Tom Clancy's H·A·W·X

HIGH ALTITUDE WARFARE

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FEATURE

AIR COMBAT

Everything you need to win the war in the skies



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INTERVIEW

FLYING HIGH

Under the cockpit of Tom Clancy's HAWX



EXCLUSIVE PLAYTEST

Tom Clancy's H·A·W·X

Air-combat will never be the same

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Welcome

As discerning, clued-up gamers, you're bound to have played one or more of Ubisoft's Tom Clancy games – the mark of the writer famous for his vision of near-future warfare and espionage has become a by-word for top-notch gameplay, thanks to the likes of Rainbow Six, Ghost Recon Advanced Warfare, EndWar and Splinter Cell. Now the Tom Clancy game universe has acquired a new franchise, HAWX, and like its siblings, it's an absolute corker.

In many ways, HAWX is Ubisoft's most ambitious Tom Clancy game yet, as it aims to drag a fairly obscure, special-interest genre (air combat) into the mainstream. That it succeeds, and provides a polished, thrilling and satisfyingly meaty gameplay experience – even if you're not a flight-sim-nut – is a testament to the skills of Ubisoft Bucharest. Its innovative assistance on/off system and clever virtual cockpit computer mark it down as that rarest of beasts: a game which has been the beneficiary of deep thought from an early stage and, as a result, it makes ancestors like Ace Combat seem pallid and one-dimensional in comparison.

We've enjoyed playing HAWX so much that we created this special supplement, in which you'll find pretty much all you need to know about it before it comes out, an exclusive developer's diary providing an insight to the making of HAWX and an interview with Ubisoft's head Tom Clancy honcho, Phil Brannelly. Hope you enjoy it.

Steve Boxer, Editor

WIN!
FLY A FOUGA MAGISTER JET PLANE



ENHANCED VIEW



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Find out all about HAWX in our in-depth five-page preview feature.

Interview
We talk to HAWX's UK Senior Brand Manager, Phil Brannelly about the game.

Air Combat
Want to know more about how these planes really work? Our six-page guide tells you everything you need to know.



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Tom Clancy's HAWX
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HANDS-ON PREVIEW

Tom Clancy's HAWX

We feel the need, the need for speed...



Publisher: Ubisoft
Developer: Ubisoft Bucharest
Platforms: Xbox 360, PS3, PC
Heritage: Blazing Angels: Squadrons of WWII
Link: http://hawxgame.uk.ubi.com
ETA: 6th March 2009

Solid and blockbusting though his films are, and however fascinating his books may be, it's us gamers who have consistently got the best of Tom Clancy. It's 10 years since Ubisoft first invoked his name, on Rainbow Six, and a steady stream of subsequent triple-A titles – Splinter Cell, Ghost Recon Advanced Warfare and EndWar – means that gamers now see his name on a box as a stamp of quality. And now HAWX is set to broaden the Tom Clancy repertoire still further.

Despite being a departure – it's an air-combat game – it emphatically carries on the tradition of quality.

"HAWX's storyline has a real impact on the gameplay"



Advice from your wingman will pop up in an on-screen video window.

Indeed, it single-handedly drags the air-combat genre – hitherto very much shunted into a niche – into the mainstream of 21st-century games. Which is quite an achievement. Its success can be attributed to two factors: clever use of the Tom Clancy universe and the investment of a considerable amount of thought into how to make air-combat games supremely playable.

THE PLOT

Like us, you probably don't set too much store by the stories which unfold in games (they're inevitably secondary to the gameplay), but HAWX's storyline has a real impact on the gameplay, allowing it to feature real (and future) aircraft without alienating all but flight-sim aficionados. It's 2019, and you play as David Crenshaw, who has been a special-ops pilot in the US military's HAWX flying division. But as it's Tom Clancy-world, HAWX has been disbanded, since private military companies (PMCs) have taken over from national armies, and you now work for Artemis Global Security. But there's a spot of bother in South America, which unfolds with you at its epicentre: war breaks out between Brazil and a bloc of

ENHANCED VIEW



The amount of ground detail is astonishing, with everything being accurately mapped in 3D.

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The flight of your life

The three versions compared



PC | PS3 | 360

HAWX on PC

If you have a suitably pumped-up machine, you should be able to get this looking even more spectacular than the PS3 and Xbox 360 versions – but it will run on a fairly low-spec, albeit less than a couple of year old, PC. The PC version does support all the joysticks that the flight-sim brigade are likely to own, but we'd recommend you buy a console-style gamepad to play it – that's what it was really designed to take as a means of input.

>HAWX continued

South American countries which calls itself Las Trinidad. At first, because Artemis aligns with Brazil, you actually find yourself taking on American planes. But as Las Trinidad takes the war to the United States and Artemis switches sides, you return to the HAWX fold. Mercifully, none of this unfolds in lengthy cut-scenes, but rather through snippets of video and audio delivered in mid-flight.

FIRST IMPRESSIONS

If, for example, you've played Ace Combat 6, one aspect leaps out at you the moment you boot HAWX up. All the landscape and cities you fly over have been properly modelled in 3D (using GeoEye satellite mapping as a base), so you can fly between skyscrapers or under bridges.

HAWX starts you off gently with a rerun of a GRAW 2 mission in the Middle East, except this time you're giving air support. Which instantly gives you a point of reference in the Tom Clancy universe.

"All the landscapes and cities you fly over have been properly modelled in 3D"



The plane models are nothing short of stunning.



HAWX takes in locations all around the world.



All the planes are packing some very serious weaponry.

