

MILITARY TECHNOLOGY

UNINHABITED COMBAT AERIAL VEHICLES AND THE LAW OF ARMED CONFLICT

FLIGHT LIEUTENANT HYDER GULAM AND CAPTAIN SIMON W. LEE

ABSTRACT

This article discusses the application of the Law of Armed Conflict (LOAC) to the world of cutting-edge military technology in the form of the uninhabited combat aerial vehicle or 'UCAV' as it is known in military circles. UCAVs are pilotless aircraft that can launch, attack, recover and return to base. The discussion focuses on LOAC, examining the legal implications of the use of UCAVs in combat with particular reference to Australia. Prior to the introduction of UCAVs into military service, the user nation—in this case Australia—has a legal obligation to ensure that its employment of the UCAV complies with customary international law and the various applicable conventions and treaties.

The law of armed conflict is something that all military people need to know. I never found it constraining. There were some targets we wanted to hit that we couldn't. But nonetheless, we must abide by some level of morality.

USAF General Charles 'Chuck' Horner
Coalition Air Commander, 1991 Gulf War¹

INTRODUCTION

On 3 November 2005, Senator the Hon. Robert Hill, Minister for Defence, stated that miniature unmanned aerial vehicles (UAVs) were to be deployed to Iraq to provide increased protection for Australian Defence Force (ADF) soldiers. The miniature UAVs were to be used for reconnaissance and surveillance missions and provide real-time information about terrain and activities.² UAVs are not new to the ADF, which deployed them as part of the Regional Assistance Mission to Solomon Islands.³ The logical next step in the genesis of the UAV is undoubtedly the introduction of combat functions to these craft. This article concerns the next step in the progression from UAVs to 'uninhabited *combat* aerial vehicles' (UCAVs) and the Law of Armed Conflict (LOAC) implications of the employment of these craft.⁴

UCAVs are aerial vehicles that can launch, attack, recover and return to base without onboard aircrew.⁵ Some UCAVs are used as imagery sensors for reconnaissance or as a tool for guiding other weapons onto a target.⁶ UCAVs represent the air power element of the revolution in military affairs in that they embody an intersection of technological advancement, conceptual innovation and organisational adaptation.⁷ From an economic perspective UCAVs are perceived to represent value for money in that they are cheaper to buy and fleet operations cost less. Given the spiralling expenses of many defence budgets, UCAVs have the potential to allow a military force to field an effective and substantial fighting force without the overheads traditionally associated with manned aircraft and without the risks posed by having combat pilots undertake dangerous missions.⁸

The aim of this article is to discuss the legal implications of the introduction of UCAVs into the military forces of a nation with particular reference to Australia. Before UCAVs can be introduced into service with the ADF, Australia must ensure compliance with its legal obligations under customary international law and various conventions and treaties. These obligations may also apply to other nations,⁹

UCAVs represent the
air power element
of the revolution in
military affairs ...

depending on the nature of Australia's legal relationship with the applicable laws and conventions. The purpose of this article is to examine whether the introduction of UCAVs is likely to contravene any of these legal obligations.

This discussion will focus on LOAC as it applies to UCAVs (excluding the technical details of the UCAV's operation¹⁰) and also explore Australia's other legal obligations.¹¹ This article incorporates an exploration of Article 36 of *Additional Protocol 1 (API) of 1977* which comprises a legal assessment of new weapons, a discussion of the legality of civilians controlling a UCAV in a combat military operation, and the issue of legal responsibility when a UCAV malfunctions with unforeseen consequences.¹² Compliance with LOAC obligations in the current media-rich environment will avoid the stigma and consequent loss of moral and national support that inevitably result from a nation's breaching its LOAC obligations.¹³

Before UCAVs can be introduced into service with the ADF, Australia must ensure compliance with its legal obligations ...

