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Eyes in the sky, weapons in hand: FPV drones and the challenges for IHL and the protection of civilians

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Mauro Vignati
Adviser on digital technologies of warfare, ICRC



Eirini Giorgou
Legal Adviser, ICRC



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Drones have become a defining feature of contemporary armed conflicts. Their use has surged dramatically in recent years, originally with the proliferation of inexpensive, commercially available systems, and increasingly with militaries also manufacturing drones at scale. Among these, first-person view (FPV) drones – small, agile aircraft controlled by an operator with a live video stream directly from the drone's camera – have emerged as a particularly versatile tool. Small, cheap, and easy to assemble and operate, FPV drones have reportedly been used by both state and non-state armed actors in conflicts across all regions of the world, including in Latin America, Gaza, Syria, Iran and elsewhere in West Asia, the Sahel (e.g. Mali), Sudan, Ukraine, Thailand and Cambodia, and Myanmar.

In this post, ICRC Advisers Georgia Hinds, Mauro Vignati and Eirini Giorgou examine how FPV drones are reshaping the conduct of hostilities, with implications for civilians in armed conflict and for compliance with international humanitarian law (IHL). They go on to suggest practical measures that parties to armed conflict should take to address these risks and ensure respect for IHL.

ICRC Humanitarian Law & Policy Blog · Eyes in the sky, weapons in hand: FPV drones and the challenges for IHL and the protection of civiliansThe term "first-person view" has its roots in video games of the 1970s, in which the player could experi

The term "first-person view" has its roots in *video games of the 1970s*, in which the player could experience the game through the eyes of a character. Originally developed for civilian use, *particularly hobby flying and drone racing*, FPV drones are characterized by a front-facing camera transmitting live footage to the operator, enabling immersive control beyond line of sight. This relatively simple innovation has made FPV drones highly adaptable for military use. Technological improvements – enhanced maneuverability, increased payload capacity, extended range or flight time, and *the integration of thermal cameras* – have further expanded their operational utility.

Recent developments also point toward increasing autonomy. Some FPV drones can continue flying toward a pre-designated target even when communication with the operator is disrupted. While autonomy in navigation on its own does not make an FPV drone an *autonomous weapon system*, it illustrates a broader trend toward reduced human involvement in certain functions.

From hobbyist tool to battlefield weapon

These drones are now used for both surveillance and attack, often in combination with other systems, in addition to less traditional tasks *such as the acceptance of surrender by adversaries*.[1]

Their appeal for armed forces and non-state armed groups lies in several factors:

- Accessibility: FPV drones can be easily bought off-the-shelf or produced domestically, and their parts can be 3D-printed;
- Usability: operators can be quickly trained to fly FPV drones, sometimes in hours;
- Affordability: FPV drones are relatively cheap and often treated as expendable;
- Adaptability: components can be assembled and modified in the field;
- Agility: they can maneuver rapidly and engage moving targets, including in dense urban environments.

These characteristics enable their use at scale, including in "one-way" missions, where FPV drones, fitted with explosive charges, become munitions. However, these characteristics also raise significant humanitarian and legal concerns; this article focuses on concerns specific to when FPV drones are used in attack.[2]

Versatility and evolving patterns of use

FPV drones are increasingly used to carry out attacks in armed conflict. They are typically armed with explosive payloads which are then dropped onto targets or detonate when the drone crashes into a target. They can be used individually or in coordinated swarms to target personnel or equipment. Whilst FPV drones are still predominantly "multirotor" configurations, *fixed-wing models are increasingly being used* to extend range, speed and payload capacity, with *reported examples of operational range now reaching 30 kilometers*.

Some FPV drones may "loiter" for periods of time. They can be used in ambush-style operations, kept concealed until a target appears and the operator detonates the munition. Others are *reported* to be configured to detonate upon movement or tampering. It is extremely difficult to verify these claims and technical capabilities. But such "victim-activated" systems may qualify as *mines* or *booby-traps*, governed by the relevant treaty and *customary IHL rules*, or as autonomous weapon systems if they can select and engage a target based on its movement without further human intervention, in which case the *ICRC's recommendations on autonomous weapons* are especially relevant.

