

Fifth Review Conference of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects

10 June 2016

Original: English

Geneva, 12–16 December 2016

Item 13 of the provisional agenda

Consideration of proposals for additional protocols to the Convention and other proposals

Report of the 2016 Informal Meeting of Experts on Lethal Autonomous Weapons Systems (LAWS)

Submitted by the Chairperson of the Informal Meeting of Experts

1. The 2015 Meeting of the High Contracting Parties to the Convention held on 12 and 13 November 2015 in Geneva decided, as contained in paragraph 35 of its final report (CCW/MSP/2015/9), "to convene an informal meeting of experts of up to five days during the week of 11 to 15 April 2016 to discuss further the questions related to emerging technologies in the area of lethal autonomous weapons systems (LAWS), in the context of the objectives and purposes of the Convention. The Chairperson of the meeting of experts will submit a report in his personal capacity to the 2016 Fifth Review Conference of the High Contracting Parties to the Convention. The meeting of experts may agree by consensus on recommendations for further work for consideration by the 2016 Fifth Review Conference." The Meeting further decided, in paragraph 36, that "following consultations conducted by the Chairperson, taking into account the principle of geographical rotation, the Meeting decided to designate Mr. Michael Biontino, Ambassador of Germany, as Chairperson of the 2016 Meeting of Experts on LAWS and adopted the estimated costs (CCW/MSP/2015/7)".

2. The following High Contracting Parties to the Convention participated in the work of the meeting: Albania, Algeria, Argentina, Australia, Austria, Belarus, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Cameroon, Canada, Chile, China, Colombia, Croatia, Costa Rica, Cuba, Cyprus, Czech Republic, Djibouti, Dominican Republic, Ecuador, El Salvador, Estonia, Finland, France, Georgia, Germany, Greece, Holy See, Honduras, Hungary, India, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kuwait, Lao People's Democratic Republic, Latvia, Lithuania, Mexico, Mongolia, Morocco, Netherlands, New Zealand, Nicaragua, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Qatar, Republic of Korea, Romania, Russian Federation, Saudi Arabia, Serbia, Sierra Leone, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, State of Palestine, Sweden, Switzerland, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Venezuela (Bolivarian Republic of) and Zambia.

GE.16-09565(E)



* 1 6 0 9 5 6 5 *

Please recycle



3. The following Signatory State to the Convention participated in the work of the meeting: Egypt.
4. The following States not party to the Convention participated as observers: Bhutan, Ghana, Indonesia, Iran (Islamic Republic of), Lebanon, Malaysia, Myanmar, Oman, Singapore, Yemen and Zimbabwe.
5. The representatives of the United Nations Institute for Disarmament Research (UNIDIR), United Nations Interregional Crime and Justice Research Institute (UNICRI), United Nations Office for Disarmament Affairs (UNODA), European Union, International Committee of the Red Cross (ICRC), International Federation of Red Cross and Red Crescent Societies (IFRC) and Geneva International Centre for Humanitarian Demining (GICHD) participated in the work of the meeting.
6. The representatives of the following non-governmental organizations participated in the work of the meeting: Campaign to Stop Killer Robots [Amnesty International, Article 36, Association for Aid and Relief, Japan, Facing Finance, Human Rights Watch, International Committee for Robot Arms Control (ICRAC), Mines Action Canada, Nobel Women's Initiative, Nonviolence International, Norges Fredslag (Norwegian Peace Association), PAX, Pax Christi Ireland, Project Ploughshares (Canada), Pugwash Conferences on Science and World Affairs, Seguridad Humana en Latino América y el Caribe (SEHLAC), Women's International League for Peace and Freedom], Centre for a New American Security, Human Rights Now, Human Rights Watch, and International Campaign to Ban Landmines – Cluster Munition Coalition (ICBL–CMC).
7. The representatives of the following entities also participated in the work of the meeting: Ben Gurion University, Cambridge University, Carnegie Mellon University, Geneva Academy, General Atomics Aeronautical Systems, German Institute for International Security Affairs (SWP), Harvard Law School, Harvard Sussex Programme – University of Sussex, Hiroshima Peace Institute, Institute for Peace Research and Security Policy at the University of Hamburg (IFSH), International Institute for Strategic Studies (IISS), International Law and Policy Institute (ILPI), King's College London, Lancaster University, Leiden University, Mercator Kolleg für Internationale Aufgaben, Nanyang Technological University, National Center for Scientific Research (CNRS), National University of Ireland, Netherlands Organisation for Applied Scientific Research (TNO), Radzyner Law School, PIR Center for Policy Studies, SMU Dedman School of Law, Stockholm International Peace Research Institute (SIPRI), Universidad de los Andes, University College London (UCL), University of Barcelona, University of Glasgow, University of Minnesota, University of New South Wales, University of Oxford, University of Tampere, VU University Amsterdam and Yale University.
8. On Monday, 11 April 2016, the meeting was opened by Ms. Tehmina Janjua, Ambassador of Pakistan, as President-designate of the 2016 Fifth Review Conference of the High Contracting Parties to the Convention. Ambassador Biontino was confirmed as the Chairperson of the meeting by acclamation.
9. In accordance with its programme of work, the meeting of experts had interactive exchanges on the following issues: mapping autonomy, towards a working definition of LAWS, challenges to international humanitarian law, human rights and ethical issues, and security issues. The meeting commenced with a general debate.
10. Serving as Friends of the Chair were Ms. Alice Guitton, Ambassador of France, on mapping autonomy; Mr. Kim Inchul, Ambassador of the Republic of Korea, and Ms. Beatriz Londono Soto, Ambassador of Colombia, on towards a working definition of LAWS; Mr. Urs Schmid, Ambassador of Switzerland, and Ms. Päivi Kairamo, Ambassador of Finland, on challenges to international humanitarian law; Ms. Marta Maurás, Ambassador of Chile, on human rights and ethical issues; Ms. Yvette Stevens, Ambassador