UNINHABITED COMBAT AERIAL VEHICLES AND UNINHABITED AERIAL VEHICLES

Air power has come a long way since Italian Army Lieutenant Giulio Gavotti launched the first bombing run against the Libyans by tossing a grenade from his biplane.¹⁴ Since that time air power has become one of the decisive elements in an armed conflict. The use of an unmanned combat aerial vehicle has been at the forefront of thinking by air power theorists and practitioners since the First World War.¹⁵ Clarence Johnson, the founder of Skunk Works (the ultra-secret Lockheed testing facility and birthplace of the SR-71 and U-2), for example, was noted to have remarked that the future of military aviation belonged to UAVs.¹⁶

Unlike UCAVs, UAVs obviously do not have a combat function and thus generally are unlikely to fall foul of LOAC obligations. However, the technology for both entities remains largely similar, particularly the unmanned capacity of both craft and their control via remote access or pre-programming. UAVs have been used in Iraq,¹⁷ Afghanistan¹⁸ and in Yemen, where a Predator unmanned vehicle controlled by the CIA is

The use of an unmanned combat aerial vehicle has been at the forefront of thinking by air power theorists and practitioners since the First World War.

reported to have fired a Hellfire missile that killed a number of al Qaeda suspects.¹⁹ UAVs have been used in a military role with great success since the last century. There are no more famous examples than the events surrounding the 1973 Yom Kippur War in which Israel mounted successful UAV operations over the Bekka Valley in Lebanon. These UAVs were able to suppress Syrian radars and also to simulate Israeli aircraft in order to locate Syrian radars for strikes by Israeli anti-radiation missiles. Apart from the provision of real-time video imagery of enemy positions and strength, the success of these aerial vehicles resulted in the loss of only one Israeli aircraft against Syrian losses of 18 surface-to-air missile units and 86 combat aircraft.²⁰

UCAVs can be classified within two extremes in terms of command and control. The 'dumb UCAV' is wholly controlled by a remote human operator via a data link. On the other side of the continuum is the so-called 'terminator': a UCAV that is wholly autonomous and able to function independent of human interaction once assigned a target to kill.²¹ Regardless of the command and control methodology of the UCAV, these weapons have become highly desirable given their reusability and the significant cost saving per target destroyed or neutralised.²² Other advantages lie in the design of the UCAV. By removing the operator from the weapons delivery system, employment of the vehicle ceases to involve risk to human life. Without the need to build a cockpit capable of enclosing a pilot, the vehicle can be smaller and possess fewer radar emitting edges, lower signature and less reflectivity. A smaller vehicle can yield greater range and endurance and has better survivability. The lack of aircrew can facilitate the political decision to use armed force, without the electoral repercussions when service personnel are wounded, killed or go missing in action. UCAVs can significantly minimise risk, especially in an air campaign against the enemy's integrated air defence systems and are capable of deep penetration strikes against enemy centres of gravity. Finally, the long loitering ability of UCAVs over a battlespace can mean a persistent presence to rapidly strike targets of opportunity.²³

... these weapons have become highly desirable given their reusability and the significant cost saving per target destroyed or neutralised.

LAW OF ARMED CONFLICT (LOAC)

LOAC is the law that governs states engaged in armed conflict.²⁴ LOAC seeks to regulate the means and methods of warfare permitted to combatants and protect those who are not, or are no longer participating in the conflict. Through the 1949

Geneva Conventions and the *1977 Additional Protocols*, fundamental principles are established in relation to the conduct of armed conflict. This body of law articulates that the right of belligerents to choose means or methods of warfare is not unlimited and that distinction must be made between civilians and combatants.²⁵

Any military use of UCAVs must comply with the basic principles of aerial targeting as established by LOAC.²⁶ These principles are: discrimination, military necessity, humanity and proportionality. Each of these will be discussed in turn.

Discrimination involves exercising diligence in identifying non-combatants as distinct from combatants who can be legitimately targeted. There is a rebuttable presumption that non-combatants are to be prohibited from attack. This principle is not, however, designed to stand alone, and must be read in conjunction with the other principles—in particular, that of military necessity.²⁷ Under LOAC, combatants have a right to participate directly in the armed conflict during hostilities, while civilians do not. While combatants must distinguish between civilian and military objectives, the presence of civilians near a military objective does not render it immune from attack.

Under the principle of military necessity, the legitimate use of force in the pursuit of military objectives may cause incidental injuries and collateral damage. Military necessity involves a recognition that lives may be lost and damage inflicted. However, such losses and damages must be incidental to the military mission. The principle of military necessity does not permit an indiscriminate attack.

Humanity is the principle that recognises that there are limits to the means and methods of warfare. Because certain targets are afforded special protection, they cannot be attacked unless certain conditions apply. For example, civilians and civilian objects are prohibited from attack, as are religious and cultural sites, hospitals, medical personnel, and military forces that have left the conflict (for example, prisoners of war, sick, shipwrecked and wounded, and those who have surrendered).