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>HAWX continued



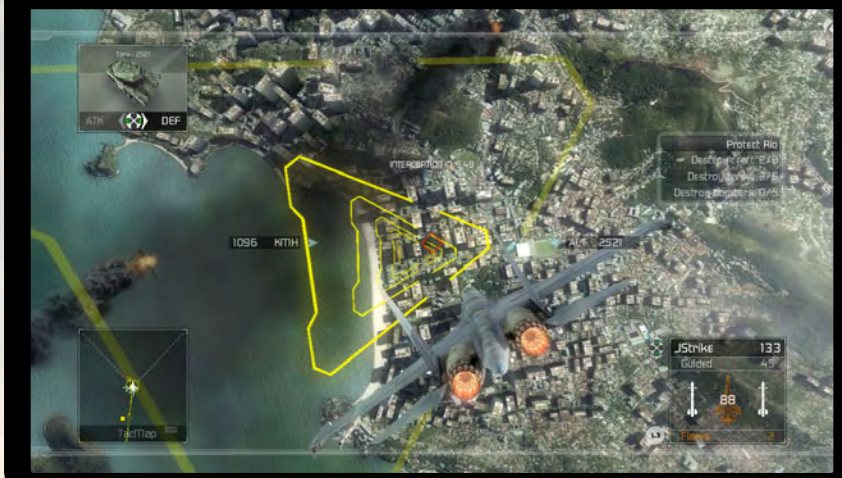
Some of the 50 aircraft you'll get to fly are more obscure than others.



Four-player dog-fighting promises to be thrilling stuff.

The very fulcrum of HAWX, and the concept which renders it accessible to gamers who wouldn't necessarily class themselves as aviation-nuts, is the assistance on/off system. Essentially, it's a nannying system – when you turn it on your aircraft becomes less manoeuvrable, but also harder to crash, and you get a vast amount of info pumped through to your head-up display. Turning assistance off makes your aircraft super-manoeuvrable, but removes most of the HUD info, and moves you out from a first to a third-person view.

Roll over screen for annotations



Lead game designer Thomas Simon explains: "Assistance is useful for giving you the trajectories which can allow you to intercept enemies or make a surgical strike. You turn it off when you need to react quickly or when things start to get out of hand; when you have too many enemies to deal with."

The other key differentiator which defines HAWX's gameplay is the Enhanced Reality System (ERS). This too is a device enabled by the game's future setting – it's basically a head-up display which feeds vast amounts of information to you from spotters on the ground, AWACS radar planes and so on, as well as video-windows from your wingmen and support staff, and all your targeting information. It allows HAWX to sidestep the urge found in flight simulators to meticulously copy the planes' real HUDs, and present a consistent interface, no matter what you're flying. And it includes features that don't yet exist – for example, when you target an aircraft, you can press a controller button and the ERS will draw a series of gates allowing you to follow that plane and engage it in a dog-fight. And because – according to the game's story – you can download new features to it, it mutates

> *"You can press a button and the ERS will draw a series of gates allowing you to follow that plane"*

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>HAWX continued

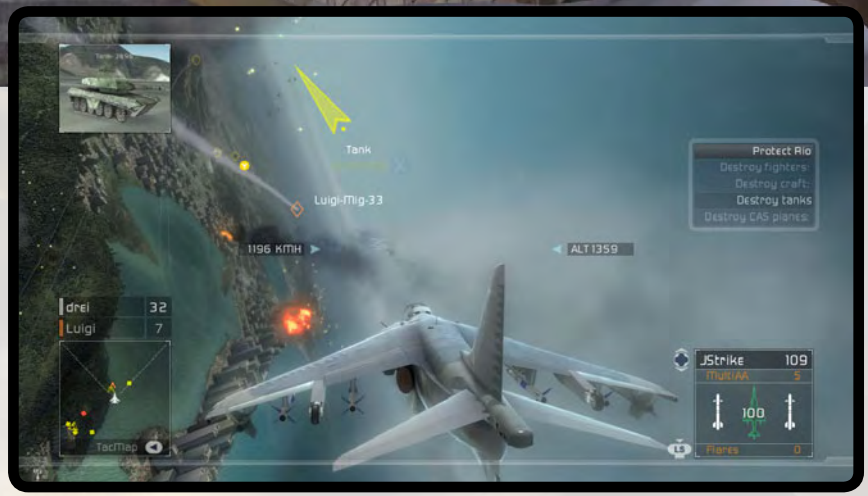
helpfully according to the mission your playing.

THE MISSIONS

The single-player missions are another area that marks out HAWX as a cut above previous air-combat games. They are varied, long, involving and played out in the skies above some gloriously rendered locations. You might, for example, have to evade radar and take out a succession of early-warning systems, protect Air Force One from attack or, indeed, the Space Shuttle as it bids to repair the crippled US satellite defence system – or take out both air and ground targets as Rio de Janeiro succumbs to a full-on enemy assault.

All the missions can be played by four people co-operatively and, while the overall objectives and geographical settings remain the same, they have been tweaked for co-op in clever ways, as Thomas Simon explains: "The pure level design evolves from the single-player to the multiplayer. So you really have to co-operate with

> "All the missions can be played by four people co-operatively"



Co-op gameplay: Players can jump in or out any time and, while overall objectives remain the same, more immediate objectives will alter according to how many people are playing. In the sequence shown above, you and your mates are defending Rio de Janeiro from attack – from enemies on the ground and in the air, as shown in the top left-hand corner of your ERS. Note how your plane doesn't remain rigidly positioned in the centre of the screen, giving rise to some luscious camera-trickery.



One mission has you escorting the President's plane, Air Force One.



It's fair to say that an air-combat game has never looked as good as this.

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>HAWX continued

your team-mates. Enemy units will come from new directions, and will have to be intercepted in a different way." You can also engage in some pure, no-holds-barred dog-fighting, thanks to the four-on-four Team Deathmatch mode.

Some of the world's most iconic military aircraft can be unlocked: the F-22 Raptor, Eurofighter Typhoon and Sukhoi SU-27 Terminator are the stock planes that you fly, but everything from the slow but deadly A-10A Thunderbolt (aka the Tank-Buster) to the F-117 Nighthawk Stealth fighter are present.

WHAT DOES THAT ADD UP TO?

Perhaps the greatest accolade we can give HAWX is that it's good enough to turn us onto the joys of air-combat – a genre which, we'll admit, we previously approached with trepidation. You don't need to be the sort of person who hangs out at air shows to enjoy it – by the time it requires higher-end flying skills from you, you've been exhaustively trained to meet the challenge, without having to endure any tedious training exercises. The storyline is utterly engrossing and surprisingly believable, too.

Possibly the easiest way to describe HAWX is as a very solid, meaty, intelligently designed proper game, which just happens to put you at the controls of some of the most exotic military aircraft in existence. And that sounds like the sort of game we want to play.