of Sierra Leone, and Mr. Ravinatha Aryasinha, on security issues. The Chairperson presided over the general debate and concluding discussions.

General debate

11. In accordance with the mandate of the meeting, the following paragraphs are presented by the Chairperson in his personal capacity.

12. During the general debate, a large number of delegations underlined the importance of addressing the issue of lethal autonomous weapon systems (LAWS). The involvement of civil society and non-governmental organizations and their substantive contributions were welcomed.

13. There was a general understanding that fully autonomous weapons systems do not yet exist and there were diverging views as to whether these weapons might be developed in the near or long-term future, or not at all. A number of delegations stressed that they had no intention of developing such systems.

14. A large number of delegations emphasized the need for a better understanding of LAWS. In this regard, delegations stressed the need for a working definition at this stage, while others noted that this endeavour is problematic given that LAWS do not yet exist. In addition, some delegations indicated the need for further discussion on possible elements of a definition.

15. A number of delegations proposed considering LAWS in relation to human involvement. For example, the concept of "meaningful human control" was proposed by some delegations as a framework to assess the legal, moral and ethical aspects of LAWS. Although there was broad interest in this concept, it was noted that there would be difficulties in identifying its scope. Others suggested that "meaningful human control" should be considered at different stages of the use of LAWS, such as in weapon selection, deployment, target selection and attack. However, some criticised the subjective nature of "meaningful human control" and expressed a preference for "appropriate human judgement" instead.

16. There was general consensus on the importance of the application of international law, in particular international humanitarian law (IHL) and international human rights law. Concerning the application of IHL, there were calls for strict compliance with its fundamental principles of distinction, proportionality and precautions in attack. While some delegations stated that the current IHL rules are sufficient to regulate the use of any type of weapon, including LAWS, other delegations questioned whether this would be the case. A number of delegations emphasized the importance of legal weapons review processes to ensure compliance with IHL. In response, some delegations argued that existing legal weapons reviews are incapable of addressing the potential challenges posed by LAWS.

17. The issue of responsibility and accountability with respect to LAWS was raised by a number of delegations. There was a widely shared understanding that the responsibility for the development, production and deployment of LAWS rests with the operating State. Some delegations noted that individuals could be held responsible under the relevant bodies of international law. The importance of ensuring an unequivocal accountability chain in the deployment of a weapon system was underlined.

18. Tasking machines to make decisions on the life and death of a human being without any human intervention was considered by many delegations to be ethically unacceptable. Several delegations made the point that they had no intention of developing or acquiring weapon systems of this nature.

19. Many delegations pointed towards the potential challenges and threats arising from the development and use of LAWS. These included the risk of proliferation, including LAWS being obtained by non-state actors; possibility of an arms race; lowering the threshold for the use of force; and exacerbation of global and regional instability. It was argued that the military utility of LAWS might not be the same in symmetric conflicts as compared to asymmetric conflicts. The gap between technologically advanced States with the ability to develop, procure and deploy LAWS and States without these capabilities could amplify the asymmetric character of armed conflicts in the future.

20. In terms of the way ahead on LAWS, a number of delegations called for the development of transparency and confidence-building measures and stressed the importance of information sharing, particularly in the area of legal weapons reviews. On this last point, there were calls for the establishment of best practices and benchmarks.

21. A number of delegations proposed a preventive approach, calling for a prohibition on the development, acquisition, trade, deployment and use of LAWS. Some called for a moratorium until a regulatory framework was established.

22. The dual-use character of autonomously operating technology and their benefits for civilian applications was raised by a number of delegations. There was a widely shared view that legitimate developments in the civilian sphere should not be hampered by regulatory measures taken with regard to LAWS. In this context, Protocol IV of the CCW was cited as an example of banning a future weapon category without curtailing research and development in the civilian sphere.

23. The CCW was widely affirmed as the appropriate forum for the discussion of LAWS. Many delegations emphasized its inclusiveness and its proven ability to strike the right balance between humanitarian and security concerns. Some delegations noted that the CCW's work does not preclude discussions in other relevant *fora*.