Proportionality embodies the requirement to balance the principles of humanity and military necessity. The death and destruction caused must be proportional to the military advantage anticipated. Military necessity cannot justify the unmitigated

... the right of belligerents to choose means or methods of warfare is not unlimited ...

Humanity is the principle that recognises that there are limits to the means and methods of warfare.

use of force, as the principle of proportion carries with it established limits. Thus, the consequence of the attack must be weighed up against the military objective to be achieved. Again, proportionality attempts to minimise collateral civilian casualties and collateral damage to civilian objects.

THE ADF'S LEGAL OBLIGATIONS

As a signatory to the *Additional Protocols*, Australia is obliged to honour its treaty obligations in good faith. Nowhere is this obligation more important than with reference to Article 36 of *API*. This article refers to the legal review of new weapons to ensure compliance with the rules of international law. It states:

In the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party is under an obligation to determine whether its employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party.

Although Article 36 does not articulate how this obligation is to be met, the implication is that national measures are to be implemented to evaluate the employment of new weapons, means and methods of warfare.²⁸ The treaties to which Australia is a party and which pertain to the ADF include the 1972 *Biological Weapons Convention*, the 1993 *Chemical Weapons Convention* and the 1997 *Convention on the Prohibition of Anti-personnel Mines*.

Any employment of UCAVs by the ADF would need to be evaluated in light of Article 36 of *API* and ADF policy²⁹ that cover Australia's treaty obligations, as well as the other major component of international law—customary international law. According to the International Court of Justice in its *Advisory Opinion on Nuclear Weapons*,³⁰ there are two 'cardinal principles' that can be considered as customary. The first is the principle of distinction, which carries a ban on employing weapons that are incapable of distinguishing between civilian and military targets. The second cardinal principle is the prohibition on causing unnecessary suffering to combatants and on the use of weapons that cause such suffering or pointlessly aggravate their suffering.³¹ States are encouraged to address a wide range of issues in reviewing their obligations, including military, technical, health and environmental issues.

Prior to the introduction of new weapons such as the UCAV into the ADF, it is essential that an extensive review of obligations be undertaken ...

Prior to the introduction of new weapons such as the UCAV into the ADF, it is essential that an extensive review of obligations be undertaken pursuant to Defence Instruction (General) Operations 44-1 *Legal Review of New Weapons*. This review should be conducted by ADF nominees including representatives from Defence Legal (DL). The DL representatives would be expected to pose a number of questions in order to assess the legality of new weapons, including:

- What is the purpose of the new weapon?
- What are the factors that favour the introduction of the new weapon?
- What is the damage mechanism of the new weapon (blast, fragmentation, etc)?
- Is the new weapon specifically designed to cause injury to personnel?
- What human injuries will the new weapon be capable of inflicting?
- What other weapons, if any, would be capable of fulfilling the same purpose as the new weapon?
- Has the new weapon been adopted by the armed forces of other states or by other agencies in Australia and overseas and, if so, by which ones?
- Is evaluation data concerning the new weapon available from the armed forces of other states or from other agencies in Australia or overseas?³²

Given that the UCAV is a platform from which conventional air-to-surface munitions are to be fired—for example, the Hellfire anti-armour missile—there appears to be no legal impediment that would preclude the introduction of the UCAV vis-à-vis the DL questions. The UCAV may be a weapon in itself; but it is more properly classified as a weapons system, able to deliver munitions onto a given target. However, the issue of the next generation of sub-munitions that a UCAV will be able to deliver is another legal question entirely. It is this next generation of sub-munitions that will need to be reviewed as new weapons systems prior to their introduction into the ADF. These weapons are capable of loitering over the battlespace under their own power and of searching out their own targets following delivery by a UCAV.³³ The main issue is whether the UCAV that loiters over the battlefield is able to distinguish legitimate targets—friend from foe.

The main issue is whether the UCAV that loiters over the battlefield is able to distinguish legitimate targets—friend from foe.

