Conclusions and Recommendations

1. Guiding Principles

It was affirmed that the following general principles as well as international law, in particular international humanitarian law but also international human rights law and the UN Charter, should guide the continued work of the Group, and these principles may be updated as work continues:

1. International humanitarian law continues to apply fully to the use of all-weapons systems, including any lethal autonomous weapons systems in armed conflict.

2. Human agency-responsibility for decisions on the use of lethal foree weapons systems should must be retained since accountability cannot be transferred to a non-human agentmachine-computer-program-or other autonomous system. In a human-centric approach, there may be no single touch point or notion, for instance ‘human in the loop’, that can fully describe the role of humans throughout the cycle of design, development, testing, and deployment and use-cycle of lethal autonomous weapons systems. Instead a cumulative effect must be sought through a number of touch points without diluting human responsibility.

3. Accountability for developing, deploying and using any lethal autonomous weapons system must be ensured in accordance with applicable international law, including through the operation subordination of such systems within a responsible the chain of human command and control.

4. In accordance with States’s obligations under international law, in the study, development, acquisition, or adoption of a new weapon, means or method of warfare, and as applicable, determination must be made whether its employment would, in some or all circumstances, be prohibited by international law.

5. When developing or acquiring new weapons systems based on intelligent autonomous systems and other systems in the area of lethal autonomous weapons systems, physical security, appropriate non-physical safeguards, safety (including cyber security against hacking or data-spoofing), the risk of acquisition of terrorist groups, security, the risk of proliferation, auditability, explainability, and the complexity of human-machine interfaces should be considered.

6. To mitigate risks and unintended consequences, risk assessments and mitigation measures should be part of the design, development, testing and deployment cycle of emerging technologies in the area of lethal autonomous weapons systems and rigorous testing must be carried out under realistic conditions.

7. Consideration should also be given to positive benefits of the use of emerging technologies in the area of intelligent lethal autonomous weapons systems to promote and uphold compliance with IHL principles and other applicable international legal obligations. Autonomy being seen in this regard as a way of extending human control beyond the time a munition is deployed.

8. Experience-sharing in national policies and practices that guide the development, testing and deployment of emerging technologies in the area of intelligent lethal autonomous weapons systems should be fostered to the extent permitted by without prejudice to national security considerations or commercial restrictions on commercial-proprietory information.

9. In crafting potential policy measures, emerging technologies in the area of intelligent lethal autonomous weapons systems should neither be anthropomorphized nor seen as stand-alone physical objects.

10. Discussions and any potential policy measures taken within the context of the CCW should not hamper progress in or access to beneficial peaceful uses of intelligent autonomous technologies.

10-11. CCW offers the appropriate framework for dealing with this issue of emerging technologies in the area of lethal autonomous weapons systems without prejudice to work in other forums and within the context of the objectives and purposes of the Convention.
II. Characterization of the systems under consideration in order to promote a common understanding on concepts and characteristics relevant to the objectives and purposes of the Convention

Having examined different conceptual approaches to characterization and considered sets of specific characteristics relevant to the objectives and purposes of the Convention, and without prejudice to any future understanding on characterization, it was affirmed noted that

1. A definition of lethal autonomous weapons systems is essential to tackle the potential risks posed but the absence of an agreement on a definition should not prejudice the precondition for making progress within the CCW. Characterization, or working definitions, should neither predetermine nor prejudice policy choices; they should be distinctly understood by stakeholders.

2. There could be several four possible approaches to characterization, and the approaches discussed so far--separative, cumulative, accountability, and effect-based--may not be mutually exclusive and characterization could be combined to best fit the CCW context. Consideration must be given to exclusion of tele-operated or other forms of legacy automated systems.

3. Purely technical characteristics such as physical performance, endurance or sophistication in targeting acquisition and engagement would—may alone not be sufficient to characterize lethal autonomous weapons systems, especially in view of rapid evolution in technology and different characteristics could be combined to best fit the CCW context. Likewise, technical characteristics related to self-learning (without externally-fed training data) and self-evolution (without human design inputs) do not yet lend themselves to characterization given the lack of use-cases.

4. Technical characteristics related to self-learning (without externally-fed training data) and self-evolution (without human design inputs) may not yet lend themselves to characterization given the lack of use-cases. Similarly, attempting to define a general threshold level of autonomy based on technical criteria alone would pose difficulty as autonomy is a spectrum, and its understanding shifts changes with shifts in the technology frontier, and different functions of a weapon systems could have different degrees of autonomy. At the upper end of the spectrum, it is difficult to separate technically “fully” autonomous systems from autonomous systems while at the lower end consideration must be given to exclusion of tele-operated or other forms of legacy automated systems.

