The Urgent Need for a New Picture

BLUF: America's enemies have developed advanced weapons and methods that present startling threats to the western world. To counter these threats, the US is developing a new way of warfare that synchronizes air, land, sea, space, and cyberspace forces. Warfighters need a way to understand, coordinate and synchronize information and action across all these domains. Spatial computing technologies, and specifically 3D visualization and analytics, are being developed and applied at a rapid pace - application and training today will allow us to realize their benefits for situational understanding of the operational environment in the conflicts of tomorrow.

In late 2017, in an effort to devise a strategy to mitigate the far-reaching effects of adversary Anti-Access/Area Denial (A2AD) measures, the US Army released its concept for Multi-Domain Battle: an approach to conflict that applies concerted force across five major domains - space, cyberspace, air, land, and sea. The truth is that while peer and near-peer adversaries have figured out ways to mitigate some of our clearest technological advantages, the US still has many excellent capabilities in many different domains that when combined at the right place and the right time, can be very difficult to counter. The idea is that if commanders can simultaneously employ these capabilities from all these domains to generate complementary effects of combined arms, they can use speed of action, coordination, and synchronization of effects "to create windows of advantage for maneuver to defeat enemy forces, disrupt enemy capabilities, physically control spaces, and protect and influence populations.[1]" Where past American operations often focused only on closely integrating air assets and ground forces, future operations will integrate cyber attacks, satellites for imagery and communication, online news and social media, attack aircraft, as well as ground and maritime forces. And in order to be effective, leaders must use each one of these in a coordinated, synchronized way to create seemingly unsolvable dilemmas for our adversaries.

The Challenge

The real difficulty will be in creating and maintaining the speed of action, coordination, and synchronization of effects required to create those windows of advantage for maneuver forces. Different services that use different systems and different jargon, not to mention partner nation forces who speak their own languages on their own systems, will need to be able to quickly and easily mass effects at a given point on the battlefield. Taken further, this means that leaders at the operational level will need to be able to know where capabilities outside their own domain exist, how they operate and what they can provide, and how to plan and execute given their availability.

Further compounding the problem, US and allied forces will need to act, coordinate and synchronize across services and nationalities often without the availability of the drones that give them situational awareness today, and often without the assured network connectivity that makes coordination over distances possible today. Instead of characterizing the battlefield with multiple video feeds about enemy forces, they'll be trying to apply satellite and sensor data on timetables that US ground forces often can't dictate. Intelligence pictures will have to be generated opportunistically, gathering and stitching together information from many technical sources over varying time periods from a variety of providers.

[1] https://www.tradoc.army.mil/Portals/14/Documents/MDB_Evolutionfor21st%20(1).pdf

A Solution

Throughout history, maps have been the canvas upon which leaders define the battlefield and explain how it affects operations. In order to fully perceive, comprehend and project action, commanders build their understanding of their environment and its players onto a map in order to derive an "operating picture". The new multi-domain battlefield demands a platform for the operating picture that handles all the different kinds of data, hides unnecessary information, and surfaces relevant information, so that important decisions can be made quickly, and with the right context. Until recently, in many cases, nearly everything an operational-level commander had to plan for with this operating picture could be represented in 2-dimensional space. Today, because so many more factors influence the outcomes of conflicts (such as information and space operations), and given the growing likelihood of a conflict taking place primarily in a dense urban environment, the ability to perceive, comprehend and project action across all domains in three dimensions will be key.

Visualizing the battlespace in 3D is becoming key for urban and multi-domain operations

The space industry has had to manage its operations in time dynamic 3D for a long time, and the open-core platform Cesium was created originally to handle situational awareness for satellites in orbit. From those origins in 2011, Cesium has grown to become the platform for viewing, understanding, decision making, and assessing operations in any domain in time-dynamic 3D. Built on CesiumJS, the world's most precise rendering engine, it can visualize a satellite in High Earth Orbit in the same scene with a 3D CAD model of a building detailed down to the door knobs. In order to handle

many different domains and integrations, its open API and compatibility with OGC open standards makes it highly flexible, compatible, and interoperable with many datasets and platforms. And it includes the 3D Tiles open specification for sharing, visualizing, fusing, and interacting with massive heterogenous 3D geospatial content (including photogrammetry/massive models, BIM/CAD, 3D buildings, instanced features, and point clouds).

So when DoD users gather new data or get it from interagency or multinational partners, they can upload that data to be quickly processed and made available for consumption on any device. Cesium's scalable and secure platform processes and optimizes all the data into the 3D Tiles file format and delivers it in the cloud—ready to stream to any device, even those being used in DDIL environments. In order to analyze all this information, Cesium's integrated toolset provides GPU-accelerated geospatial time-dynamic analytics including measurements, line of sight, viewsheds and more using multiple data sources and formats at the same time. Finally, users can share dynamic briefings of these 3D visualizations and analysis online without writing a single line of code. Using an intuitive interface, users can create and augment their data with rich text and images that put information like briefs, orders and CONOPS in context with the ability to drill into interactive scenes as desired. When a ground commander needs to share the concept of the operation to a Space Force commander, or a commander from another partner nation, all he or she needs to do is send a URL.

How we win: using the tech better than the adversary

History shows that simply having a superior technology isn't the key to success in warfare. Winning is often the result of the proper and effective application of technology, which comes from intimate knowledge of a technology's advantages and constraints and by exploiting both. In order to win a future multi-domain war with a peer or near-peer adversary, our forces must build the technology into their organizations, train on the equipment continuously, and know when it's valuable and how far it can take them. Put simply, if we want to win a war that's going to happen in five years, we need to acquire and begin training on the right tools now.

Today, several innovators across DOD are moving fast to develop the future of multi-domain visualizations. The US Army is using 3D Tiles as the foundation for its One World Terrain (OWT) Well Formed Format for the Synthetic Training Environment (STE). 3D Tiles are allowing the warfighter to train, plan and rehearse in highly realistic, virtual environments created from photogrammetry and AI algorithms applied to satellite imagery, drone imagery, and other types of remote sensing. US Special Operations Command is using Cesium to optimize 3D data for use on tactical mobile devices as well

as game engines, and for situational awareness in a Common Operating Picture (COP) prototype viewable in both 2D and 3D.

Anyone can sign up for a free Cesium ion community account and see how 3D visualization works today delivered through their web browser. Users with verifiable .mil and .gov email addresses also get access to high resolution 3D TIN models from Vricon of 30 worldwide locations. Take the opportunity to see how visualizing the operational space in 3 dimensions adds valuable context across many domains, and how embedded analytics tools allow you to understand the world around you.