MAN IN THE LOOP

Some UCAVs can be categorised as ‘state aircraft’ under Article 3(b) of the *1944 Convention on International Aviation (Chicago) Convention*. The basis for this categorisation is that, unlike a cruise missile, UCAVs are designed to return to base.³⁴ In addition, the UCAVs that have been used in combat to date have complied with

the criteria laid down for a state aircraft; that is, a requirement for visible external military and national markings. In addition, UCAVs have flight control capabilities, removing the requirement for the UCAV to fly straight to its target. These technical characteristics also mean that UCAVs do not violate the 1987 *Intermediate-range Nuclear Forces (INF) Treaty* or the *Strategic Arms Reduction Treaty (START)*. Under the former treaty, ground-launched cruise missiles between the ranges of 500 and 5500 kilometres are prohibited. Under the START Treaty, the UCAV would not be considered a bomber due to its range and payload.³⁵

The major legal dilemma that arises from the introduction of UCAVs is that of the replacement of the decision-making entity—the pilot and/or aircrew.³⁶ An element of this dilemma is the replacement of a combatant with a non-combatant while the UCAV is in an active combat role. Another issue lies in the complicated legal problem of to whom to assign legal responsibility if a UCAV malfunctions and causes collateral and other damage in violation of LOAC. The implication is that, by not having a ‘person in the loop’, the ADF may have difficulty maintaining the required fidelity and confidence to meet its LOAC obligations.³⁷ The added bonus of having a ‘person in the loop’ is that it minimises ‘blue-on-blue’ incidents of fratricide that may result from a UCAV on autopilot completing a 180-degree turn and returning to kill friendly forces.³⁸

Questions arise over the application of LOAC if non-ADF personnel are controlling the operation of a UCAV during a combat mission. This issue of non-combatants performing part of a combat role has both domestic and international implications, as it impacts on the ADF’s obligations under LOAC.³⁹ A combination of declining numbers of military personnel and the increased use of highly complex and sophisticated equipment has made armed forces around the world more reliant on civilian contractors than ever before.⁴⁰ During the 1991 Gulf War, the US military was so reliant on civilian contractors that the ratio of contractors to US combatants was as high as 1:34. During Operation *Allied Force* in the Balkans, fewer than ten years later, this ratio had increased to one civilian contractor to ten US combatants.⁴¹ The introduction of new technology such as the UCAV has resulted in a heavy dependence on civilians for major aspects of the UCAV’s operations including, in some cases, control and operation of the weapons system.⁴² This is an obvious breach of LOAC as only a combatant is legitimately permitted to take part in armed conflict.

The added bonus of having a ‘person in the loop’ is that it minimises ‘blue-on-blue’ incidents of fratricide ...

While outside the scope of this paper, the issue of civilian contractors merits mention due to the situation that occurred in Iraq in 2003. A number of reports noted that US troops in Iraq suffered months of unnecessary poor living conditions because some civilian contractors hired by the US Army for logistic support 'failed to show up'.⁴³ The major issues include not only vendor reliability, but the lack of competition for the contractor; vulnerability of the contractor to a stock market takeover by a foreign organisation that is hostile to national interests; lack of surge support; and protection of civilian contractors during an armed conflict. Another pertinent issue concerns whether civilian contractors could be deemed to be mercenaries under the definition in Article 47 *API*.⁴⁴

The ADF has a policy in place that articulates the role of civilians in support of ADF operations and which outlines government policy seeking an increased role for Defence public servants and industry in support of those operations.⁴⁵ This policy clearly indicates that, as a party to the Geneva Conventions and the AP, Australia has an obligation to remove civilians from military threat or to protect them to the maximum extent feasible. Importantly, civilians who support ADF operations are forbidden from wearing military uniform or carrying any form of weapon. By extension, civilians would also be forbidden from operating weapons systems such as the UCAV.

Under LOAC, the UCAV operator who actually fires a weapon must be a combatant; that is, a member of a military force in accordance with the criteria set down by The Hague and the 3rd Geneva Convention. Non-combatant civilians may thus become legitimate targets due to their proximity to the operations of the UCAV.⁴⁶ These civilians are at risk of being deemed part of a military target due to their participation in hostilities—that is, assisting in the operation of the UCAV. Civilians have no right to participate in hostilities and may be targeted during the length of their involvement and even held legally accountable for their participation.

Legal responsibility for a UCAV that breaches the Laws of Armed Conflict may rest with the ground control team or even the flight authorising officer. The authorising officer is generally responsible for ensuring that adequate planning, briefing, conduct,

... civilian contractors could be deemed to be mercenaries under the definition in Article 47 *API*.