24. The goal of adopting consensus recommendations to the Fifth Review Conference was widely welcomed and seen as a positive way of achieving further progress on LAWS. Many delegations stressed the need for substantive recommendations, including reaffirming the principles of international law and IHL. A large number of delegations supported the establishment of an open-ended group of governmental experts (GGE). However, there was a proposal to continue the discussions in an informal format. Proposals for the group's mandate included, work on definitions, the consideration of instruments for transparency and confidence-building measures, and building on the legal principles and rules applicable to LAWS.

Session – "mapping autonomy"

25. The panel on "mapping autonomy" featured presentations by six experts. The session took stock of the current autonomous technologies and attempted to identify future trends. Mr. Vincent Boulanin, Stockholm International Peace Research Institute (SIPRI), described the development of autonomy in the military sphere, focusing on key trends and hurdles. Ms. Heather M. Roff, Senior Research Fellow at the Department of Politics and International Relations at the University of Oxford, and Research Scientist at the Global Security Initiative at Arizona State University, presented data on autonomy in existing weapon systems. Mr. Markus Höpflinger, Swiss Federal Department of Defence, Population Protection and Sports, presented issues related to mobile autonomous systems. Mr. Leon Kester, Netherlands Organisation for Applied Scientific Research presented insights on the ethics concerning the development and application of autonomy. Mr. David Hyunchul Shim, Intelligent Unmanned Aerial Vehicle National Defence Laboratory, Department of Aerospace Engineering at KAIST University of the Republic of Korea, presented issues related to autonomous vehicle systems in the civilian sphere. Mr. Didier

Danet, French Military Academy Saint Cyr Coëtquidan, highlighted progress and limitations of artificial intelligence.

26. The presentations addressed both civilian and military aspects as these technologies are of a dual-use nature. They also addressed different types of systems being developed in the context of land, sea and air operations.

27. There was agreement amongst the panellists that although the latest developments in terms of autonomous technologies are well known, there remain a number of unknowns with regard to what could be achieved in the future and the timescale involved. Even by charting the areas in which research and development are focused, it is difficult to predict what the results would be or when they might be achieved.

28. The presentations were based on the characteristics of a number of existing systems (missiles, drones, land vehicles, mine searches), which are used in certain operational contexts, but are categorized as being autonomous, in order to evaluate the progression of technology in this area. Some experts stressed that although some existing systems were automatic (e.g. automatic target recognition, although still limited), and researchers were working on refining this aspect, this does not make them autonomous. Clear distinctions were made between teleoperated, automated and autonomous systems. The experts underlined that all existing systems continue to rely on human supervision, particularly in view of their technical limitations. For this reason, work is needed on the human-machine interface. In terms of developing autonomous technology, the experts drew attention to the following challenges: the reliability and comprehensiveness of communications with the human operator, the risks of interference and detectability, the delay in calculating algorithms in complex situations, the consideration of system or machine failures, and mobility in a complex environment unfamiliar to the system.

29. The main limitations encountered during research were highlighted, which were related both to the systems themselves (e.g. their inability to handle an unexpected situation, their weaknesses with regard to situational awareness and assessment, the need for faster processors able to deal quickly with complex algorithms), as well as to military culture (reluctance to lose control of a deployed system, lack of confidence in the capabilities of technologically complex systems). There were also limitations with respect to the process of acquisition and authorization of such systems.

30. To assess what could reasonably be expected in the future, several experts put forward the idea of plotting a trajectory of autonomy or trends to chart the course of technological progress. Several presentations focused on possible methods for charting the progress of autonomy and various potential approaches: either according to functions, or according to system capabilities (such as mobility, target identification, target prioritisation, communication, training, formalisation of primary and secondary goals, etc.).

31. The experts identified a number of areas in which research and development is currently taking place: mobility, cooperation between a large number of players (ability of systems to cooperate and interact with one another) and situational awareness (ability of the system to collect and analyse data on which to base a decision). Mobility was regarded as the area in which the fastest progress had been made, particularly in the air (navigational autonomy). Given the complexity of the environments under consideration, research in other areas is still in its infancy.

32. Some experts regarded a purely technical approach to understanding autonomy as insufficient and that additional factors needed to be taken into account. The majority of the experts referred to research, which is still in the early stages, on the concepts of machine learning, self-learning (online or offline), self-determination, self-assessment and artificial intelligence to underscore the complexity of potential LAWS. Some experts also stressed the idea that future systems could have self-training capacities, which might render pre-

programming obsolete. Scepticism was expressed at the idea that completely autonomous systems could one day become a reality and at the possibility of linear development in the area of robotics.

