FULL MOTION VIDEO

Enhancing real-time video technology for military ISR

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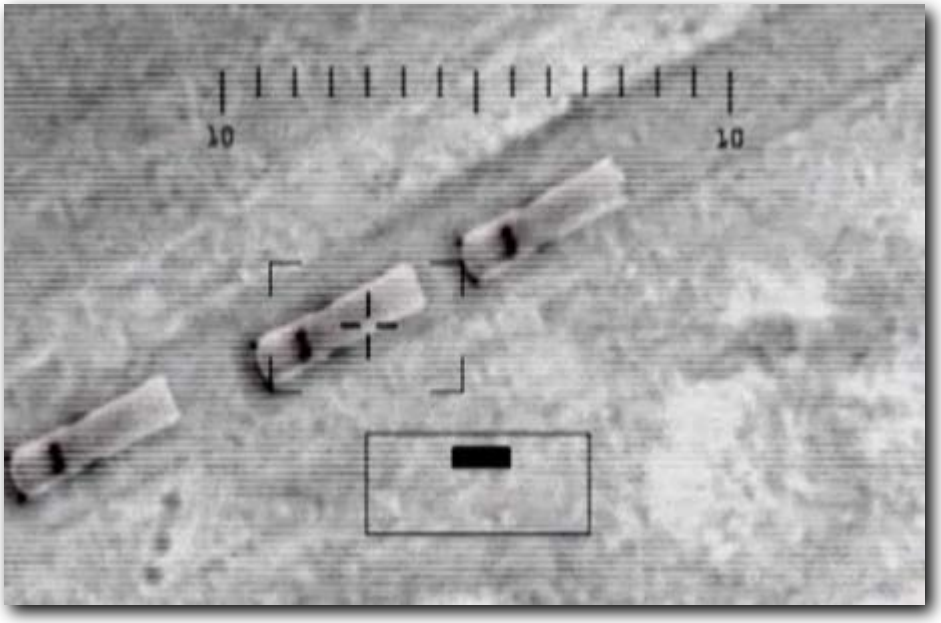

The requirement for intelligence information is today at an all time high. Manned and unmanned military platforms have spiked both in number and in overall capability, each acting as individual data sponges on every mission and helping to piece together the wider battlefield picture.

The objective across most forces is to now have at their disposal full motion video awareness at any time of the day, achieving this visualisation by inter-changing between electro-optical feed when the sun is up and infrared feed when it's not.

Enabling commanders to simply dismiss the fog of war in this way is of huge benefit, allowing forces to engage on its own terms, saving time and cost.

This is all the more true in irregular scenarios in which pockets of adversaries aim to fight their battles from covert hiding holes, and where the adversary itself is not always visually identifiable amid civilian populations without the use of high resolution airborne cameras.

As such, the use of full motion video (FMV) technology and processing to reduce the time required to obtain situational awareness information as well as improve the performance of existing automated analysis tools, such as facial recognition, targeting and video analytics is becoming a priority for defence budgets. Last year, U.S. government spending on military video surveillance systems reached over $8 billion, and rose further still over 2012.

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Brigadier General (Ret) Brian Keller, former director of military support (DMS) of the US National Geospatial-Intelligence Agency, pinpointed the value of FMV in practice.

'One factor that made the surge in Iraq successful was our ability to successfully target al-Qaeda leadership as well as their media centres and bomb making facilities. These successes were related to the increased availability of full motion video.'

FMV captures video at a high frame rate (30 fps), ultimately providing a clearer and more defined picture. A higher fps allows the US military to gain biometric identification information and subtly threatening activity which is then relayed to troops in the field. It can just as equally be used on ground mobile platforms and fixed persistent surveillance systems as it is on UAVs.

Donnie Self, Chief of the NGA's Sensor Assimilation Division described the impact of availability of the systems for soldiers in the field.

'Troops do not want to go out without a UAV with motion imagery providing overwatch for them,' he said.

'They are brave young men and women; they do go out without it, but it is so much safer if they have that overwatch provided by motion imagery.'

Capability growth

The sheer volume of the data however is creating its own urgent requirement for faster and more complex data management. Not only must all video data be stored indefinitely, it must be sifted through for relevance and then disseminated to other databanks and decision-makers.

Groups of analysts watch every second of the streamed footage in real-time to military bases and intelligence agencies, often in other parts of the world. Those watching communicate through the use of private chat rooms, alerting each other to possible threats, passing this analysis to those in the field and snapping still images of anything suspicious.

For perspective, operations over Iraq and Afghanistan in 2009 are believed to have collated about 24 years of video footage; today, Boeing's A160 Hummingbird unmanned helicopter and Autonomous Real-time Ground Ubiquitous Surveillance (ARGUS) Imaging System is capable of amassing 80 years worth of video *per day*.

Unmanned assets therefore carry particular precedence on military shopping lists and have, over the past seven years, slowly been taking over the role of manned assets thanks to more affordable solutions entering the market.

Challenges

Although many of the ISR platforms in theatre today have kept up with the times, legacy technologies such as large antennae and inefficient management of bandwidth are slowing troops down and escalating the cost burden.