... civilians are at risk of being deemed part of a military target due to their participation in hostilities—that is, assisting in the operation of the UCAV.

and debriefing of a flight has occurred.⁴⁷ It could be argued that, under the rules of engagement, UCAVs should have a human in the authorisation loop. The human controller makes the decision to release the weapon based on situational awareness gained from the on-board systems as well as an integrated data link picture of the target.⁴⁸ This means that a UCAV cannot autonomously release a weapon without authorisation from a ground station operator.⁴⁹ If such authorisation is not forthcoming, or the data link from the UCAV to the ground station is lost or jammed, then the UCAV should revert to a pre-programmed flight program and return to base.⁵⁰ The UCAV should come under command control prior to launching an attack; it should not be permitted to have an automated attack function.

Air Marshal Brian Burridge, Britain's RAF commander during the 2003 Iraq conflict, summarised the situation succinctly:

Under the laws of armed conflict, there remains the requirement to assess proportionality, and within this there is an expectation that the human at the end of the delivery chain makes the last assessment by evaluating the situation using rational judgement... Conflicts now confront us with ambiguous non-linear battlespaces. And thus we cannot take the human, the commander, the analyst, those who wrestle with ambiguity, out of the loop.⁵¹

CONCLUSION

UCAVs represent a new frontier in warfighting. These weapons systems add another dimension to the principles of modern air power with their unparalleled flexibility and reach. Despite this apparent revolution in military affairs, adherence to LOAC is paramount in ensuring the preservation of the basic dictates of humanity. UCAVs must conform to both LOAC and other international obligations if they are to be inculcated into the stable of deterrent military force of a modern defence arsenal. This article has argued that it is essential for UCAVs to have a human element so as to ensure the employment of sound operating procedures in this cutting-edge technology. The 'man in the loop'—the human dimension of the UCAV—must be a serving member of a military force so that the nation concerned is able to meet its obligations under LOAC. To do otherwise, risks non-compliance with that nation's legal obligations and the unfavourable glare of the international media spotlight.

UCAVs represent
a new frontier in
warfighting.

ENDNOTES

- 1 USAF General Charles 'Chuck' Horner, Coalition Air Commander, 1991 Gulf War, cited in E.E. Casagrande, 'International Law and the Law of Armed Conflict', in Mark Lax (comp.) *Air Power Presentations 1995*, Air Power Studies Centre, RAAF Fairbairn, Canberra, 1995, p. 221.
- 2 Senator the Hon. Robert Hill, Media Release: Unmanned Aerial Vehicles to be deployed to Iraq, 176/2005, dated Thursday 3 November 2005.
- 3 I. Bostock, 'Australian drones rushed into service', *Jane's Defence Weekly*, 30 July 2003; and (author unknown) 'UAV deployment for Solomon's force', *Defence Information Bulletin*, July 2003, p. 11.
- 4 This article will use the term 'uninhabited' as opposed to 'unmanned' because there is still a degree of 'human in the loop' controlling the functions of a UCAV. UCAVs are not autonomous entities able to function without input from an operator in, for example, target identification, location and flight path, actual loading and arming of weapons, etc. Therefore, even though the operator is removed from the cockpit, there is still a human element in the mission. See M. Lax and B. Sutherland, *An Extended Role for Unmanned Aerial Vehicles in the Royal Australian Air Force*, Air Power Studies Centre Working Paper No. 46, Canberra, 1999, p. 4, accessed 1 June 2003 at <http://www.defence.gov.au/apsc/publish/paper46.htm>. ADFP 101—the *ADF Glossary*—defines unmanned aerial vehicles as: 'powered aerial vehicles that do not carry a human operator, use aerodynamic forces to provide lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and carry lethal or non-lethal payloads.'
- 5 R. E. Chapman, 'Unmanned Combat Aerial Vehicle: Dawn of a New Age', *Aerospace Power Journal*, Summer, 2002, p. 60.
- 6 For example, the British Army Phoenix battlefield surveillance and target acquisition drone used by the Royal Artillery near the city of Basra. See C. Hoyle, 'Iraqis capture Phoenix drone', in *Jane's Defence Weekly*, 2 April 2003.
- 7 S. Metz, 'Strategists and the Revolution in Military Affairs' in *The Strategists*, H. Smith (ed.), Australian Defence Studies Centre, Canberra, 2002, p. 100.
- 8 C. Kopp, *The UCAV Ascendancy: What are the Problem Issues?*, UAV Australia Conference, 8–9 February 2001, Melbourne, Australia, E-mail: Carlo.Kopp@aus.net
- 9 B. Bender, 'Pilotless combat vehicles await legal green light', *Jane's Defence Weekly*, 20 September 2000, accessed 26 May 2003 at <http://defweb.cbr.defence.gov.au/jrl/~janes/jdw2000/jdw54484.htm>