VERDICT

Percentage complete 85%

First impressions 91%

Tom Clancy and Ubisoft redefine air-combat games

ENHANCED VIEW

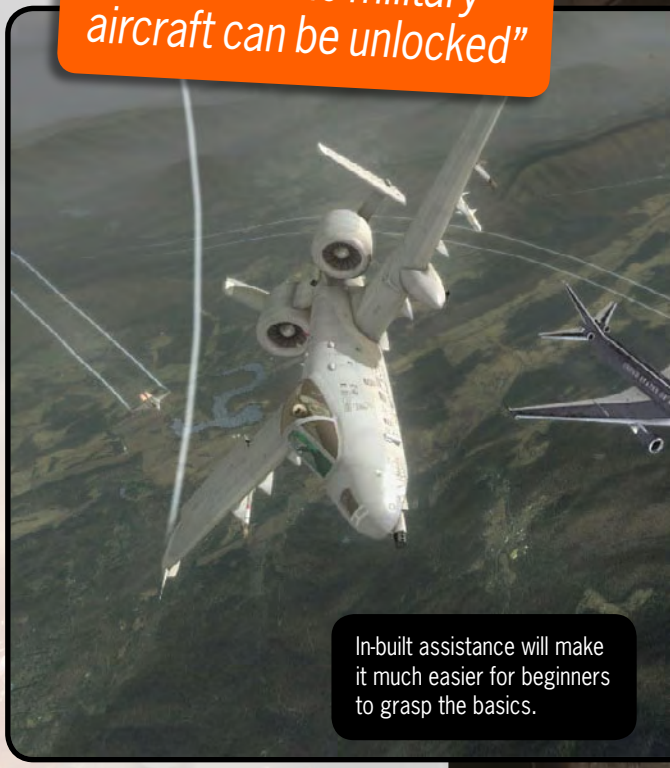


Your plane will be colour-coded to the location your flying in. This camouflage will make it harder for your opponent to spot you.



Whatever you do, don't fire at the President's plane!

"Some of the world's most iconic military aircraft can be unlocked"



In-built assistance will make it much easier for beginners to grasp the basics.

Tom Clancy's HAWX
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INTERVIEW

The sky's the limit

So how do you make the most playable air-combat game ever?

We caught up with Ubisoft's UK Senior Brand Manager, Phil Brannelly, in order to grill him about HAWX. This is what he said...

HAWX moves the Tom Clancy franchise into the air-combat genre. Do you think that is a risk, as it's probably much more of a niche than existing Tom Clancy genres are?

Phil Brannelly: I think it's a calculated risk. Yes it is niche but don't forget, in Ubisoft Bucharest we had a team that were already producing highly successful air-combat games in the Blazing Angels series, so the marriage of them to the Tom Clancy universe really wasn't such a difficult decision. And our key objective is to grow the air-combat genre beyond anything we have already seen to date.



This is the perfect opportunity to live out those Top Gun fantasies.

What new aspects does HAWX bring to air-combat?

PB: The Tom Clancy universe first and foremost, but the most exciting feature is the assistance on/off mode and the Enhanced Reality System. Also, for the first time ever in the air-combat genre, players will be able to experience the entire solo campaign with seamless jump-in/jump-out four-player co-operative play. In PVP mode, players can challenge each other in intense dog-fighting sessions and find out who's the top gun. Winning players are rewarded with experience points and money to unlock more weapons. Players have the opportunity to take the throttle of over 50 famous aircrafts, and take them over real world locations and cities in photo-realistic environments.

How much input has there been on the project from Tom Clancy and his team?

PB: Last March, Ubisoft



"HAWX is a good mix between simulation and arcade gameplay"

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>INTERVIEW continued

concluded an agreement with Tom Clancy to acquire all intellectual property rights to the Tom Clancy name, on a perpetual basis and free of all related future royalty payments, for use in videogames and ancillary products, including related books, movies and merchandising products, meaning Ubisoft has total control of the franchise moving forward in all key areas. To be fair though, there was very little involvement from Tom Clancy himself in the past, or his team, apart from approval of assets that featured the Tom Clancy brand name and green-lighting games in their initial phase.

HAWX developers talk gameplay.



Is assistance on/off the game's key gameplay mechanic, and what does it mean for people playing the game?

PB: Players can ease into their flight missions and gain a level of comfort with the use of the assistance mode. Once employed, players can take full advantage of their technological support through the E.R.S and gain maximum piloting security, particularly if they are novice aviators. ERS is the core of the HAWX flight experience – aircraft interception trajectories, incoming missile detection, anti-crash system, damage assessment, tactical map and weapons trajectory control. ERS also allows players to issue orders to their squadron and other units, making this system as iconic to HAWX as the Cross-Com system is to Tom Clancy's Ghost Recon Advanced Warfighter.

If the situation calls for the player to unleash the full potential of the aircraft, the assistance mode can be switched off and all safety features will be deactivated. This comes with increased risks, but allows the player advanced dog-fighting manoeuvres and stunning third-person views.

To what extent did you have to trade off realism (with, for example, all the existing military planes) and playability, and did the Tom Clancy licence manage to help with that process?

PB: HAWX is a good mix between simulation and arcade gameplay. We use a fully realistic physics engine, tuned in a way that allows every player to be able to

>

In-built flying aids will ensure that you'll be up and flying high within minutes.



"Our objective is to grow the air-combat genre beyond anything we have seen to date"

This one shouldn't be hard to spot.



Tom Clancy's HAWX
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>INTERVIEW continued

enjoy it. The focus is on the gameplay depth, not on the gameplay complexity. Even if, at a first glance, our game offers a very accessible piloting experience, we also managed to keep the experience authentic, with huge room for skills improvement over time.

"Players can gain a level of comfort with the use of the assistance mode"

HAWX does not aim to simulate reality, but to build on it and provide an experience that feels accurate, while allowing everybody to perform complex, fun and rewarding manoeuvres. So everybody will have the same realistic weapons but how you use them is another matter...

HAWX was given a bit of extra development time. What was that used for?

PB: Fine tuning, polishing and last-minute features that were not certain to make it. This wasn't really extra development time, but more of a strategic move in terms of release date. We already had EndWar from the Tom Clancy franchise in as a Xmas release, so it made sense to give HAWX its own launch space.

Can we expect downloadable content for the game in future and if so, on which platforms?