33. In the subsequent discussions, delegations sought to clarify the terminology used by experts in their presentations, such as autonomy and critical functions. Although autonomy was considered a central characteristic of LAWS, it appeared to be difficult to understand this concept in absolute terms. It was therefore suggested that a focus on the functions of a system would provide a better understanding of autonomy in weapon systems. Another intervention proposed to simplify the concepts being discussed and instead to understand autonomy in weapon systems merely as a "lack of human control".

34. Further questions were related to the military necessity of LAWS. Difficulties arise due to the fact that "autonomy" is used to describe the desirable characteristics of a weapon system. For example, increased capacities in the field of target selection was mentioned, which offer advantages in terms of avoiding collateral damages. This last aspect is increasingly pursued by developers. At the same time, "autonomy" can refer to the lack of predictability of a system, which some claim is the reason why military commanders would be reluctant to use LAWS. Another view was that it would be preferable to understand the military utility of such systems in terms of their reliability or capacity, rather than their level of autonomy *per se*. Alternatively, it was proposed to consider autonomy as a necessary response to the increasing complexity of a weapon system and, a form of support to the human operator. Another issue raised related to the increasing speed of technological development and the concern that artificial intelligence would potentially override human decisions.

Session – "towards a working definition"

35. The first panel on "towards a working definition" focused on different ways to define LAWS by their technical features. Against this background, Ms. Gro Nystuen, Senior Partner and Director of the Centre on International Humanitarian Law at the International Law and Policy Institute (ILPI) in Oslo, spoke about the challenges of identifying and agreeing on a definition of a weapon system within a multilateral forum. Mr. Chris Jenks, Director of the Criminal Justice Clinic and Assistant Professor of Law at SMU Dedman School of Law in Dallas, presented the concept of "critical functions" of a weapon system as a way to provide more clarity on what is an autonomous weapon system. Professor Lucy Suchman, Chair in the Anthropology of Science and Technology at Lancaster University and President of the International Society for Social Studies of Science, spoke on "autonomy as self-directed action". Mr. Wendell Wallach, Yale Interdisciplinary Center for Bioethics, elaborated in his presentation on the concept of "predictability" and how this can assist our understanding of the potential challenges raised by autonomous weapons systems. The second panel focused on the exploration of alternative approaches that define an autonomous weapon in relation to the human operator and the level of control or influence that an operator has over a particular system. Ms. Anja Dahlmann, Research Assistant at Stiftung Wissenschaft und Politik (SWP), presented a multi-dimensional risk-assessment to classify the issue of human control in increasingly autonomous weapons systems. Mr. Richard Moyes, Managing Partner and Co-Founder of the non-governmental organisation - Article 36, spoke on the concept of "meaningful human control". Ms. Merel Ekelhoff, PhD Researcher at the Free University of Amsterdam, outlined the current targeting process, what checks and balances this process includes, and how these insights could shape the approach to LAWS. Mr. Dan Saxon, Professor of International Law at Leiden University College in The Hague, spoke on "human judgment" in the context of the design and use of LAWS.

36. There was a widely shared view that a working definition or conceptual understanding of the characteristics of LAWS is necessary to frame and progress the discussions. Some delegations pointed to the general difficulty or even impossibility to define what are LAWS as they argued that these systems do not yet exist and that technology is continuing to evolve. Others noted that a working definition may overcome the challenge of discussing this issue in the abstract. Many delegations stressed that a widely accepted definition of LAWS was not a necessary prerequisite for proceeding with substantial work and it was noted that it would be unusual to agree on a definition at this stage.

37. A number of delegations highlighted that a working definition would need to be sufficiently broad to encompass future developments in technology. Some delegations expressed the view that semi-autonomous weapons systems and existing systems should also be considered. Further points made were that the question of definition is a political one, and that this should not be used as a tool to prejudge the outcomes or seek to draw the line between acceptable and unacceptable systems. In this context, a CCW specific definition was proposed that would take into account of the Convention's objectives.

38. Different proposals were put forward for working definitions. A central element of the discussion was the relationship between the human operator and the machine regarding the level of human involvement in the use of force. A number of delegations proposed that human control must be maintained over weapon systems, regardless of whether this should be considered as appropriate, meaningful or effective. "meaningful human control" was proposed as a framework to help advance an understanding around a threshold delineating acceptable or necessary levels of human control from those that are insufficient. Others were sceptical towards this approach as they argued it was too subjective and difficult to identify. An alternative suggestion was the "appropriate level of human judgment" required to ensure that a weapon functions as expected.

39. Some delegations preferred to focus on particular characteristics of LAWS, such as the element of "autonomy". It was proposed to consider systems as autonomous when they operate without human supervision from the moment of their activation. There were differing views as to whether autonomy should be considered as a continuum or to distinguish autonomous weapons systems from "automated" or "fully autonomous" systems. There were questions as to whether full autonomy was even possible and some questioned the usefulness of this term to move discussions forward. A number of delegations supported focusing exclusively on autonomy in the "critical functions" of a weapon system, such as the selection and engagement of a target. It was noted that autonomy in other functions would be beyond the CCW's mandate.

