

The overall goals of Red Flag remain the same from exercise to exercise, but the individual mission sets are tailored to the specific squadrons and allied air forces participating. In terms of coalition partners, Australia, the UK and the United States are about as close as they come, so the first Flag of each year features these players and is normally at a correspondingly higher level of intensity. This year was no exception, as the US Air Force debuted the latest addition to its aerial inventory, the F-35A Lightning II. The US Air Force declared initial operational capability (IOC) for the F-35A in August,

2016; Red Flag 17-1 was the type's first large force exercise since IOC. Commander of the 34th Fighter Squadron, Lt Col George Watkins said: "It is exciting to integrate the newest operational fighter squadron and the F-35A with all the other experienced aircrew, including two of our partner nations. The professional aggressors [based at Nellis] are providing great training, but [they are] no match for our integrated fourth and fifth-generation air force." While exercises in the past few years have expanded in scope and have been embedded in larger scenarios involving off-site and even virtual players, this year's Red Flag concentrated more on the tactical issues of integration and interoperability of fourth and fifth-generation fighters. Mission scenarios included defensive counter-air (defending airspace

F-35A Lightning II 13-5072/HL (c/n AF-78), with tail markings for the 388th Fighter Wing commander undergoing flight line maintenance at Nellis Air Force Base on January 24. Airman Kevin Tanenbaum/US Air Force



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## ***Red Flag Debut***

*Norman Graf spoke with aircrew from the 388th and 419th Fighter Wings about participation of the F-35A in Exercise Red Flag for the first time*





No.6 Squadron 'Flying Can Openers' based at RAF Lossiemouth, Moray deployed eight Typhoons to Nellis for Red Flag 17-1. Typhoon FGR4 ZK321/EG is seen departing the Nevada base on a mission. *Jim Dunn*



against the Red Air force), air interdiction (AI, striking targets deep in enemy territory) and dynamic targeting (trying to find targets on the fly detecting threats and finding those on the ground and trying to hit those targets). As the most modern fighter in the US Air Force inventory, possessing capabilities to gather, fuse and share sensor data, coupled with its stealth technology and offensive weapons capabilities, the multi-role F-35A was at the centre of the action.

### **Rude Rams at Flag**

The 34th Fighter Squadron 'Rude Rams' was reactivated at Hill Air Force Base, Utah on July 17, 2015 as part of the 388th Fighter Wing (FW) and its reserve component, the 419th FW. The first operational F-35As arrived at Hill in October 2015. By the end of 2019 there will be three operational F-35A

fighter squadrons, with 78 aircraft based at Hill. About 200 personnel and 13 of 17 F-35As currently assigned to the 388th FW were joined by nine Air Force Reserve F-35A pilots and 16 maintainers from the 419th FW to participate in Red Flag 17-1. Commander of the 419th Operations Group, Detachment 1, Lt Col Dave DeAngelis and one of the reserve pilots said Red Flag offers intensive training and is a tremendous learning experience. He said: "The aggressor pilots are among the best of the best and spend their days learning the tactics of enemy air forces, so it definitely puts us to the test."

Just one week into the exercise, the first ten-aircraft sortie was launched, followed in the late afternoon by an eight-ship launch.

Lt Col Watkins highlighted how four of his squadron pilots, who previously flew

F-15s and F-16s at Red Flag for years, had expressed their satisfaction with the F-35A. The squadron commander quoted them as saying, 'This is amazing. I've never had this much situational awareness while airborne. I know who's who, I know who's being threatened, and I know where I need to go next.' Watkins said "You just don't have all of that information at once in fourth-generation platforms. On the first day we flew defensive counter-air and we didn't lose a single friendly aircraft. That's unheard of. It feels like air dominance."

### **Red Air**

One of the more demanding tasks for the Red Air force was to make this exercise challenging for the combined Blue Air force comprising fourth and fifth-generation fighters.



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*Lt Col Watkins., Commander 34th Fighter Squadron*

Major Mark Klein, an Air Force Reserve Command pilot who flies with the 64th Aggressor Squadron said: “We focus on adversary tactics all the time, so we are subject matter experts on how enemy aircraft operate and perform. Then we replicate that here [at Red Flag].”

Civilian contractor pilots from Draken International flying A-4 Skyhawks augmented the F-16s of the Nellis-based 64th Aggressor Squadron. Additionally, F-16Cs from the 115th Fighter Wing, Wisconsin Air National Guard and F-15Cs from the 125th Fighter Wing, Florida Air National Guard, and Block 50 F-16Cs assigned to the 77th Fighter Squadron from Shaw Air Force Base, South Carolina rotated on to the Red Air team to increase the number of aggressor aircraft needed to assure a robust threat laydown. On average 20 to 24 Red Air aircraft flew

each day, including regeneration (a process allowing aggressor aircraft that have been shot down to rejoin the fight), so the Blue Air force would face three or four times that number.