PB: The console version of the game will certainly receive downloadable content in future.

What is your personal favourite mission in HAWX?

PB: Rio is a great level, and will be the featured level in the Xbox Live and PlayStation Network demo, which we are planning to release on 12th February, but other levels encompass a variety of missions, including Night Strikes, Close Air Support, Air Supremacy, Escort (of Air Force One, of course!), Rescue and good old dog-fighting.

How important is the Tom Clancy brand to Ubisoft?

PB: Having published games successfully under the Tom Clancy moniker for the past 10 years – including blockbusters that set standards in the videogame industry, such as Tom Clancy's Splinter Cell, Tom Clancy's Ghost Recon, and Tom Clancy's Rainbow Six – the future of our industry lies in our capacity to create and develop brands that captivate consumers. That presents a myriad of opportunities for the full spectrum of entertainment, be it videogames, books, movies or other media. The Tom Clancy brand is recognised around the world for offering people exciting videogames, films and books.

In the words of our Chief Executive Officer, Yves Guillemot, "Capitalizing on the strong franchises that we've built over the past 10 years, we will take the Tom Clancy game brand to the next level of the global entertainment industry." I think that means it's important!



We're very much looking forward to four-player dogfights in the skies above Rio.



The level of ground detail is unlike anything you've seen before in an air-combat game.



If in doubt, fire off a couple of missiles...

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THE MODERN AGE

Air Power in the Age of the Jet

In the decades since the end of World War 2, military aeronautics have evolved beyond measure, and now encompass aspects unknown in 1945. Manned flight is still essential but increasingly being usurped by electronic and unmanned warfare. In Korea in 1950, jet aircraft still duelled as in 1940, albeit with modification; increasingly air power was applied by Western nations to offset the numerical superiority of their enemies. Although with the introduction of helicopters to the battlefield, wars became more flexible, the limitations of air power were exposed in Vietnam against a largely hidden enemy prepared to accept high losses for political purposes. Then, and frequently since, the application of overwhelming air power has been severely curtailed for purely political reasons, constraints that did not apply in World War 2, even though, at the same time, unscrupulous and fanatical opponents have deliberately targeted defenceless civilians.

Between 1945 and the 1990s, technology remorselessly advanced but was often combat-proven by proxy in 'small wars' fought by lesser powers but armed by the two main protagonists, the Soviet Union and the United States, which equipped one side or the other. The escalating cost of all this 'hi-tech' type hardware eventually excluded all but the most major players, with the ultimate example being the way in which the mere threat of expensive 'Star Wars' technology helped to undermine the Soviet Union.



The Korean War of 1950 to 1953, saw the last large scale air-to-air clashes by groups of gun-only fighters. The F-86 Sabre and the MiG 15 fought bitter battles over North Korea in a war that ended in deadlock and partition.

Surface-to-air missiles proved an increasing hazard, but AAA continued to be a major threat. The same pattern is seen today in Afghanistan. Fighters continued to duel, but the opportunities for such aerial jousting continue to diminish. Air-to-air missiles, intended to revolutionise air combat, never totally replaced conventional fixed-cannon armaments, as evident in the F-22A, Mauser BK27-equipped Typhoon and the Rafale. With associated Forward-Looking Infra-Red (FLIR), ACS and HUD equipment, the fighter's gun still has its place as it did in the days of the hand-operated Lewis. The heavy bomber continued to decline; it brought North Vietnam to the peace table when used en masse, but was only a temporary reprieve, with the Vulcan attack on Port Stanley's runway in 1982 a defiant swansong.

Occasionally, as in the Falklands, totally outclassed aircraft, such as the Argentine Daggers, with superior pilots could still successfully hold their own, but mainly ECM warfare predominated. The need to avoid detection remained an important facet, with the introduction of the radar-absorbent, low radar cross-section F-111A Nighthawk, YF-22, A-12 and B-2 Stealth-featured warplanes, but even these are not invulnerable, as Serbia proved. The ability to overcome an entire nation's defence capability via 'Rapid Dominance' led to a 'Shock-and-Awe' concept of cruise missiles, laser-guidance bombs and B-61 'Bunker-busters', but was followed in Iraq by the same brutal stalemate on the ground. To counter today's clandestine terror-based conflicts, precision-guided weaponry, including unmanned drones, gives an added technological edge to an often murky, battle scenario. But the current Hellfire-C laser-guided-missile-armed RQ-1 Predator Unmanned Aerial Vehicle (UAV) is still a relatively slow, noisy and vulnerable machine that is easily taken out by the most basic weaponry. The enemy also moves with the times, using portable, but deadly, rocket-launching tubes to fire heat-seeking missiles. These Man Portable Air Defense Systems (Manpads), American Stingers or Soviet SA-7s, have already been used against both military and civilian aircraft, locking on to engine exhausts.



Dawn of the jet age. The revolutionary Me 262 changed the face of air warfare in the autumn of 1944. A considerable shock to the Allies when it entered combat, its technologies were much sought after by the Soviets and the West and both went to much effort to gather the relevant data in the ruins of post-war Germany.



Six-Day Air War. In 1967, four Arab states with 810 combat aircraft threatened to destroy Israel. The Israeli Air Force initiated a pre-emptive air strike (Moked) on 5 June. They destroyed 300+ Egyptian military aircraft in two hours. Jordanian, Syrian and Iraqi air forces were also eliminated. At a stroke, all aerial opposition was removed for the loss of twenty aircraft and twelve pilots. Israeli aircraft subsequently concentrated on providing close air support. Here, a MiG 21 explodes in flame, caught in the gunsight of an Israeli fighter.



An F-15 is refuelled in flight by a tanker. Logistical support has played a crucial role in conflicts in the Middle East and Afghanistan in recent years with large forces being deployed at relatively short notice.



The successful use of the Sea Harrier in the Falklands War of 1982 demonstrated the value of the aircraft carrier.



An Israeli F-15. Israel has continued to maintain its superiority in equipment and pilot ability.



An F-15 and a P-51 flying together at an air show. Although generations apart, many of the principles of air combat familiar to the pilots of World War 2, continue to be taught to current-day pilots.

Despite all these innovations, the skilled fighter pilot is still in demand, and today, no less than in 1918 or 1940, flying the world's most challenging aircraft in one of the most skilled, exacting and exciting professions.