40. The issue of the predictability of autonomous weapons systems was another important aspect of the debate. It was often framed by the notions of risk, reliability and possible differences between human fallibility and malfunctions of machines. Several delegations expressed concern at the prospect of weapons systems that could act unpredictably. It was argued that the control over a system by a military commander is a core capability for the military and determines the value of such systems. A further point was that the possibility of autonomous "swarms" would mean that such systems would be inherently unpredictable.

41. The question was raised as to whether the attribute of lethality was required and that instead it would be more constructive to focus on the use of force. There was a proposal to understand LAWS more inclusively, covering also means and methods of warfare that do not necessarily inflict death. Others argued that only the lethal use of weapons is relevant in regard to IHL.

42. While several delegations welcomed the progress made on the conceptual understanding of LAWS, there was a widespread agreement that further work was needed on this issue. In this regard, it was reiterated by many that a GGE, established by the Fifth Review Conference, would be the appropriate body to address a possible working definition.

Session – challenges to international humanitarian law

43. The two sessions on IHL focused on the importance of legal weapons reviews and considered the question of accountability with regard to LAWS. Mr. Gilles Giacca, Legal Advisor for the International Committee of the Red Cross, provided an overview of the legal requirements of a weapons review process. Mr. Christopher Ford, Lieutenant Colonel, Professor at the Stockton Center for the Study of International Law at the United States Naval War College, focused on the rules of distinction and proportionality. Ms. Kimberley Trapp, Senior Lecturer in Public International Law at the University College London, focused on the principle of precaution. Ms. Neha Jain, Associate Professor of Law at the University of Minnesota in the United States of America, spoke about how differing degrees of autonomy may affect human-machine interaction, and potentially the political and legal responsibility for actions of autonomous systems. Mr. Robin Geiss, Professor of International Law and Security at the University of Glasgow, spoke on the possible risks raised by LAWS in the context of international law and focused on the notion of due diligence. Ms. Cecilie Hellestveit, Senior Legal Advisor at the ILPI in Oslo, elaborated on accountability under IHL and specifically addressed challenges that may arise with regard to the principles of distinction and the prohibition of unnecessary suffering and superfluous injury. Ms. Roberta Arnold, former legal adviser on the Laws of Armed Conflict, Swiss Federal Attorney General's Office, presented on how national and international criminal law would address violations of IHL by autonomous weapons. Mr. Martin Hagström, Deputy Research Director at the Swedish Defence Research Agency (FOI), spoke on the technical issues related to the transparency of an autonomous weapon system.

44. It was of common understanding that, as with all weapon systems, the rules of IHL are fully applicable to LAWS. However, many delegations questioned whether weapons systems that select and attack targets autonomously would be able to comply with these rules.

45. A number of delegations argued that human judgment was necessary in order to assess the fundamental principles of proportionality, distinction and precautions in attack. For this reason, it was recognized that a human operator should always be involved in the application of force. Many delegations questioned if it would be possible to programme a legal assessment into a machine prior to its deployment. Given the rapidly changing circumstances in a conflict, it would be difficult to conceive of a LAWS distinguishing between lawful and unlawful targets. For example, it was unclear as to how LAWS could be programmed to recognize the surrender of a combatant or take feasible precautions in attack. Additionally, it was noted that a potential target may alter its behaviour in order to deliberately confuse assessments made by a machine.

46. Some delegations framed their concerns in terms of predictability and risk. For example, in complex environments it might be impossible to predict or rely on the action of a machine without some form of human oversight. However, others noted that this unpredictability was also present in human behaviour. This raised the question as to whether the associated risk of unpredictability could be comparable between human and machine judgement. Most delegations maintained that machines are simply incapable of executing legal judgements as required by IHL, especially in complex and cluttered environments typical in conflict scenarios.

47. Several delegations stated that the current rules of IHL are adequate and capable of addressing all issues arising from LAWS and saw no need for further regulatory measures, but a number of delegations disputed as to whether this would be the case. Another view was that even if LAWS could be used in compliance with IHL, there would remain an ethical dilemma over delegating decisions on human life to machines. It was noted that considering LAWS only through an IHL framework would not address the wider consequences of using these systems, for example, the risk of escalation when such systems are used by more than one party to an armed conflict.

48. Legal weapons reviews were highlighted as a central tool to ensure that new weapon systems can be used in conformity with IHL. The debate was enriched by the contributions of several States that presented their national procedures for legal weapons review processes. From the presentations, reviews are commonly conducted by members of the respective ministries of defence and foreign affairs as well as members of the armed forces. Some delegations noted that there was the possibility of an independent review process. Most of the presented processes favoured a multi-disciplinary assessment, relying on experts with legal, military, political, technological or medical backgrounds. Whilst some review processes are directly conducted by a multi-disciplinary team, other processes rely on expertise by way of consultation where necessary. It was apparent that the outcomes of most review procedures have advisory status, although some are directly linked to procurement decisions. The findings of weapon reviews may result in modification of system requirements, the formulation of operational directives that prescribe or restrict how a weapon system would be used, or the introduction of training and education processes.