5. The focus on lethality-lethality is a characteristic made explicit in the mandate of the GGE does not prejudice the application of and respect for all rules relevant to the conduct of hostilities. In this regard, consideration may be given to even though it is possible to separate the interface with non-lethal autonomous systems such as decision-support systems might need to be examined further. In this regard, a focus on lethality does not prejudice the triggering of IHL obligations with regard to the use of force with possible lethal consequences.

6. A narrowing autonomy’s focus on the human element in the military targeting and engagement cycle is challenging could be studied further keeping in view that autonomy can exist throughout or during parts of the targeting cycle and could start to be applied increasingly in other contexts such as close combat. Further, semi-autonomous machines could have highly autonomous targeting-acquisition and engagement functions while highly autonomous machines could have no autonomy in such so-called critical functions.

7. In the context of the CCW, a focus on characteristics related to the human element in the use of force and its interface with in particular machine characteristics that bring out accountability and responsibility for the use of force is useful. In view of the connectivity of the characterization discussion with the human-machine interface discussion, consideration of specific systems and use scenarios is helpful in building a shared understanding of the problems that might arise for human control and accountability as well as elaborating of characteristics related to the human element in the use of force, one should be taken to avoid notions that compare subjective human cognitive capabilities such as intention and judgment to machine performance.

8. Going forward, and in light of the foregoing it would be useful to focus the characterization discussion on systems, attributes and interpretations listed at page 3 of the Chair’s summary of the April 2018 meeting.
III. Human element in the use of lethal force; aspects of human-machine interaction in the development, deployment and use of emerging technologies in the area of lethal autonomous weapons systems

In the context of the objectives and purposes of the CCW, it was affirmed noted that the nature and quality of the human-machine interface is critical to addressing concerns related to the development, deployment and use of emerging technologies in the area of lethal autonomous weapons systems. There is, however, no single touch point or notion, for instance "human in the loop" that can fully describe the role of humans in supervising the development, deployment and use of weapons system. Instead a cumulative effect must be sought through a number of touch points without diluting human responsibility. In line with the Chair's 'sunrise slide', the following touch points in the human-machine interface were considered for the exercise of human intervention and control: 0) political direction in the pre-development phase; 1) research and development; 2) testing, evaluation and certification; 3) deployment, training, command and control; 4) use and abhor; 5) post-use assessment. It was understood noted that:

1. Accountability threads together these various human-machine touch points in the context of the CCW. Humans should must at all times remain accountable in accordance with applicable international law for decisions on the use of force or related actions related to the use of force performed by machines, computer programmes or other lethal autonomous weapons systems during the full duration of deployment.

2. Inter-disciplinary perspectives should must be integrated in research and development, including where feasible and appropriate through independent ethics reviews.

3. Developers should could seek to establish in the design phase itself as appropriate and feasible that any autonomous weapons system is receptive to human intervention, judgement and control.

4. Weapons systems under development, or modification where computational features are employed which significantly changes the use of existing weapons systems, should must be reviewed as applicable to ensure compliance with IHL and other applicable international law.

5. Verifiability and certification procedures against covering all likely possible-use scenarios should must be developed, and where feasible and appropriate, the experience of applying such procedures should be shared without prejudice to national security considerations or commercial restrictions on proprietary information.

6. Accountability for lethal action be the conduct of hostilities in armed conflict in accordance with applicable international law should must be ensured, including through the operation of any lethal autonomous subordination of weapons systems within a responsible to the chain of command and control.

7. Human control over the use of force by lethal autonomous weapons systems must and for aborting weapons systems in use should be retained. In the extent possible or feasible, this could extend to the aborting of the use of such systems if necessary to ensure compliance with IHL.

8. In the post-use assessment of the systems under consideration, it should be considered how their use complied with IHL and other applicable international legal obligations and if there were difficulties in exercising human intervention, judgement and control.

9. Necessary investments in human resources and training should be made in parallel with investments in emerging technologies in the area of lethal autonomous weapons systems.

10. Keeping in view some of the examples of measures listed above, the precise measure or its form being the prerogative of States, it would be useful to focus on reaching shared understandings on the extent and quality of the human-machine interaction intervention, judgement and control required to be exerted in the various human-machine touch points as well as clarifying the accountability threads along these touch points.
IV. Review of potential military applications of related technologies in the context of the Group's work

The valuable contribution of experts from the tech community, industry, academia and civil society to building awareness and understanding of the potential military applications of emerging related technologies in the area of lethal autonomous weapons systems in the context of the Group's work was recognised. These inputs have been channelled mainly through experts participating in national delegations, panels put together at the invitation of the Chair, side events and open calls for contributions on the CCW website. They have ensured that the Group's policy consideration advances in step with developments in the technology field and a minimum degree of transparency regarding potential military applications is built up.