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MISSION: VIETNAM AIR WAR

The lessons of fighter combat which were honed in World War 1, hurriedly re-learned during World War 2 and painfully resurrected in Korea, came close to being abandoned during the nuclear warfare obsession in the post-war era. In the USAF, the Tactical Air Command (TAC) mission became totally subservient to the overriding Strategic Air Command (SAC) lobby. The old maxim – 'Fighter aircraft would never again engage in dogfights because of the high speeds involved' – was heard again, as in the late 1930s and 1940s. In the 1960s, Air Combat Manoeuvre (ACM) was pronounced dead, deliberately abandoned for the need for pure interceptor missions which emphasised supersonic speed, electronic-target sensoring and total concentration on missile weaponry.

Moreover, political considerations began to dominate. The Beyond Visual Range (BVR) asset that missiles gave the fighter was, in itself, unacceptable to the cramping new Rules of Engagement (ROE) forced upon the military. Targets had to be 'eyeballed' before being taken out to prevent error, negating most of the advantages of the system! When missile-only armed McDonnell F-4D Phantom IIs subsequently intercepted MiG-17s of the Vietnamese People's Air Force (VPAF) over Vietnam at low altitudes, not only could these old aircraft, with determined pilots, out-turn and out-manoeuvre the Americans, but once all missiles had been expended, the latter proved incapable of destroying the MiGs, even if visually confirmed at point-blank range! Colonel Robin Olds, an early fighter-ace over Vietnam, summed it up concisely: 'A fighter without a gun is like an airplane without a wing.' Some very fast re-thinking had to be done after the resulting outcry when ancient MiG-17s shot down two Mach-2-capable Republic F-105 Thunderchiefs on 4 April 1965.

This led to a hasty 'fix' with cannon pods being added to the Phantom's weaponry, which adversely affected performance. The F-4E variant had an internally-mounted General-Electric Vulcan M-61 20mm cannon with a 6,000rpm rate of fire added, which quickly proved invaluable and was credited with one-third of all Phantom MiG-kills. So frustrated were the group known as the 'Fighter Mafia' at Systems Command policy, that they mounted a vigorous campaign, which later resulted in the F-15 being turned into a very different aircraft than that originally planned. Training was modified from 1968 onward, with the Dissimilar Air Combat Training (DACT), the Navy 'Top Gun' and Air Force 'Red Flag' programmes, reintroducing old skills from scratch.



HELICOPTER WAR
The war in Vietnam will always be associated with the extensive use of helicopters. Helicopters gave new mobility to airborne forces, but could be vulnerable to ground fire. Many were turned into 'gunships', heavily armed with guns and rockets to provide suppressive fire in the landing zones or 'LZ'.

The fighter duellists in the Vietnam conflict were McDonnell Douglas F-4D Phantom IIs (145 enemy aircraft destroyed, making 75 per cent of kills); Republic F-105 Thunderchiefs – the 'Thud' – (30 kills) and Vought F-8 Crusaders (19 kills). The enemy was principally some 70 subsonic Mikoyan-Gurevich MiG-17F/PF Frescos, agile and equipped with one N-37 37mm and two NR-23 23mm cannon with Chinese-trained pilots from 1964; and Russian-supplied MiG-19F-13 Farmers from 1965. These were effectively utilised and forced strong counteraction as in 'Operation Bolo', which tricked them into battle with F-4s, destroying 50 per cent of the VPAF's inventory.

American tactics reverted to variations on the old World War 2 'Barrel-Roll', this 'short-cutting' manoeuvre enabling Sidewinder ATAs to be fired from astern the faster enemy, locking on to its engine exhaust. After a few such experiences, the Communists thereafter avoided fighter combat as much as possible, relying instead on AAA and SA-2 SAMs to inflict most American losses. Toward the end, a few Mach-2 capable MiG-21F-13/PF/PFM/MF Fishbeds were used which could out-turn the Phantom II.

A grand total of 192 MiGs were destroyed for the loss of 76 American fighters.

MiG 17
The Vietnamese Peoples' Air Force made determined use of its Russian-supplied MiG fighters, notably the MiG 17 seen here and the more advanced MiG 21 Fishbed. Though less sophisticated than contemporary US aircraft, the MiG 17 was robust and agile and in the right hands could be a dangerous opponent.





MUD-MOVERS
Much of the American air power fielded in Vietnam had been designed with a potential war against the Soviet Bloc in mind. The supersonic nuclear weapons delivery bomber, the F-105 Thunderchief, found itself ranged against conventional targets in North Vietnam, armed with conventional 'iron' bombs.



MiG-KILLERS AND GROUND-POUNDERS
The F4 Phantom, together with the F8 Crusader, were the primary counter to the threat from MiGs over Vietnam. The Phantom was also widely used in the fighter-bomber role in support of ground forces. Here, a Phantom is readied as a bomber, its bombs fitted with fuse extensions to cause detonation above ground level, a sign that the aircraft is assigned to a close air support mission.



MiG 21
Newly arrived MiG 21 Fishbeds brought a modern edge to the defending Vietnamese Peoples' Air Force of North Vietnam.



NEW DESIGNS
Despite early teething troubles, the introduction of the F-111 brought new power to the strike forces available to the USAF. The F-111 could carry the same bomb load as four F-4 Phantoms and its new terrain-following radar meant it could strike deep into North Vietnam with minimal ECM back-up.



FAST LEARNERS
The Vietnamese Peoples' Air Force had to learn fast to have even a chance of interfering with the massive American air effort. Here, a group of pilots listen as a more experienced pilot describes tactics employed in a combat mission.

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MISSILE COMBAT

The introduction of air-to-air missiles changed combat in many ways. Most significantly, the range of engagement opened up hugely; the distances of engagement as seen in World War 2 with machine guns and cannon in a visual field of combat had now evolved to vast distances. Missile combat also introduced the concept of 'fire-and-forget' weapons, allowing the pilot to engage multiple targets. And in the present era, it has now become possible to engage targets beyond visual range.