- 10 There are a number of excellent papers that deal with the technical details of UCAVs and their operating parameters. See G. Hale, *ADF Employment of the Global Hawk Uninhabited Aerial Vehicle (UAV)*, Air Power Studies Centre Working Paper No. 76, Canberra, 1999; Lax and Sutherland, *An Extended Role for Unmanned Aerial Vehicles in the Royal Australian Air Force*; and P. Ashworth, *Unmanned Aerial Vehicles and the future Navy*, Royal Australian Navy Sea Power Centre, Working Paper No. 6, 2001.
- 11 See Australian Defence Force Publication 37 *Law of Armed Conflict* and DI(G) OPS 33-1 'ADF IHL Training', copy on file with the Australian Red Cross – Victoria Chapter at: http://www.redcross.org.au/vic/vic_services_ihl_home.htm
- 12 Protocol Additional to the Geneva Conventions of 12 August 1949 relating to the Protection of Victims on International Armed Conflicts, 8 June 1977 (AP1).
- 13 Casagrande, 'International Law and the Law of Armed Conflict', p. 211. For example, Casagrande cites the example of the My Lai massacre by the US military in Vietnam in 1968 that both stunned the US nation and led to the loss of popular support for that conflict.
- 14 M. Cerasini, *The Future of War: The Face of 21st Century Warfare*, Alpha, Indianapolis, 2003, p. 123.
- 15 K. Munson, *Jane's Unmanned Aerial Vehicles and Targets*, Jane's Information Group, Surrey, UK, 23 October 2002, accessed 26 May 2003 at <http://defweb.cbr.defence.gov.au/disgjan/janes/juav20/juav1285.htm>; and Lax and Sutherland, *An Extended Role for Unmanned Aerial Vehicles in the Royal Australian Air Force*, p. 2, accessed 1 June 2003 at <http://www.defence.gov.au/apsc/publish/paper46.htm>
- 16 A. J. Lazarski, 'Legal Implications of the Uninhabited Combat Aerial Vehicle', *Aerospace Power Journal*, Summer, 2002, p. 75.
- 17 B. Sweetman, 'Endurance above all for UAVs', *Jane's International Defence Review*, 1 June 2003. This article is particularly interesting because it mentions the first UCAV (the Predator) versus manned fighter (MiG) air combat situation which occurred in Iraq in January 2003. The Predator was armed with Stinger (ATAS) air-to-air missile. The Predator lost the aerial duel.
- 18 J. Garamone, 'Unmanned aerial vehicles proving their worth over Afghanistan', *Army Communicator*, accessed 16 May 2003 at <http://www.gordon.army.mil/AC/sumr02/uav1.htm>
- 19 J. McIntyre, 'Predator hits Iraqi missile support van', CNN.com, accessed 12 August 2003 at <http://www2.cnn.com/2002/WORLD/meast/12/30/sproject.irq.predator.iraq/index.html>
- 20 Lax and Sutherland, *An Extended Role for Unmanned Aerial Vehicles in the Royal Australian Air Force*, p. 10.
- 21 C. Kopp, *The UCAV Ascendancy*.

