

Turning the benefit of virtual threats into a combat reality

Creating synthetic enemies is now essential to training on fifth-generation fighter aircraft

Northrop Grumman is relishing the opportunities arising from complex training requirements associated with advanced combat aircraft such as the Lockheed Martin F-35, and believes that the use of live, virtual and constructive (LVC) technologies will increase markedly as their operation becomes more widespread.

With limited range space constraining the military's ability to fully test the capabilities offered by advanced and widely networked fighters, augmenting live assets through the use of simulators and virtual entities is a growing trend.

"LVC training solutions can provide enhanced realism by adding more virtual and computer-generated aircraft and adversary weapons into an exercise," says Northrop, which made its first venture into the sector more than a decade ago.

"We have provided training to the US Air Force since 2006 in LVC: we have been at the forefront since the outset," says Andy Horler, its air business development manager for the UK and Europe.

During this time, the company has provided more than 150 LVC

events in support of the USAF's Air Combat Command and Air Mobility Command, and manages two of the service's distributed mission training networks for simulators. "Those distributed networks plug into the live training ranges," Horler notes.

"We have provided training to the USAF using live, virtual and constructive systems since 2006"

Andy Horler

Air business development manager for UK and Europe, Northrop Grumman

As a former USAF Lockheed F-16 and F-22 pilot, Northrop's director, airborne C4ISR systems, Phillip Guy, has a first-hand understanding of the challenges posed when conducting air combat training in a fifth-generation fighter. Even during large-scale exercises, such as the Red Flag series staged regularly from Nellis AFB in Nevada, a large package of 80-100 "Blue Air" assets will operate against a much smaller adversary fleet with per-

haps only a dozen aircraft – and formed partly of vintage fighters flown by private contractors.

"You need LVC to balance it up," Guy argues. By using a mix of networked simulators and virtual entities, exercise participants can be put through their paces against a comparable-sized "Red Air" component until the event reaches its conclusion. "Then you can strip out the virtual [players] and have 12 live aircraft in one lane" for within-visual-range engagements, he says.

"When we reference LVC, we're talking about the live component – a live aircraft, or a live tank, where there's a warfighter involved," he says. "We're very comfortable in saying we've done the most advanced LVC in the world, because we're the only folks who have connected live aircraft all the way to live simulators where there's a warfighter in each one conducting full-up training, at full-up security levels."

CONSTRUCTIVE INPUTS

Since 2015, Northrop has provided such expanded services to Air Combat Command, and last year put the capability through its paces at the Northern Edge event at Eielson AFB, Alaska. "We've now done more than a dozen exercises where we have had more than 100 live aircraft in a scenario, more than 130 constructive inputs and more than two dozen virtual aircraft," Guy says.

Successes have included enabling the mission crew of a Boeing RC-135 Rivet Joint signals intelligence aircraft to participate when there was no aircraft available to support the manoeuvres. Instead, a simulator for the asset was brought into the exercise network.

"Simulators now are high definition and extremely high quality – to the point that for the majority of simulators in the US, the

warfighter counts them as training: just like they were flying a live jet," notes Guy.

Realistic weapons use can also be shown, with the computer-generated employment of surface-to-air missiles (SAM), Lockheed AGM-158 JASSM cruise missiles and Raytheon's miniature air-launched decoy having been simulated during training events.

Guy says that before the advent of LVC, if a crew wanted to simulate a weapon release, they would press the 'pickle' button and make a radio call. "It was totally pretend," he says. "Now, a SAM operator sees those weapons, and has to make a decision whether to try and shoot them down, or keep out of the attack.

"People think live is always the perfect training, but even though we're adding all this LVC and the synthetic component, it actually makes it more realistic for them, because they can 'see' the weapons, and you can simulate SAMs," he adds. "As a pilot, you want to know what SAM, C2 [command and control] and Red Air is active. We don't want them to know whether someone who's fighting with them is live, virtual or constructive. If you can achieve that, then you've achieved your primary goal."