KNOW YOUR MISSILE

Guided missiles use one of two main methods of guidance: Infrared (IR) homing and radiation homing. Infrared or heat-seeking missiles detect heat from the bandit's engine or parts affected by air friction. Radiation-detecting missiles home in on radar signals reflected from the target; the radar might be carried on the aircraft or, in some cases, the missile itself. Semi-active radars home in on radar emissions from an aircraft's radar. Active missiles like the AMRAAM have their own radar. Most examples of semi-active missiles rely on the aircraft's radar guidance and then transfer to terminal/active guidance when they close on the target. The first generation missiles were IR homing. Their crude sensors could only 'see' the intense heat from a bandit's engine, and as a result they had to be launched from more or less behind the bandit. Also, they could be easily countered by flares, by turning the aircraft to conceal the hot tailpipe or by flying towards the sun to confuse the missile with its own heat signature. The IR missile was the first example of a fire-and-forget weapon. Once locked on to a bandit and fired, the attacking aircraft had no further role in guiding the missile to its target. The next generation of IR missiles had a larger viewing angle, allowing them to target a bandit from a wider arc on their direct '6' line. The most recent designs are 'all-aspect' missiles, sensitive to home in on any parts of a bandit that are heated due to air friction. Radar-homing missiles can detect bandits at longer ranges, but early designs relied on the attacking aircraft to continuously illuminate or 'paint' the bandit with a beam of energy along which the missile could fly to its target. This could put the launching aircraft in danger because its manoeuvrability was severely restricted until the missile hit the bandit. If the attacker was forced to break off, the missile would lose its lock, stop tracking and turn 'ballistic'. In other words, it would fall to earth. The latest generation of radar missiles carry their own transmitters which maintain a lock on the target once launched (the aircraft radar usually provides initial guidance). This produces a formidable long-range fire-and-forget weapon that can only be shaken off by an aircraft equipped with electronic countermeasures (ECM) or by hard manoeuvring with chaff that may break the aircraft radar's lock. Despite this, semi-active systems remain popular as they are considerably less complex to manufacture.



PRIMED AND READY
A fighter pilot performs his final checks before a mission. Part of the check is to ensure that missiles are armed and ready for combat. Here the pilot can be seen removing the protective cover from the missile's sensitive nose sensor.



VIETNAM SHOWDOWN

High over Vietnam, an F-4 Phantom launches an AIM-9 Sidewinder at its North Vietnamese opponent. Missiles in Vietnam were not as sophisticated as their modern equivalents, especially the longer-ranged AIM-7 Sparrow. Frustrated Phantom pilots often found their missiles malfunctioning at the critical moment leading to the hurried fitting of a gun aircraft. Modern fighters carry both cannon and missiles, despite the increased power and reliability of contemporary missile models.



MiGS AND ATOLLS
The Russian and Chinese-supplied Vietnamese MiG 17s and MiG 19s were purely gun fighters, but from 1965 the North Vietnamese Air Force began equipping with the MiG 21, a true missile-era fighter. The MiGs were armed with up to four K-13 Atoll, a reverse-engineered copy of the AIM-9 Sidewinder. An example of the AIM-9 had been captured intact during a border clash between Taiwan and China in 1958, the missile having hit a Chinese MiG 17 without exploding and consequently being carried back to its base for examination.





NEW ERA
An AIM-9 Sidewinder missile successfully launches from an F/A-22 Raptor during a launch test, demonstrating its ability to fire an air-to-air missile from an internal weapons bay. In its primary air-to-air role, the F/A-22 will carry six AIM-120C and two AIM-9 missiles.



SIDEWINDER
An F-16 Fighting Falcon pilot fires an AIM-9 missile. The Air Intercept Missile-9X Sidewinder, developed by Raytheon engineers, is a fifth generation AIM-9 missile that is a substantial upgrade to the Sidewinder family featuring an advanced infrared seeker and a higher off-bore sight capability.



OUT WITH A BANG
There is no target like a real target and with the cost of missiles it is imperative that any test-firing be aimed at something as close as possible to the real thing. As a result, the conversion of redundant airframes into target drones has been a way of making sure that practice is as real as it can be beyond a shooting war. This F-102 Delta Dagger was converted to act as a target drone after serving with a National Guard unit in America.

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SAM EVASION

In today's war zones it is often the missile that poses the greatest threat to warplanes. Made in their thousands and widely exported, the SAM can be a potent danger to operations and where enemy air forces have done little to hinder operations in recent wars, they have continued to take their toll. Surface-to-Air missiles were the most feared threat to US aircraft in North Vietnam. The MiGs might come up when the conditions were in their favour, but the SAMs were always there. Knowing what to do when the alarms sound and the sky lights up is critical. Plan ahead and follow the drill. Every second counts.



FLYING TELEPHONE POLES

Caught on the camera of a US warplane over Vietnam, a SAM climbs towards its target. SAMs claimed 196 US aircraft in Vietnam up to 1973, their success making them a priority target in that war and every war since.

The F-15's Electronic Counter Measure pod (ECM) is mounted on the wing. If it is up-to-date, it should counter the SAM's onboard guidance

SAFETY FIRST

SAMs can be launched visually, for example, infrared shoulder-launched SAMs such as the SA-7. They can also be launched ballistically without guidance or with the aid of radar. If you want to avoid detection, avoid flying at high altitude which produces contrails and highlights your aircraft against the silhouette of a cloud. If detected, you can confuse the enemy radar by overloading its system with chaff, fooling it into believing the sky is full of multiple aircraft. Also, intelligence is key – know where the location of enemy installations are prior to your mission as it will give you the opportunity to conduct countermeasures.

SHOW-STOPPER

An F-15 is witness to the fiery launch of a SAM over a desert target. Staying cool and making the right decision in the next few seconds will be vital if the crew are going to make it home.