49. Review processes cover methods and means of warfare. Weapons that are assessed in a legal review processes were generally described as systems that had not been previously deployed or having been substantially modified. A number of legal weapons review procedures were centred around whether a weapon would be inherently indiscriminate, or would cause superfluous injury or unnecessary suffering, or as to whether it falls within a category of weapons that have been specifically prohibited or otherwise restricted by international law. In most cases, reviews were conducted at an early stage of the development or acquisition process.

50. The view was expressed by some delegations that weapon review processes are insufficient to address LAWS. Several delegations noted that despite being an obligation under customary IHL, such reviews are implemented by relatively few States and little information was available on these processes. There was also concern that some States might consider these essentially national review processes as a means to legitimize their weapons, rather than to filter unlawful systems. In this context, it was asserted by some delegations that there was limited value to such national processes in the absence of common standards at the international level. Furthermore, the point was made that the discussions on LAWS should not be about weapons review processes *per se*.

51. Several delegations pointed to the possibility of developing a guide on legal weapons reviews that would clarify the legal landscape. This could include, for example, compiling a list of best practices. These would be helpful to establish consistent, transparent and comprehensive standards and thereby strengthen the confidence of all CCW delegations in these processes. Many delegations welcomed the possibility for further information on national review processes being made available by States as an important step to increase transparency and confidence building in this area.

52. Accountability was highlighted as a central element of IHL. Doubts were raised over whether the required standards of accountability and responsibility for the use of force and its effects could be upheld with the deployment of LAWS. In the case of an incident involving LAWS, it was uncertain as to who would be held accountable within the chain of command or responsibility, such as the commander, programmer, or operator. As a result, it

was argued by some that legal grey zones could emerge, which in turn might be deliberately exploited and foster impunity. Others noted that this would not be the case, but that evidentiary issues may arise. It was proposed that there should be a requirement for LAWS to keep records of their operations. Other delegations responded that, if LAWS can be used in compliance with IHL, there would not be an accountability gap as any issues could be addressed under international criminal law and the law of State responsibility.

Session – human rights and ethical issues

53. This session considered the human rights and ethical concerns potentially raised by LAWS. Mr. Christof Heyns, Professor, United Nations Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, addressed the question of whether life and death decisions should be delegated to machines. Mr. Eliav Lieblich, Assistant Professor at the Interdisciplinary Centre at Radzyner Law School in Herzliya, Israel, presented a case study on the matter of discretion in international law and how this relates to LAWS. Ms. Danièle Bourcier, Head of Research at the Centre for Studies in Administration and Political Science Research in France, illustrated how legal judgements could be integrated into a machine. Mr. Pablo Kalmanovitz, Associate Professor of Political Science at the Universidad de los Andes in Bogotá, Colombia, addressed how the development of autonomous weapons could foster the dynamics of asymmetrical warfare.

54. The applicable international human rights law to situations of armed conflict alongside IHL were highlighted and discussions of these issues were welcomed by many delegations. There was an understanding that the use of force must be carried out in accordance with what the international community deems to be ethically acceptable. It was also understood that these particular aspects of the discussion on LAWS within the CCW, does not preclude consideration in other *fora*, such as the Human Rights Council.

55. Concerns were raised by a number of delegations that the use of LAWS might severely impact human rights, in particular human dignity, the right to life, the right to physical integrity, the right to a fair trial and due process, and the right to peaceful assembly. Several delegations highlighted that the lawful use of force under international human rights law is limited to strict conditions, for example, to defend an imminent threat to life.

56. Ethical concerns took a prominent place in the debate and there was a common understanding that whether or not LAWS are morally acceptable is a critical question to be addressed. It emerged as an area of common understanding that delegating the decision over life and death of a human being to a machine would be unacceptable. It was noted, for example, that machines cannot die and should therefore not decide over the life and death of humans.

57. A number of delegations highlighted the need to consider the potential benefits of autonomous systems and other emerging technologies, such as the potential use of autonomous technologies in hazardous environments and for search and rescue operations. It was further noted that compliance with IHL might be enhanced through the use of LAWS. For example, when assisting a human operator to filter large amounts of data, LAWS could improve human sensor capabilities and increase precision in the delivery of force.

58. Many delegations emphasized that ethical discussions might assist in determining a minimum threshold of human involvement. In this context, the concept of "meaningful human control" was suggested by several delegations as an appropriate framework to develop such an ethical standard. In light of the fact that many delegations felt it premature to commit to regulating LAWS at the international level, others proposed to place a

moratorium on the development and use of LAWS until a regulatory framework on LAWS was established.

59. Another issue was the relationship between law and ethics. It was suggested that distinguishing between moral values and legal requirements was important in order to avoid unnecessary confusion. Others recognized that both concerns cannot be fully separated and noted that ethical questions are unavoidable in situations where the law itself is not entirely clear. Further, it was argued that ethical considerations are necessary to give meaning to the open-ended principles contained in many rules and ultimately aid in determining the normative core of the law. This was underlined with regard to the Marten's Clause, the principles of "humanity" and "dictates of the public conscience".