The value of initiatives by industry, the science and technology community, academia and other organizations to develop technical, legal and ethical standards, and a common scientific and policy vernacular across the globe was also recognized.

Moving forward, ways and means to preserve this momentum and cross-fertilization of knowledge through dialogue in the context of the CCW need to be found.

Potential ways and means include an appropriate mechanism for technology—technological lighthouse mechanisms for understanding the humanitarian and international security challenges posed by related technologies, or another platform that provides a continued opportunity for High Contracting Parties to share how technology development and deployment is proceeding in the context of the objectives and purposes of the CCW while allowing other stakeholders to provide inputs. Regardless of the choice made, the enhanced participation of technical, military and legal experts in delegations attending CCW meetings would be crucial in ensuring that the Convention's consideration of the issue stays in step with the march of technology.

V. Possible options for addressing the humanitarian and international security challenges posed by emerging technologies in the area of lethal autonomous weapons systems in the context of the objectives and purposes of the Convention

In the context of the CCW, delegations raised potential risks and the main challenges posed by lethal autonomous weapons systems is including loss of human control resulting in possible harm to civilians and combatants in armed conflict in contravention of IHL. An equal challenge is exacerbation of regional and international security dilemmas through arms races and the possible lowering of the threshold for the use of force. Proliferation, to acquisition and use by non-State actors/terrorists, vulnerability of intelligent autonomous systems to hacking and interference, and the possible undermining of confidence in the civilian uses of these related technologies are other major concerns were also raised.

Delegations presented different options to address these potential risks and challenges in the context of the objectives and purposes of the CCW. Their pros and cons were discussed under three broad categories: a legally-binding instrument, a political declaration, and clarity on and enhanced implementation of existing obligations under international law, in particular IHL. Under the first category, a proposal for a legally-binding instrument stipulating prohibitions and regulations on lethal autonomous weapons systems was made. A mandate to negotiate such as well as a proposal for a legally-binding requirement instrument to ensure for exercising human control over the critical functions of lethal autonomous weapons systems were made under the first category also was also proposed. Under the second category, a proposal for a politically-binding declaration that would outline important principles such as the necessity of human control in the use force and the importance of human accountability, and with elements of transparency and technology review was made. Under the third category, proposals were also made to further discuss the clarifying how human-machine interface and the application of control and intervention could be better applied under existing international legal obligations. The need to identify practical measures, best practices and information sharing for improving compliance with international law, including Article 36, was also underlined. It was also stated that IHL is fully applicable to lethal autonomous weapons systems and its modernization, or adaptation, to such weapons systems is not needed.

It was felt that the options were not mutually exclusive, there were commonalities and regardless of the option pursued, the work carried out so far in the GGE on principles, characterization, human-machine interface and review of potential military applications of emerging technology in the area of lethal autonomous weapons systems offered useful building blocks for future work. It was also felt that discussions needed to mature evolving understandings need to be consolidated, open questions clarified and further common ground built on the basis of consensus.

The Group emphasized that the CCW offers an appropriate framework for dealing with the issue of emerging technologies in the area of lethal autonomous weapons systems. Within the context of the broader policy work internationally necessitated by the combinatorial effects of emerging technologies in the area of lethal autonomous weapons systems, the Convention's modular and evolutionary character, the balance it seeks to strike between humanitarian considerations and
military necessity as well as the opportunity it offers to engage multiple stakeholders make it an ideal platform for focused and participative discussions for reaching common understandings on the subject.

**Recommendation**

Some delegations made proposals for strengthening the mandate of the GGE going forward. These proposals are listed in Annex I. Some delegations called for retaining the existing mandate; others underlined that the current mandate offered sufficient flexibility and scope for stepping up work while continuing to explore options for an outcome.

In the light of the foregoing conclusions, the Group recommends that,

The Group of Governmental Experts related to emerging technologies in the area of lethal autonomous weapons systems (LAWS) in the context of the objectives and purposes of the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons shall meet for a duration of ten days in 2019 in Geneva in accordance with Decision 1 of the Fifth Review Conference of the High Contracting Parties to the Convention (CCW/CONF.V/10), consistent with CCW/CONF.V/2.

The Rules of Procedure of the Review Conference shall apply *mutatis mutandis* to the Group. The Group shall conduct its work and adopt its report by consensus which shall be submitted to the 2019 Meeting of the High Contracting Parties to the Convention. The widest possible participation of all High Contracting Parties is to be promoted in accordance with the goals of the CCW Sponsorship Programme.

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1. The exact dates and number of meeting days to be decided.