Lt Col Watkins said: “They have ramped up the level of the threat. They’ve stepped it up with the number of Red Air aircraft fighting against us. The amount of jamming, the skill level of the adversaries and the surface-to-air missile threat have significantly increased from when I was here last flying the F-16. There’s always a change in the threat. We’re continuing to build new systems and get more capable [but] the adversary threats are also becoming more capable, so there’s always a stair step approach. But there’s a marked difference in this Flag from the ones I’ve experienced in the past. I believe that’s

because of integration of the F-22, F-35 and all the fourth-generation players. We’re able to bring that all together for this fight. It’s needed to challenge all of us as we’re fighting together.”

### Interoperability

When asked how Blue Air was learning to defeat increased threat levels and work together, Lt Col DeAngelis replied: “Good mission planning. When we get the Air Tasking Orders we usually have about six hours to plan. For example, I’m able to sit down with EA-18G aircrew and ask ‘How are you able to find different threats and how are you able to jam them? I’m can also explain how I’m able to find threats with the F-35. Using the Link 16 network we’re able to pass each other targets. Under certain scenarios involving a high threat SAM we’ll work closely



## CURRENT F-35A CONFIGURATION

*Mark Ayton outlines the F-35A Block 3i configuration and current problems, as outlined in the FY2016 DOT&E Annual Report*

All of the F-35As deployed to Nellis for Red Flag 17-1 were configured with Block 3i software, the interim standard prior to release of Block 3F the full warfighting capability developed during the System Development and Demonstration phase for production Lot 9 and later. Based on the interim configuration of the Hill jets at Red Flag, mission system capabilities of the aircraft are somewhat short of the future Block 3F requirement.

According to Director, Operational Test and Evaluation, Michael Gilmore's annual report for FY2016, the F-35 programme designated Block 3i for aircraft built in Lot 6, Lot 7 and Lot 8, jets that include a set of upgraded TR2 integrated core processors. Block 3i software began flight testing in May 2014 and completed baseline testing in October 2015, eight months later than planned in the integrated master schedule. Because of software immaturity and instability during start-up and in flight, the programme paused flight testing of Block 3F (subset 3FR5) software in February 2016 and returned to Block 3i development and flight testing to address poor mission systems stability. After completing flight testing of Block 3i (subset 3iR6.21) software in April 2016, that version was fielded to operational units, including the 34th Fighter Squadron at Hill, with improved stability performance similar to that seen in the latest build of Block 2B software.

In July, the US Air Force completed its IOC readiness assessment report. The assessment was based on a limited series of events conducted with six Block 3i-configured aircraft, including test missions in close air support (CAS), AI and suppression/destruction of enemy air defences (SEAD/DEAD).

Unacceptable problems in fusion and electronic warfare and others concerning the CAS mission determined the Block 3i-configured F-35A had not demonstrated equivalent CAS capabilities to those of fourth-generation aircraft.

In August 2016, an F-35 operational test (OT) pilot from Edwards Air Force Base, California, briefed the results of an OT community assessment of F-35 mission capability with Block 3FR5.03, based on observing developmental flight test missions and results to date. This OT assessment rated all initial operational test and evaluation (IOT&E) mission areas as red, including CAS, SEAD/DEAD, offensive counter air, defensive counter air, AI, and surface warfare. Developmental test Integrated Product Team representatives also briefed the status of different F-35 mission systems capabilities, most of which were rated red and not meeting entrance criteria to enter graduation-level mission effectiveness testing. Trend items from both briefings were limitations and problems with multiple Block 3F system modes and capabilities, including the AAQ-40 Electro-Optical Targeting System, AAQ-37 Distributed Aperture System, APG-81 radar, ASQ-239 electronic warfare, avionics fusion, identification capabilities, navigation accuracy, GPS, datalinks, weapons integration and mission planning.

In November 2016, the JSF Operational Test Team (JOTT) based at Edwards Air Force Base provided an assessment of a later version of

Block 3F (subset 3FR5.05) software based on observing and assisting with F-35 DT flight operations and maintenance. The JOTT assessment made top-level, initial predictions of expected IOT&E results of the F-35, with Block 3FR5.05 against planned scenarios and realistic threats. For mission effectiveness, the assessment predicted severe or substantial operational impacts across all the planned IOT&E missions (similar to the list of missions given earlier) due to observed shortfalls in capabilities, with the exception of the reconnaissance mission area, which predicted minimal operational impact. Unlike the other assessments, the JOTT also assessed suitability, predicting mixed operational impacts due to shortfalls for deployability (from minimal to severe), severe impacts for mission generation, and substantial impacts for training and logistics support.