FPV drones are adding to the reach of attacks beyond the immediate frontline, including in populated areas. While this threat is not unique to FPV drones, their range and maneuverability can make it harder to anticipate where and when attacks may occur. Their ability to access areas previously considered difficult or impossible to reach, including basements and other enclosed spaces, combined with their numbers, agility and capacity to observe and pursue targets, can contribute to what is sometimes described as a "transparent battlefield".[3] For civilians, that transparency can manifest as a persistent sense of exposure and vulnerability, with a constant fear of being mistakenly targeted or incidentally harmed. In this environment, combatants may be more likely to seek to conceal their movements among civilians or civilian objects, while drone operators may be located far from the frontline, including in civilian residences. *Military objectives are therefore increasingly located in close proximity to civilians*, potentially complicating efforts to *distinguish* between military objectives and protected persons or objects.

Key humanitarian and legal concerns

While *FPV drones are not expressly prohibited or specifically regulated as a category of weapon under IHL*, the patterns of use described above raise a number of humanitarian and legal concerns. These relate to the technology itself, the people who operate it and the circumstances of acquisition and deployment of FPV drones. The following examples are intended to be illustrative rather than exhaustive.

Constraints on target identification

FPV drones are typically equipped with low-cost sensors, often analogue cameras with limited resolution. While sufficient for navigation, they may not allow reliable identification of targets or assessment of the surrounding environment.

What is more, the "tunnel vision" effect created by an FPV drone's video feed deprives the operator of awareness of the surrounding environment, including any protected persons or objects which may be present in the vicinity of the target.

Under IHL, *attacks may only be directed at military objectives*. In case of doubt as to the status of a person or object, *they must be presumed to be civilian*. Where available technology does not permit *sufficient verification* of a target, an attack must not be launched.

Moreover, parties must do everything feasible to assess the expected incidental civilian harm of an attack. They *must take all feasible precautions* to avoid or at least minimize incidental civilian harm from their attacks, including in the choice of their weapons and tactics.[4] Attacks that may be expected to cause incidental civilian harm that would be excessive in relation to the concrete and direct military advantage anticipated (*disproportionate attacks*) are also strictly prohibited.[5]

These obligations may require the use of additional intelligence, surveillance and reconnaissance (ISR) assets, higher-quality sensors, or otherwise may prevent the use of FPV drones to carry out attacks in certain conditions.

Locating military objectives and combatants in populated areas

The changing geography of hostilities brought about by the use of FPV drones raises concerns regarding compliance with the obligation to take *precautions against the effects of attacks*. Under IHL, parties to a conflict must, to the maximum extent feasible, *avoid locating military objectives within or near densely populated areas* and take other necessary precautions to protect civilians under their control from the dangers resulting from military operations.
The presence of military objectives or drone operators among civilians can raise questions about compliance with these obligations, and in any event, increases the risks to civilian life. Using civilians to shield military operations or military objectives – including drone operators or combatants who might be targeted by drone operators – from attack is *prohibited*. These obligations remain essential as the reach of weapons and the areas in which attacks may occur continue to expand.

To be clear, however, even when a party fails to comply with the *obligations not to use human shields* or to take precautions against the effects of attacks, the rules on distinction, proportionality and precautions continue to apply and *protect civilians* in the same way as they would if no violation had occurred.

Limited training and increased civilian involvement

FPV drone operators are often trained rapidly, leaving little to no time for instruction on IHL. At the same time, the accessibility of these systems means that civilians, who are unlikely to have any prior IHL training, may assemble or even operate them. This raises concerns regarding knowledge of and, consequently, compliance with IHL.[6] It also *increases the risk of civilians being drawn into directly participating in hostilities* and exposes them to attack.[7]

Reliability, safety, and legal reviews

The commercial origins of FPV drones, and the ease with which they can be assembled from off-the-shelf components or 3D-printed parts, raise concerns that go beyond how they are used in the field.

Drones assembled outside formal military supply chains may not meet the reliability and safety standards normally applied to weapons. They may exhibit increased failure risks, including unintended detonations or failures to detonate on impact (becoming unexploded ordnance), both of which create dangers for civilians.

Further, *states must review new weapons* to determine whether their use would be prohibited under IHL. This obligation is not contingent on how a weapon is procured. However, where drones are built from commercially sourced components, outside formal acquisition processes, this legal review step risks being missed.

FPV drones and munitions

Reports indicate a range of FPV drone payloads, including *grenades*, *mines*, *incendiary devices*, and other explosive materials.