Up until now they have managed to keep up with the most urgent assignments but as forces withdraw from Afghanistan and UAVs remain on duty, the task of monitoring video will quickly become more challenging.

Today, military FMV analysts spend 75 per cent of their time reviewing intelligence data and only 25 per cent analysing it, which many believe is the opposite of what the situation should – and could – be. Following this, the time it takes to also return findings into the hands of the warfighter requires as much of a reduction as possible.

Bandwidth requirements for broadcasting FMV, especially in high definition (HD) are tremendous,

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while the question of how to store all those decades worth of footage is proving a headache.

Adding to the problem, video can suffer from quality issues such as low resolution, shake and noise that obscure forensically valuable details or information, not just on an operational level, but also after-the-fact where video evidence may be required to form forward strategy or prosecute detainees.

As ever, there is also the familiar interoperability challenges of recording and sharing FMV across a multinational operating environment.

Solutions?

Governments and militaries are beginning to turn to other industries that deal regularly in video transfer and storage – such as the television industry – as well as in learning ways to provide cutting-edge interaction and debriefs, such as mixing data feeds and "drawing" over stored video with arrows and symbols much like a broadcaster may commentate on a football match. Military agencies are openly referring to this activity as a form of forensic analysis.

This development could also see the advent of an intelligent scanner running in real time over the video feed in which objects are automatically tagged with data, alerting viewers to anomalies, coordinates, distances of the target and potential threats.

UAV manufacturers are also making room to increase the amount of camera angles available to on board cameras, with Reaper being augmented to increase from 12 rotatable angles at once to up to a possible 65.

A few years back, UAVs on reconnaissance missions had become very good at finding things on the ground and being able to identify what was those objects were. The problem was in determining where, in exact coordinates, that object existed when communicating with troops on the ground and other units in the battlespace.

'They were somewhat limited in terms of real-time geolocation,' admits Todd Johanesen, a senior scientist at the NGA. >>

‘Specifically, when they saw something in the video stream of interest and they identified what it was, the very next question was related to where it was, i.e. the *somewhere*.

‘As new systems come on line, whether they are terrestrial or airborne, people will want to know the *where* and will want to use this data in conjunction with other GEOINT data.

‘It is also possible that we'll rely less on the actual FMV footage, but more on the activity that is occurring in the FMV, or in some cases, the *absence* of activity.’

Johanesen’s work on photogrammetry – the science of differentiating geometric properties from photographic imagery – is becoming a critical enabler to forces in meeting this capability.

Work also continues on new and innovative technologies in the same scope, from integrating with FMV ways to measure electromagnetic radiation (useful for detecting remotely activated IEDs, for example) to temporal compression to reduce the size of video files.

Changing channels

One of the key initiatives taking place at present is in the implementation of standards. One of the reasons the commercial broadcast world can produce and distribute the range of video that it does while maintaining the quality of the image between devices is that it has, over the years, developed and implemented standards.

‘Within NGA, we have worked in partnership with the Services and DoD and established an NSG Interoperability Action Team (NIAT),’ says Self.

‘NSG is the National System for Geospatial Intelligence. So it is more than just the NGA, it includes all of the DoD. NIAT is a group of subject matter experts who go out and work with sensor builders, sensor developers, aircraft developers, and communications developers to help them understand how to implement the standards dealing with video.

‘The NIAT will work with them to implement the correct configurations in their encoders/decoders and in other components, so that we can share the video that is produced.’

This effort must also extend to coalition forces as well as civilian partners, which will not only benefit information gathering during combat but will also prove priceless in times of disaster relief where foreign services frequently pitch in together.

Looking to the skies

Aside to the immediate and minor tweaks and augmentations to this technology, science is laying the bricks of a parallel road to bigger developments for the future.

‘A robust "space-based" FMV surveillance system will be capable of providing global, real-time, FMV access to multiple sites around the world, simultaneously,’ says Chris Brehany, an independent consultant of Earth Observation and geospatial intelligence.

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“This is one of those inflection points, one of those times when the whole path of history shifts.”

General Norton A. Schwartz Former Chief of Staff of the U.S. Air Force, on the use of motion imagery to fight wars

'The two most transformational aspects this will provide are "immediate access" to any location in the world, without having to wait for an airborne FMV systems to be deployed; and routine, persistent access to "denied areas" which are not accessible to airborne FMV surveillance systems for multiple reasons, including lack of permissive overflight, political sensitivities, operational security, untenable threat environments, et cetera.'

According to Brehany, for a fraction of the cost of one 'exquisite' spy satellite, it is currently technologically feasible (and affordable) to field a global FMV surveillance system, that will enable persistent, full colour monitoring of any location on Earth.

Derrek Hatton of the European Union Satellite Centre will be speaking at the Airborne ISR 2013 event in London on the subject of FMV for satellite and its future potential. Stay tuned…

Airborne ISR 2013 will take place between February 25–28, at 76 Portland Place, London, UK. Visit www.AirborneISR.com for more information or call +(0) 44 207 368 9300.

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