Gilmore's report also listed details of problems with the F-35's mission data files (MDF) and mission data loads (MDL), the essential data that enables the aircraft's mission systems to function properly. Block 3F upgrades to the US Reprogramming Laboratory (USRL) – where MDF are developed, tested and validated for operational use – are late to meet the needs for Block 3F production aircraft and IOT&E. These upgrades to the Block 3F configuration, including the associated MDF generation tools, are necessary to enable the USRL to begin Block 3F MDF development.

Gilmore said that despite the importance of the mission data to both IOT&E and to combat, the F-35 Joint Program Office and Lockheed Martin have failed to manage, contract and deliver the necessary USRL upgrades to the point that fully validated Block 3F MDLs will not be ready for IOT&E until June 2018, at the earliest.

Operational units, including the 34th Fighter Squadron, are also affected by the capability shortfalls in the USRL to create, test and field MDLs. The complete set of Block 2B and Block 3i MDLs developed for overseas areas of responsibility (AOR) have yet to undergo the full set of lab and flight tests necessary to validate and verify them for operational use. Consequently, the services will likely not have Block 3F MDLs for overseas AOR until late 2018 or early 2019.

In addition to the late Block 3F USRL upgrades, the required signal generators for the USRL – with more high-fidelity channels to simulate modern fielded threats – have not yet been placed on contract. As a result, Block 3F MDLs will not be tested and optimised to ensure the F-35 will be capable of detecting, locating and identifying modern fielded threats until 2020, as per a recent programme schedule. Multiple laboratories are being developed to produce MDLs tailored for partner nation-unique requirements, some of which will have more high-fidelity signal generator channels earlier than the USRL.

The programme is considering using one of these other laboratories for Block 3F MDL development and testing. However, the MDL that will be used for IOT&E must be developed, verified, validated, and tested using operationally representative procedures, like MDLs that will be developed for operational aircraft in the USRL.

with the Growlers, find the [site] and suppress it and go ahead and take it out, as well."

There were no unexpected or unachievable problems when the F-22 and F-35A worked together, despite some roadblocks communicating between the two types.

Commander of the 27th Fighter Squadron and an F-22 pilot, Lt Col Charles Schuck, said: "The advanced weaponry used to target the Blue Air picture has advanced over time. This is the first Red Flag in which Raptors have integrated in such a large scale with air force F-35s. My squadron integrated at the last Red Flag with US Marine Corps F-35Bs, which put us a little out front in terms of getting ready for the Flag, so we didn't have to start from square one. This helps to alleviate some of the frustration in the early days of integration."

Whereas in previous Flags there might have been one or two advanced surface-to-air missile threats to counter, this year's event featured a more complex integrated air defence system. Fourth-generation aircraft would have had to concentrate exclusively

on eliminating the threats from a distance, launching many stand-off weapons, including calling in Tomahawk cruise missiles for fixed sites.

Lt Col Watkins explained how this has been ramped up. "In this Red Flag we've seen four advanced SAMs in one scenario, and we don't necessarily know where they are. We can't simulate hitting them with standoff weapons before the vul time [the time period a flight plans to be on station] even starts, so we're using an integrated cross-domain approach to find them. We're using information supplied by cyber and space assets, Rivet Joint and Wedgetail, and we're fusing all information together to find the target location. Between the Block 50 F-16s and the F-35s we're locating the threats and are able to use the F-22's standoff capability and the stealth capability of the F-35 to get close enough to the target locations where we can drop on them. Even in a Block 50 F-16 it would be impossible to target the missile system, because it would be too dangerous to get that close."

Jim Dunn



Lt Col DeAngelis echoed that sentiment: “We’re able to use our sensors to find the location and use our synthetic aperture radar mode to map the general area and determine where the surface-to-air missile site is. We carry two internal GBU-31(V)3 JDAMs, so we’re able to put a 2,000lb bomb on the threat. As a former F-16 pilot, we used to shoot HARMs [AGM-88 High-speed Anti-Radiation Missiles], which have much smaller warheads and are not as capable. With the F-35 we’re able to find the site and put a 2,000lb bomb on it, which is much more effective against an integrated air defence system.”