The use of FPV drones fitted with munitions must comply with all applicable IHL rules, including both general rules and specific treaty-based prohibitions and restrictions on weapons.

For example, drone-delivered mines remain mines for the purposes of the *Anti-Personnel Mine Ban Convention* and *Amended Protocol II to the Convention on Certain Conventional Weapons* (CCW). Similarly, it is prohibited, under *CCW Protocol III*, to use FPV drones to drop incendiary weapons in populated areas.

Beyond specific treaty-based prohibitions and restrictions, the general IHL rules on the conduct of hostilities (including those set out in the previous section) impose further constraints. FPV drones carrying large explosive payloads may produce wide-area effects – a significant blast and fragmentation radius that extends well beyond the intended target – raising *serious concerns about indiscriminate effects* even where precision guidance is used. These risks are compounded in populated areas, where the likelihood of civilian harm increases significantly.

Emerging autonomy

The large-scale, intensive deployment of *electronic warfare to jam or disrupt communication links* has driven a growing interest in developing drones with autonomous capabilities. While it is extremely difficult to reliably verify the extent to which FPV drones have been used in armed conflict to autonomously select and apply force to targets, certain functions – such as take-off, landing, target tracking and navigation – are undoubtedly being increasingly automated, and the general trajectory toward greater autonomous operation is clear.

The ICRC has *highlighted serious concerns* about how autonomous weapon systems – weapons that select and apply force to targets without human intervention – reduce a human's ability to control the effects of an attack. It *calls for* new international law to be urgently adopted prohibiting certain types of autonomous weapon systems and restricting the development and use of others.

Risks at the end of a mission

Unlike conventional drones, FPV drones built for one-way missions may not have the capability to return to base; they are purpose-built to expend themselves on impact and typically lack the range and flight endurance for a return journey. This creates particular challenges when no target has been identified by the time the drone reaches the limit of its operational range, when technical failures occur, or when adversarial interference (including electronic warfare measures) deprives the operator of the ability to make any disposal decision at all.

In some cases, depending on the FPV model and battery capacity, the drone may attempt to return to the starting coordinates. If that is not possible, it may crash-land and either explode in an uncontrolled manner, causing unintended and likely unpredictable harm, or in other cases fail to detonate on impact, leaving unexploded ordnance that poses ongoing dangers to civilians even after hostilities have ended.

This latter risk engages *Protocol V to the CCW*, which imposes obligations on parties to take precautionary measures during the planning and conduct of operations to minimize the risks posed by explosive remnants of war (ERW). This includes, to the maximum extent possible and as far as practicable, recording and retaining information on explosive ordnance used or abandoned during a conflict (including armed FPV drones) and sharing information about potential ERW once fighting has ended, to facilitate its clearance, removal or destruction.

Such precautionary measures should also include planning for safe disposal and incorporating safety features in FPV drones such as a reliable Return-to-Home function, self-destruct or fail-safe mechanisms.

Strengthening compliance: practical measures

Ensuring respect for IHL in the use of FPV drones, including compliance with the rules on the conduct of hostilities, requires concrete action across a range of areas. A number of preliminary recommendations, which are not intended to be exhaustive, are set out below, noting that aspects of these may already be legally required under the principle of precautions or through other IHL obligations.

Policies and procedures

The diversity of FPV drone payloads and methods of use documented in current conflicts makes clear operational guidance essential. Parties must establish robust procedures for target verification, reflecting a presumption of civilian status in case of doubt, and for anticipating and avoiding or at least minimizing incidental harm to civilians or other protected persons and objects. Specific doctrine must be established (or adapted) governing use in populated areas, reflecting the requirement that *heavy explosive weapons should not be used in such areas unless sufficient mitigation measures can be taken to reduce the weapons' wide-area effects and the consequent risk of civilian harm*.

Given the risks posed by one-way missions, protocols for safe disposal when attacks are aborted or drones malfunction are essential, both to protect civilians during hostilities and to reduce risks from explosive remnants of war. These protocols should also include requirements to record and retain information on the location of use and nature of any such FPV drone that could be classified as unexploded ordnance.