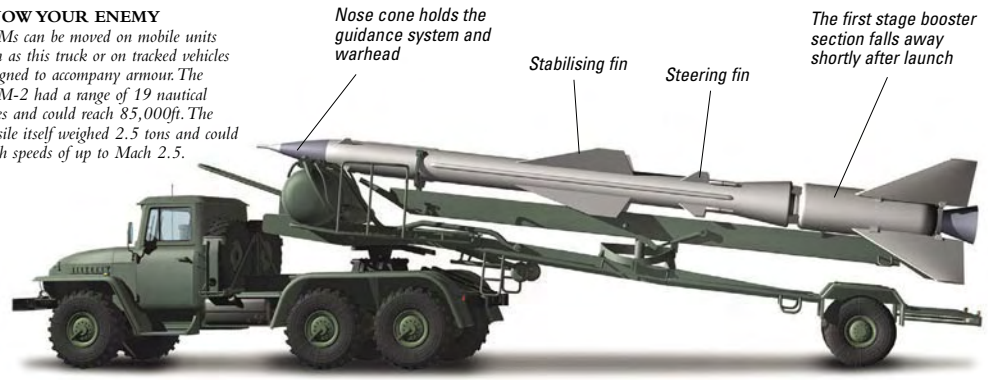
There is nothing, absolutely nothing to describe what goes on inside a pilot's guts when he sees a SAM get airborne

Commander Randy 'Duke' Cunningham, US Navy, 5 kills

The SAM leaves an impossible-to-miss trail, especially at night. If the pilot is alert he will see it, if not then only the aircraft's warning systems can alert him to the threat.

KNOW YOUR ENEMY

SAMs can be moved on mobile units such as this truck or on tracked vehicles designed to accompany armour. The SAM-2 had a range of 19 nautical miles and could reach 85,000ft. The missile itself weighed 2.5 tons and could reach speeds of up to Mach 2.5.



EVASION

Once the radar-guided SAM has launched, a 'lock-on' frequency beam is used to guide the missile(s) to you. When your 'threat warning' equipment notifies that the beam is active, you have to assume that a SAM is in the air and is coming your way. Make a hard turn and pump out two chaff bundles. It is possible for the lock-on beam to be confused by the multiple contacts and lose the lock on your aircraft and shift to one of the chaff bundles. Always manoeuvre violently!



FLARES AND CHAFF

Once a missile is sighted, you can try either to defeat its lock-on via electronics or fly out of its operating range. The use of flares can be important even with radar-guided missiles as some can carry infrared guidance as a back-up. Remember that a missile has a fixed time limit due to its limited fuel capacity. When the missile reaches your location, it may be travelling at a supersonic speed and can pull a substantial amount of Gs. The Aim-9X for example, can literally square a corner.



SAM SITES

Another option is to deliberately attack the SAM sites themselves, thereby making other sites wary of switching on their radars in case they are attacked as well. Fixed sites such as this are more vulnerable to attacks using anti-radiation missiles fired by 'Wild Weasel' aircraft specifically tasked with destroying SAMs.



JAMMING

Trusting on your electronics and radar alone is not advisable; keep your eyes peeled for threats and what you have on hand to detect and jam enemy defences. Jammers are usually contained in a pod on a wing and come in a range of types that can confuse, blanket and distort enemy radars. When the jammer is activated, it fills a portion of the SAM operator's screen with noise. However, the closer you are to the site, the better his chances of 'burning' through the jammer interference and finding you. Note that barrage noise is just one type of jamming as there are others. Here groundcrew prepare an ECM pod for use on a warplane.

HIDE AND SEEK

Of the various ways to defeat a SAM, the most efficient is to avoid detection in the first place. If the SAM battery does not know where you are, it cannot fire at you. Going in low allows the terrain to 'mask' you from radar detection.



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MISSION: A-10s in Desert Storm

The Hawg goes to War

The Fairchild-Republic A-10A Thunderbolt II ground-attack aircraft had a long and complex gestation period before entering service in 1975. By then, the 'Warthog's' role had been refined to 'tank-buster'. The A-10A had inbuilt capacity to absorb punishment and unmatched battlefield loiter capability. Her targets were the thousands of Soviet battle tanks expected to burst through the Fulda Gap into the south German plain if the Cold War went 'hot'.

The A-10 was virtually an airframe built around the mighty General Electric GAU-8/A Avenger Gatling gun, with its seven 7ft 6in long barrels, each with their own breech, firing 30mm PGU-13 high-explosive incendiary or PGU-14 armour-piercing incendiary rounds at 35 rounds per second. Each API round had a 15mm depleted-uranium penetrator in an aluminium base, capable of penetrating the toughest Soviet tank armour. Depleted-uranium strikes inject a jet of flame into the tank's interior, voiding tank and crew totally.

The A-10A also has eight underwing and three under-fuselage pylon stations with capacity for a huge range of Smart ordnance; AGMs, GBUs (AGM-65 Mavericks, GBU-10/12 Paveways, Mk 20 Rockeye or CBU-52 anti-personnel Cluster dispensers and Mk 77 Napalm canisters) plus conventional Mk 80 GP free-falling bombs, infrared countermeasure flares, chaff-dispensers, radar jamming pods and illumination flares, as well as defensive AIM-9L/M Sidewinders, although rarely used. To protect the pilot from incoming threats from SAMs to multiple AAA, the pilot is seated inside a titanium-armoured tub.

The feared Soviet tank breakthrough never materialised, but when the Iraqi dictator, Saddam Hussein, invaded the independent Gulf state of Kuwait on 2 August 1990, the bulk of his 4,000 tanks were Russian-built and supplied T-55, T-62 and T-72s. Eliminating these was the A-10A's prime task during the subsequent Operation Desert Storm.

The USA deployed 155 Warthogs, including six reserve aircraft, from the following units: 23rd TASS (15), 74th TFS (23), 76th TFS (28), 363rd TFS (26), 355th TFS (25), 511th TFS (20 and 706th TFS (18), although not all saw combat. The first mission of 322 sorties flown on 17 January 1991, was by Captain Tony Brown and Lieutenant Bryan Currier of the 74th. So-called 'Hawg' missions built up to three sorties per A-10A per day from Al Jouf. Despite the extreme heat and terrain, the Hawgs maintained a 98.67 per cent serviceability, far higher than any other warplane.

Besides tanks, APVs and the vast Iraqi ammunition dumps, A-10A targets included Scud-B missile mobile launchers, both by day and night with specially-adapted 'Night-Hawgs' using infrared targeting. Targets of opportunity included two enemy helicopters shredded by the GAU-8 at close range. Use of Mk 22 or LUU-2 flares and target-markers aided the destruction of hundreds of hostile targets in these night attacks and the A-10A took zero losses in return.

When the Iraqis sent fifty T-55 tanks into Saudi Arabia on 30 January, the A-10As pulverised them, one pilot, Captain Jack W. Thomas, personally taking out three tanks. The enemy was kept under continual pressure by the 'Push-Flow' method, ensuring a constant A-10A presence was continually reinforced over the battle zone.