60. Different views were expressed as to the effectiveness of ethical and moral standards being programmed into a machine. Many delegations maintained that it was impossible to translate qualitative value judgements and proportionality assessments into software code, whereas other delegations did not rule out this possibility.

61. It was noted that it might be inappropriate to consider an autonomous system separately from the human agent who relies on it for his or her decision making. The notion of an "intelligent partnership" between a human and a machine was introduced to describe a scenario in which a human decision-making process would be enhanced by machine generated data. Another point made in this context suggested that the human could in fact become the "weak link" in the system, for example, when given too little time to override a proposed machine suggestion, or when beginning to "over-trust" the system. It was suggested that such a view might have a far-reaching impact on the notion of compliance

62. Several questions addressed the use of LAWS in less complex environments, such as in maritime or desert areas. The discussion as to whether the deployment of LAWS in such environments would be less problematic than other more cluttered scenarios noted that the absence of civilians would simplify the task of distinction, but also that other complex legal assessments remain.

63. An issue addressed by several delegations was the requirement for discretion in any decision taken in a situation of conflict and whether this could be exercised by LAWS. Some found it useful to consider modern warfare as a form of governance in which an executive exercises authoritative decisions over humans and takes into account relevant principles from administrative law. It was suggested that considering whether there is a qualitative difference between human and machine judgement might guide further thinking on the issue.

64. Several delegations expressed concern about the potential use of LAWS in law-enforcement, some expressing concern about the increasing militarization of respective agencies. It was argued that the use of non-lethal force should be addressed as these will be deployed in law enforcement operations. However, it was noted that such situations are beyond the mandate of the CCW.

Session – security issues

65. The session about security issues examined questions concerning possible regional and global destabilization against the background of the potential development of LAWS. Mr. Jayantha Dhanapala, President of the Nobel Peace Prize-winning Pugwash Conferences on Science and World Affairs and former United Nations Under-Secretary-General for Disarmament Affairs, illustrated how LAWS could destabilize international security. Mr. Vadim Kozyulin, Senior Research Fellow at the Centre for Policy Studies (PIR) in Moscow, spoke about the global and regional security implications of LAWS from a Russian perspective. Ms. Denise Garcia, Associate Professor in the Department of Political

Science and the International Affairs Program at Northeastern University in Boston, addressed how potential challenges posed by LAWS to international law could ultimately undermine peace and security. Mr. Eneken Tikk-Ringas, Senior Fellow for Cyber Security at the International Institute for Strategic Studies, presented on other emerging technologies such as cyber capacities and their correlation with LAWS. Mr. Jai Galliot, Research Fellow in Indo-Pacific Defence at the University of New South Wales in Sydney, spoke on the military value of employing autonomous systems. Ms. Katrine Nørgaard, Institute of Leadership and Organization, Royal Danish Defence College, elaborated on "Autonomous Weapons Systems and Risk Management in Hybrid Warfare. Mr. Collin Koh Swee Lean, Associate Research Fellow at Nanyang Technological University in Singapore, gave a presentation on the potential deployment of LAWS in the maritime domain. Mr. John Borrie, Chief of Research at UNIDIR, focused on the challenges for the security and safety related to unintentional risk and system accidents of LAWS.

66. Different risk scenarios associated with LAWS were discussed during the session. It was noted that some risks are related to the technology itself. There was general agreement that these technologies are likely to be characterized by high degrees of sophistication necessary to allow for autonomous operation in complex environments. For this reason, LAWS are likely to be complex in ways that are not necessarily visible to those operating or deploying such machines. This would create risks that are unforeseen by the human operator. Further, such risks might be exacerbated when different systems or programs are combined as well as by the speed at which systems or codes interact. These factors may hamper a commander or operator's ability to predict the actions of an autonomous weapon system. Additionally, this risk could be compounded by machine learning capabilities.

67. Due to the complex design of LAWS, several delegations noted that these systems would be inherently unpredictable and would not be able to comply with IHL. It was noted that the underlying computer programmes are kept secret in order to conceal their vulnerabilities to cyber-attacks. Therefore, the unpredictability of LAWS could be exacerbated in situations where multiple systems or swarms of systems interact.

68. The operational concept of swarming was addressed by several delegations. It was suggested that in future scenarios, it would be unlikely that offensive measures will consist of a singular system. Instead, swarms of such systems with complementary capabilities may carry out attacks. In these scenarios where swarms of LAWS act as force multipliers, it would be unclear how meaningful human control could be maintained over the use of force, especially as the available time frame for human intervention is likely to be restricted. This would be exacerbated where speed becomes a motivation to deploy such systems in the first place.