Training

To ensure that FPV drone operators understand their legal obligations and the resulting operational constraints, IHL must be integrated into their training from the outset, with instruction regularly reinforced rather than treated as an optional add-on. Training scenarios should be realistic, incorporate issues of civilian protection, and specifically address the challenges identified above, including: target verification under low-visibility conditions; the limits of thermal imaging for distinguishing civilians and other protected persons from combatants; that attacks cannot be carried out where there is "doubt" as to the status of a potential target or if it is not possible to anticipate incidental harm on persons or objects other than that target; and the obligation to cancel or suspend an attack if it becomes apparent that the target is not a military objective or that incidental civilian harm would be excessive.

Command and control

The speed and scale at which FPV drones are deployed place particular pressure on command-and-control structures. Commanders must ensure that operators understand applicable rules of engagement and tactics, techniques and procedures. Where doubt persists as to the status of a target, targeting decisions must be

escalated, and operators instructed to refrain from carrying out an attack. Given the tunnel-vision effect inherent to FPV drones, operators should be supported with additional personnel and ISR/overwatch assets to improve situational awareness beyond the drone's narrow field of view.

Legal reviews

States must carry out a *legal review* of new weapons they develop or acquire, ensure that their legal review processes – including testing and evaluation of the technical performance of the weapon – can cover field-assembled and commercially sourced FPV drones, and refrain from authorizing operational use of these systems, including novel payload combinations, unless they have undergone such review.

Transferring states

States supplying FPV drones or components, including the commercially available parts from which many are assembled, must assess the risk of IHL violations, and refrain from transfers – including cancelling existing authorizations – where such risk is clear.*[8]* Conditional transfers and monitoring mechanisms can help *prevent and mitigate misuse*.

Tracking and understanding civilian harm

Armed forces should collect and analyze data, including through the systematic review of operational footage, on incidents of civilian harm involving the use of FPV drones, particularly in populated areas, to assess compliance, document civilian harm and increase understanding of the effects of these weapons. They should also ensure that such understanding and lessons are incorporated in training and military decision-making processes at all levels.

From innovation to responsible use

FPV drones illustrate how the rapid adaptation of civilian technology for military use can quickly outpace the doctrine, training and practical measures necessary to ensure IHL compliance and civilian protection in armed conflict.

Current sensor limitations in FPV drones, together with their narrow field of view, can make it difficult for operators to verify targets and assess the surrounding circumstances. This increases the likelihood of unlawful attacks harming civilians or combatants *hors de combat*. Such dangers are compounded by the minimal training on IHL that is received by some operators. One-way missions generate explosive remnants that endanger civilians, including long after hostilities end. The commercial availability of FPV components also creates a risk that systems are deployed without having undergone the legal review that IHL requires of new weapons. Without such review, weapons may be fielded without the necessary tests and accompanying guidance as to the conditions and safeguards that are needed to make sure they can be operated in compliance with IHL.

IHL provides a strong legal architecture to govern the use of FPV drones in armed conflict. Political and military leaders must set a clear expectation of compliance with these IHL rules and principles and ensure they are reflected in operational policies, realistic training, effective command oversight and responsible transfer practices. These measures are essential to reducing the risks FPV drones pose to civilians and combatants *hors de combat*.

References

[1] See, indicatively, D. Axe, *"Russian Soldiers Are Surrendering To Ukrainian Drones. This Has Happened Before"*, Forbes, 18 November 2022.

[2] The use of unarmed FPV drones, for example in surveillance, as decoys or for logistical purposes, as well as the potential for data from drone feeds to improve accountability processes, are outside the scope of this post.

[3] G. Garnier and Pierre Néron-Bancel, 'At the Other Side of the Hill': The Benefits and False Promises of Battlefield Transparency, Focus stratégique, No. 118, Ifri (May 27, 2024)

[4] Art. 57(1), (2)(a)(ii) and (c), and (3) API; Rules 15, 17, 20 and 21 ICRC CIHL Study.

[5] Art. 51(5)(a) API; Rule 14 ICRC CIHL Study.

[6] Common Article 1 of the four Geneva Conventions.

[7] Depending on the circumstances, civilians using or assembling FPV drones may be considered as directly participating in hostilities and consequently liable to being targeted; ICRC, Interpretive Guidance on the Notion of Direct Participation in Hostilities under International Humanitarian Law, 2009.

[8] Common Article 1 to the Geneva Conventions; Arts 6(3) and 7(1)(b)(i) of the Arms Trade Treaty.

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