A total of 987 Iraqi tanks was confirmed destroyed by the A-10A during Operation Desert Storm, along with 1,106 trucks, 926 artillery pieces, 501 APCs, 249 CPs, 11 Frog missile-launchers, 96 radar installations, 72 bunkers, 28 CPs and 10 enemy aircraft on the ground. An entire Iraqi tank column surrendered to the Hawgs as they circled overhead preparing to attack! During the panic-stricken flight from Kuwait City to Basrah, excellent servicing was achieved on enemy columns despite intense political restrictions on their usage. The A-10As flew only 16.5 per cent of all coalition missions – 8,655 combat sorties – and survived heavy damage. Just six Hawgs were lost in combat, five of them to SAMs, one to AAA.



BATTLEFIELD LOITER POTENTIAL
The great asset of remaining over the combat area for protracted periods was enhanced by the Hawg's ability to use in-flight fuelling to maintain their presence for extended periods, unlike fighter-bomber adaptations which could only run 'in-bash-out' type missions. The refuelling slipway was mounted high up on the nose of the A-10A, just ahead of the pilot's cockpit, for maximum visibility.



PENETRATING POWER!
When a PGU-14 DU penetrator round fired by the General Electric 7-barrelled Avenger Gatling gun penetrates the target's turret through the thickest armour, it lacks power to exit, thus remaining inside and voiding the occupants. Decapitated T-72s littered the battlefield in the wake.

DESERT HAWG - NATO COLOURS!
Designed for Close Air Support work in Vietnam, then converted to act as the 'Trip Wire' against the expected Soviet tank assault on Western Europe during the Cold War, the ungainly but supremely efficient and effective A-10A Hawg was based in England and Germany for many years and practised operating from autobahns and the like. Hastily switched to the baking sand deserts of Saudi Arabia when Iraq invaded Kuwait, many went into action still sporting their European camouflage schemes, but were just as effective. The A-10A also carried Maverick underwing missiles and eliminated other targets like SCUD missile launchers, heavy artillery guns, APCs and trucks – 6,834 targets in all for the loss of six of their number.

The Avenger spewed out a lethal cone of 35 APIDU rounds per second, each capable of gutting any known Soviet battle tank and vapourising its crew. They culled Saddam's Tank Corps during Desert Storm.

Digging in the armour to escape the attentions of the roving coalition aircraft merely rendered them inoperational and tactically impotent and in most cases the efforts proved unable to prevent them falling prey to the aircraft seeking to destroy them

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FUTURE WAR

Where Next for Air Combat?

Front line piloted aircraft are pricing themselves out of existence. At the time of writing, the F-22 Raptor costs over US $105 million per aircraft. Even the other US front line fighters are US $35 to $60 million per machine. Only the richest of nations can afford to manufacture these aircraft and those that cannot, can only afford them in limited numbers or buy older F-16s and Russian aircraft. The newest fighters are approaching the fine line where military assets cost too much to risk in combat, yet the various air forces of the world are just now starting to reap the full benefits of communication, Artificial Intelligence and unmanned aircraft technologies.



A CHANGED WORLD
The introduction of stealth technology has seen a reduction in the number of aircraft required to hit key targets in enemy territory. Less aircrew at risk and greater accuracy of the weapons deployed is a tempting scenario for governments wary of funding and political considerations. To remove the pilot and therefore the human risk implications is an understandable driving force. Stealth bombers such as the F-117 have proven their value in numerous recent engagements.



A QUESTION OF EXPENSES
Because new generation fighters as the F-22 Raptor cost over $105 million per aircraft, the pressure on government budgets is growing to new levels. Removing the human fighter pilot and his life supporting technologies could drastically slash the costs as well as allowing the aircraft to be designed with altered streamlining specifications.



NEW POSSIBILITIES
Pilots would be in no danger from training accidents or suffer losses in combat. The expertise of the pilot is safely retained. Depending on how important the destruction of a target is, a combat UAV may be used in a 'Kamikaze' role as a last resort. The combat UAV may be cheaper than a piloted fighter, but they will still be expensive enough that they cannot be casually thrown away. In their combat role they can provide firepower equal to the manned aircraft and remain on station longer. This Predator is preparing for a mission, armed with a range of air-to-ground missiles.

ATTACK OF THE DRONES

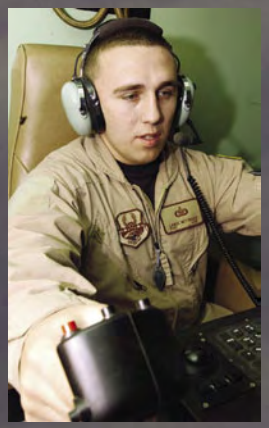
Reconnaissance and surveillance Unmanned Autonomous Vehicles (UAVs) have changed the way battlefields are viewed and fought and there have been the first moves away from a passive role to that of a combat one. So far however, targets have only been restricted to the air-to-ground scenario. Nevertheless, the full combat UAV will not be long coming and both the USAF and US Navy have been performing research along these lines. Such UAVs will be lighter and smaller than human-carrying fighters and cheaper to build and operate. How long before a country starts building these as its national fighter? When this happens, will the traditional fighter pilot fade away?



A BLURRED LINE
Today there are many flight simulators on the market that have very good flight dynamics. The Federal Aviation Authority in the United States even permits student pilots to use Microsoft Flight Simulator for some instrument-only flying time. There are many flight simulators devoted to aerial combat ranging from World War 1 to modern times. The more 'realistic' the flight and weapon models, the more real-world tactics have to be used. There are many sim-only pilots who have more 'flight' time than real fighter pilots. These sim pilots – the best of them – can go head-to-head with real pilots and come out ahead some of the time. While these sim pilots could not step off the street and effectively fly a combat UAV, in all likelihood they could at least attempt a credible mission. They would need training in formal tactics to refine what they already know.



FUTURE ACE?
With the remotely-controlled UAV replacing the piloted fighter, the loop comes full circle. Now the flight simulator and the real life fighter are both working from the armchair rather than the cockpit. In a future war, who knows? Perhaps the best of the simmers will find themselves in the front line!



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