- 22 R. E. Chapman, 'Unmanned Combat Aerial Vehicle: Dawn of a New Age', p. 61. For example, a Tomahawk Cruise Missile with a 1000lb warhead costs US\$600 000 per unit. A conventional air-launched cruise missile with a 2000lb warhead costs US\$1.16 million per unit.
- 23 Ibid., pp. 61–2.
- 24 Royal Australian Air Force, *Operations Law for RAAF Commanders AAP 1003*, 2nd edn, Air Power Development Centre, Canberra, 2004, at <http://www.raaf.gov.au/airpower/publications/doctrine/aap1003/highres/intro.pdf>
- 25 International Committee of the Red Cross, *New Weapons*, Advisory Service on International Humanitarian Law, 2001, accessed at 26 May 2003 at <http://www.icrc.org>
- 26 E. E. Casagrande, *Air Bombardment and the Law of Armed Conflict*, Air Power Studies Centre Working Paper No. 10, 1993.
- 27 R. A. Ramey, 'Armed Conflict on the Final Frontier: The Law of War in Space', *The Air Force Law Review*, vol. 48, 2000, p. 1.
- 28 I. Daoust, R. Coupland and R. Ishoey, 'New wars, new weapons? The obligation of States to assess the legality of means and methods of warfare', *International Review of the Red Cross*, vol. 84, no. 846, June 2002, p. 348.
- 29 DI(G) OPS 44-1, *Legal review of new weapons*.
- 30 *Legality of the threat or use of nuclear weapons*, Advisory Opinion of 8 July 1996, International Court of Justice Reports, 1996, para 78.
- 31 Daoust, Coupland, and Ishoey, 'New wars, new weapons?', p. 350.
- 32 Ibid., p. 360. The author understands that DL is in the process of formulating a Defence Instruction outlining the review of legality, amongst other things, of new weapons as per Art 36 API. This would be akin to the US Department of the Army 1979, *Review of Legality of Weapons under International Law*, Army Regulation 27–53; and the USAF (MAJGEN N. Sklute JAG) 1994, *Weapons Review*, Air Force Instruction 51–402, 13 May 1994.
- 33 J. Scott, 'Vehicle Design Question', 2002, Aerospace.Org, accessed 16 May 2003 at <http://www.aerospaceweb.org/question/design/q0081.shtml>
- 34 Bender, 'Pilotless combat vehicles await legal green light'.
- 35 Ibid.
- 36 Kopp, *The UCAV Ascendancy*.
- 37 A. Chuter, 'U.K. Strike Chief Notes UAV's Shortcoming', *Defence News*, 4 August 2003, p. 8.
- 38 Ibid.
- 39 M. E. Guillory, 'Civilianising the Force: Is the United States Crossing the Rubicon?', *Air Force Law Review*, vol. 51, 2001, p. 112.
- 40 Ibid., p. 111.
- 41 M. Minenko, 'Contractors on the Battlefield: Legal Aspects', Presentation to the Asia Pacific Centre for Military Law, August 2003, University of Melbourne.

- 42 L. L Turner and L. G. Norton, 'Civilians at the tip of the Spear', *Air Force Law Review*, vol. 51, 2001, p. 1.
- 43 D. Wood, 'The Bastards: Some of the Army's Civilian Contractors are no-shows in Iraq', Newhouse News Service, accessed 19 August 2003 at <http://www.sfft.org>.
- 44 For an interesting discussion of this issue see D. Shearer, *Private Armies and Military Intervention*, Adelphi Paper 316, Oxford University Press, 1998.
- 45 DI(OPS) 05-3 *Civilians in support of Australian Defence Force operations*.
- 46 Turner and Norton, 'Civilians at the tip of the Spear', p. 27.
- 47 *Australian Books of Reference* 5150 (Royal Australian Navy), 'Unmanned Aerial Vehicles', Chapter 19, para 19.5.
- 48 Lazarski, 'Legal Implications of the Uninhabited Combat Aerial Vehicle', p. 81.
- 49 C.N. Ghosh, 'Application of Unmanned Combat Aerial Vehicles in Future Battles of the Subcontinent', 2001, accessed 1 May 2003 at <http://www.idsa-india.org/an-jly-9.01.htm>
- 50 J. Mustin, 'Future Employment of Unmanned Aerial Vehicles', *Aerospace Power Journal*, Summer, 2002, p. 81.
- 51 Chuter, 'U.K. Strike Chief Notes UAV's Shortcoming', p. 8.

THE AUTHORS

Hyder Gulam is a Royal Australian Air Force Legal Officer based at RAAF Base Darwin. He is also a qualified Registered Nurse as well as an accredited mediator. Hyder speaks a number of languages including Arabic, Malaysian, Hindi/Urdu and Japanese. His legal interests include Islamic law, animal law and human rights.

Simon Lee is a barrister and solicitor. Simon served as an Army Legal Officer between 2002 and 2004, having previously served as an officer cadet with the Melbourne University Regiment. Prior to joining the Australian Army, Simon worked as an upstream oil and gas analyst in Tokyo for the Mitsubishi Corporation, as a Japanese Government Trader for Nomura International in London, and as a prosecutor with the Northern Territory Directorate of Public Prosecutions. Simon is currently a barrister and Australian Army Reserve Legal Officer. He is fluent in French, Russian and Japanese.