69. Several delegations commented on the specific risks posed by the availability or deployment of LAWS in maritime scenarios. It was stated that due to the immense economic importance of shipping lines, militaries attach great value to their ability to ensure safe passage, and the most important platform performing this task remains the warship. The importance of warships and the need for split-second reactions would lead the operators of a warship, when confronted with a threat, to be more sensitive and to increasingly resort to pre-emptive action. These scenarios might lead to situations of accelerated, or even unintended, escalation. Further, it was noted that in complex combat scenarios, highly specialized communication would be required in order to allow for a greater level of situational awareness. The question arose as to whether there is a possibility of making a distinction between legitimate defensive applications and offensive systems that should be subject to further regulation.

70. Several delegations emphasized the risk of an arms race fuelled by the emerging development and eventual procurement of LAWS. Given that these systems are associated with specific military advantages, regional instabilities might arise or exacerbate when

these trends shift sensitive power balances. Whilst these systems might be available to technologically advanced countries in an initial phase, it is likely that they will proliferate. An expert noted that terrorists are in fact actively seeking such systems. Illegal transfers might mean that LAWS would become available to non-state actors. It was noted there may be no incentive for such actors to abide by international norms and this may further increase global or regional instability.

71. Given the analogies to other revolutionary changes to warfare brought about by gun powder and nuclear weapons, the point was made that LAWS would have a major impact on the conduct of future armed conflicts. In light of the unpredictable and potentially harmful consequences of such developments, several delegations reiterated their call for a pre-emptive ban. It was also recognized, however, that some delegations are hesitant regarding possible regulation of such systems given the lack of certainty about the nature of LAWS and that they do not yet exist. In response, it was noted that the inexistence of LAWS in itself does not preclude the development of precautionary measures. Further, it was argued that if there are reasons to believe that these systems would be harmful, then preventative measures should be taken until further clarity can be reached regarding the security concerns.

72. It was also highlighted that due to the inherent dual-use character of many robotic technologies, many systems originally intended for civilian purposes could easily be modified to serve military functions. This would not only increase the risk of proliferation, but also create accountability problems.

Annex

Recommendations to the 2016 Review Conference

1. The 2016 Informal Meeting of Experts, in accordance with its mandate, discussed in detail questions related to emerging technologies in the area of lethal autonomous weapons systems (LAWS). The proceedings, building on the respective meetings of 2014 and 2015, covered specifically the areas of mapping autonomy; a working definition; international humanitarian law, including weapons reviews in the context of LAWS; human rights and ethical issues as well as security issues.

2. These discussions were conducted in a holistic manner centered on the principles and rules of applicable international law, in particular international humanitarian law. There was a general understanding that:

(a) a State will bear the legal and political responsibility and establish accountability for action by any weapon system used by the state's forces in accordance with applicable international law, in particular international humanitarian law;

(b) views on appropriate human involvement with regard to lethal force and the issue of delegation of its use are of critical importance to the further consideration of LAWS amongst the High Contracting Parties and should be the subject of further consideration;

(c) civil society organizations, industry, researchers and scientific organizations should continue to play an important role in exploring the prospective issue in accordance with the established procedural rules of the CCW;

(d) the discussion on emerging technologies in the area of LAWS is one of the priorities for the CCW and should be continued, while not prejudging discussions in other relevant *fora*.

3. The Informal Meeting of Experts recommends that the 2016 Fifth Review Conference of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons may decide to establish an open-ended Group of Governmental Experts (GGE) in accordance with established practice. The GGE should meet for an appropriate period of time starting in 2017¹ to explore and agree on possible recommendations on options related to emerging technologies in the area of LAWS, in the context of the objectives and purposes of the Convention, taking into account all proposals – past, present and future. The GGE should concentrate on technical and expert work in its first part and report on its progress to the 2017 Meeting of High Contracting Parties. The GGE shall conduct its work and adopt its report by consensus which shall be submitted to the Meeting of the High Contracting Parties. The rules of procedure of the Review Conference shall apply *mutatis mutandis* to the GGE. The widest possible participation of all High Contracting parties is to be promoted in accordance with the goals of the CCW Sponsorship Programme.

4. The GGE in establishing its programme of work, taking into account different perspectives in the context of LAWS and recognising the potential development and deployment of these systems should consider, inter alia, the following questions:

¹ This meeting recommends the Fifth Review Conference to take a decision on the specific timeframe of the meetings of the GGE after due consultations.

- identification of characteristics and elaboration of a working definition of LAWS;
- application of, and compliance with, the relevant legal principles and rules of international law, in particular international humanitarian law, in the context of LAWS.

Further consideration should be given, inter alia, to the following questions:

- compliance with international human rights law, when applicable;
 - legal and political responsibility and accountability;
 - ethical and moral questions;
 - effects on regional and global security and stability;
 - effects on the threshold for armed conflicts;
 - risk of an arms race;
 - military value and risks;
 - proliferation risks, including to and by non-state actors;
 - risks posed by cyber operations in relation to LAWS.
-