US Air Force

The F-35's advanced capabilities present a major training challenge

Large exercises involving types such as the F-22 are enhanced with digital adversaries



US Air Force

wanted to do that in the UK or Europe it just wouldn't be possible. With LVC, you can have a nice balance between cost-effective training, but training which is going to be of real benefit, and you can expand beyond the boundaries of a range."

Guy believes that LVC today provides a 10-15% training solution, but adds: "The decisions that are forthcoming for all of our nations are how high do you want to take that?"

CORE DEFICIENCIES

"Live aircraft have three core deficiencies: they can't detect synthetic aircraft with their radars; they can't get any radar warning from those aircraft; and they can't see them visually. Those are the challenges that the defence industry is trying to solve today, to advance this."

Options could include providing radar warning receiver information via datalink, or showing virtual infrared signatures via a targeting pod. However, he notes: "The biggest challenge right now for any aircraft provider is having enough memory even to put all the coding in for the synthetic portion for a live aircraft."

"If you hear any of the governments talk, regardless of which country, they all will state that it's going to take a co-operative effort amongst the entire industry to deliver the capability they want."

He notes the funding challenge facing air forces, however: "Do you want more advanced training, or do you want a more ad-

vanced weapon, or the next helmet? You're competing for the same resources."

Meanwhile, Northrop is promoting its capabilities to other operators, with the UK a particular area of interest, Horler says. The company is among four bidders pursuing the Defence Operational Training Capability (Air) Core System and Services project, which the Ministry of Defence says "seeks to fill a demonstrated capability gap that prevents air force elements training together as force packages, enable a defence-wide requirement to download live training into the synthetic environment, and allow a rebalancing of live/synthetic training".

The activity is closely aligned to the UK's ASDOT programme, which will provide live aircraft for aggressor training with the Royal Air Force.

The company is also one of the last two candidates pursuing a distributed training requirement for the Australian military, with its teaming also including CAE and Cubic.

"A lot of people think that LVC is a future technology for the next generation of aircrew, but we are delivering capability right now," Horler says. "I believe there will be a growing emphasis on synthetic training and that live/synthetic blend." This will become even more relevant, he says, since using future networked cyber and space capabilities in live training could give away key information or tactics to potential foes. ■



US Air Force

Dedicated aggressor platforms are in short supply for US Air Force

make simulators is an advantage to us: we can be agnostic, and help manage the issues between the simulator manufacturers," says Horler.

"Everyone has a vested interest in enabling this training to occur," Guy says. "So whether it's Boeing, Lockheed Martin or CAE, L3 or any of the other vendors out there, their engineers want to make their simulators the best that they can be, so they will share with us any issues."

Outlining the capabilities of its LVC experimentation, integration and operations suite (Lexios) ahead of the ITEC training show in Stuttgart, Germany, last month, Northrop said it anticipates more air forces embracing such technology to support their operational needs.

"As we're looking to bring the F-35 into other countries, where you may not have that range, you really need to leverage LVC and synthetic more, because the capabilities of fifth-generation aircraft really expand the amount of airspace you need to effectively employ," says Horler. "Their sensors and weapons are very capable systems, so you need very large distances. There are only a very few places in the world where you can do that, and if you

Northrop works with more than a dozen threat generation companies to support constructive training, and manages system problem reports for the USAF to feed back to these suppliers. "We provide analysis sometimes on their equipment, to identify what deficiencies may exist, so we can have a more interoperable force," Guy says.

"People think live is always the perfect training, but adding LVC actually makes it more realistic"

Phillip Guy
Director, airborne C4ISR systems,
Northrop Grumman

"If it's a purely synthetic event, you can train at full-up security levels with anyone else that's on the network, regardless of their security classification," Guy says. "We're almost up to 80 sites now in the USA, the UK, Germany, Japan and Korea – and they can all come together and play in same event without experiencing latency or bandwidth challenges."

"We see ourselves as a systems integrator – the fact that we don't