of lenses is replaced with processing gain.

And by moving to computational imaging, the optical pathway is no longer the equivalent of an optical bench in space.

It is more like an RF electronically steered array, or ESA, with the ability to calibrate and compensate in real-time.

This would allow for very flexible packaging and deployment system concept.

Warfighters also need to locate and measure Chemical, Biological, Radiological and Nuclear operations, or CBRN.

It would be ideal if we could peer into anti-social countries without violating sovereignty, to technically assay the chemical and biological content of particular areas.

Space overflight certainly has the advantage of being non-invasive.

But as of today, to fully characterize a suspected CBRN site, we need physical samples.

The challenge, then,
is remote spectrometry—really remote.

Imagine a space sensor system that is able to map very narrow color bands into a spectral-spatial-temporal datacube,
and then sort through the data to look for spectroscopy matches of known chemical compounds.

Such a datacube might be feasible with a computational imaging system–
but in a diffractive,
non-imaging mode.

Diffractive systems act as a prism, physically separating the colors of light, and allowing us to determine which wavelengths are present at any given location.

Here’s where you and your organizations come in:

We are looking for ideas on how to exploit this phenomenology to achieve remote, hyperspectral sensing of CRBN signature data.

One potential approach is a combination of a diffractive system, with *refractive* micro-optics,
to overcome the extended ranges to space assets.

Any ideas you have along these lines would be welcome.

NON-TRADITIONAL SPACE

So far, I've conveyed our goals for truly seamless space support to the warfighter.

Not all of our goals for space, however,
are global.

In fact, we are very interested in economical methods for bringing in expanded, persistent, sensing capabilities,
as well as filling in gaps caused by satellite failures or malfunctions — be they natural or man-made.

This may not require going to altitudes where the satellite's position must be determined by Kepler's laws.

DARPA is working the core technologies for station-keeping, lighter-than-air stratospheric operations.

Our goal is to create meaningful systems with:
—the sensing advantages of a very-low earth orbit
—the persistence of a geosynchronous orbit
—and the extended low-maintenance lifetime of a traditional satellite system.

Our Integrated Sensor Is the Structure program,
or ISIS, is developing the critical platform technologies,

such as an extremely advanced lightweight hull material, and a fully solar-regenerative
power system.

It would carry an enormous radar,
providing unprecedented knowledge of all airborne and ground-based movers within a theater.

ISIS technology is ideally suited to protect our embedded troops from air assaults, coordinated and isolated ground vehicle maneuvers, and dismounted combatant ground actions.

For example, a single ISIS could provide an underdeveloped region with precision air traffic control, and a centralized traffic management capability.

A functioning infrastructure is the first step in supporting a nascent government and winning the trust of the people.

CLOSING

Before turning over the podium, I want to recap the future I envision.

I see real-time, ubiquitous space support for the warfighter that is so seamlessly pervasive that the soldier need not realize that it is, in fact, space support.

I see Colonel Johnson deployed to any area around the world, using the same tools he relies on while working in the Pentagon.

I see a restructured military logistics capability that can be controlled from the safety of rear operational bases.

And I see geosynchronous persistence with low-earth orbit sensing attributes from stratospheric heights.

And finally, I see a new layer of infrastructure with unprecedented insight into the air and ground activities of an operational theater.

With that, I'd like to introduce Dr. Brian Pierce who will close out this series of talks.

Brian...