## Train Hard, Fight Easy

Scenarios, the number of aggressors involved and the advanced weapons being simulated presented a more complex and robust threat laydown than previous Flags, a fact not overlooked by Lt Col Watkins: “I’ve never seen a Flag with as many advanced threats put up against us. If we didn’t suffer a few losses, it wouldn’t be challenging enough.

Some threats make it through because of the sheer number and the type of advanced missiles being shot at us. We’ve had losses. That’s good for the pilots. Right now we’re counting [a kill ratio of] 15 to 1; but the F-35 is currently limited to an internal missile loadout, so we’re not carrying as many missiles as the F-22. We’re also designed for the air-to-ground mission; the air-to-air mission is not our primary role. We’re doing very, very well, but the kill ratio is not something that is going to shock anybody simply because we’re not an air-to-air platform. We’re fighting alongside F-22 and F-15Cs that are the primary air-to-air players against some of the most advanced weapons we know about.”

## Australia

The Royal Australian Air Force (RAAF) has been coming to Red Flag for over 30 years. This year the RAAF deployed 200 personnel, an E-7A Wedgetail airborne early warning aircraft and a C-130J Hercules transport. Additionally, RAAF personnel led the Combined Air and Space Operations Centre, the first time a coalition nation has performed this role during a Red Flag exercise.

Air Battlespace Managers from the RAAF’s No.41 Wing controlled missions and a Combat Control Team from No.4 Squadron ensured aircraft could seamlessly deliver support to ground forces during the exercise.

RAAF Contingent Commander and Director of the Combined Air and Space Operations Centre, Group Captain Bellingham said: “Australia’s participation in Exercise Red Flag will enable coalition partners to better understand how we operate.”

The F-35A Lightning II and the E/A-18G Growler will enter Australian service in the next couple of years, so Red Flag 17-1 was an ideal environment for RAAF personnel to experience how the Growler and F-35A are integrated within a larger mission. Understanding how assets interoperate in a near-peer adversary high-end IADS scenario proved invaluable. Group Captain Bellingham said: “It’s started to build our understanding of how we will employ the jets. Both aircraft will provide new capabilities to the Australian Defence Force, and will play an important role for future RAAF operations.”

## Brits

The Royal Air Force deployed eight Typhoons to Nellis and flew two waves of six aircraft each day. Officer Commanding No.6 Squadron, Wing Commander Billy Cooper said the majority of Typhoons tasking was air-to-air fighting. He said: “As a swing role platform, we carried bombs on some of the missions. Some of the time we’ve been using the F-35 to find some of the integrated air defence systems and on occasion the Typhoon dropped bombs on the targets located, but lots of the time we were out at the front of the package, providing air cover. Quite often the F-35 provided some of the Link 16 picture that we were able to use to generate situational awareness.”

Interest in working closely with the F-35A during Red Flag 17-1 was understandably high within the RAF contingent, as the UK is due to introduce the F-35B into service in the coming years. Once in service, the UK will have a fourth/fifth-generation mix of Typhoon and F-35B. Experience gained from exercises such as Red Flag 17-1 is critical to gain

experience and develop tactics and operating procedures for effective future operations.

RAF Detachment Commander Group Captain Graham Pemberton gave this overview: “Red Flag replicates challenging, high-end warfare, from realistic aerial combat to emerging cyber and space threats. It’s as close as we can get to real combat. Testing ourselves against highly capable enemy aggressors is hugely beneficial and improves and readies our personnel, from pilots to those in crucial support roles, for real world operations.”

In addition to the Typhoons, the RAF also deployed an RC-135 Rivet Joint, a Sentinel R1, and a Voyager, the type’s first appearance at Red Flag. The editor questions the necessity for the RAF to spend millions of pounds on such a deployment at a time when the UK Government continues to face so many budget constraints, particularly when all four aircraft types deployed to Nellis are currently supporting real world operations in the Middle East.

## What Next for the F-35A?

This is just the beginning for F-35A integration into large force exercises; the next are already scheduled, as Lt Col Watkins explained: “We are scheduled for Combat Hammer and Combat Archer [Air Combat Command’s respective air-to-ground and air-to-air Weapon System Evaluation Programs] in August and we’ll be doing that at our home station range, the Utah Test and Training Range. We will also participate in some lower-scale exercises with other local bases flying with the squadrons based at Mountain Home, and continue our pilot training programme to increase proficiency and experience in the aircraft.”

Commander of the 388th Maintenance Group, Col Michael Miles said: “From the 388th perspective, it’s important to note that since we went IOC, we’re combat-capable at any time. Day in, day out, we’re looking at measures and small-scale exercises that should enable us to better meet any kind of contingency tasking: measuring, testing, evaluating and improving our combat capability.”

