On the Controllability of Nuclear Weapons

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An increasing number of states with nuclear weapons on the one hand and new technical developments on the other could increase the complexity of possible nuclear threat situations to such an extent that the overall constellation with early warning systems and nuclear weapon systems becomes difficult to control. The three points of a quotation from a book on security policy are commented on below.

Quote from a book on security policy

Quote from the book „Sicherheitspolitik verstehen“ (2019) by Lieutenant General (ret.) Kersten Lahl and Prof. Dr. Johannes Varwick, page 121, or 2nd edition (2021), page 130:

„As a result, three conclusions can be drawn:

> **Firstly**, nuclear weapons have a damage potential that puts the survival of the entire human race at high risk.
>
> **Secondly**, this is precisely why they have so far been able to play a rather crisis-stabilising role in international practice - because a concrete deployment would be disastrous for all sides.
>
> **Thirdly**, there is no guarantee that this will always be the case. On the contrary: the more nuclear actors 'play along', the more sophisticated the technical developments become and the more complex the strategic decision-making field around nuclear missions and threats of deployment, the higher the risk of a lack of international controllability of the category of nuclear weapons."

Comment on the three points of the quote

Firstly

When the atomic bombs were dropped in 1945, there was no risk of an incalculable escalation. Only the USA had nuclear weapons at that time. Today, if nuclear weapons are used, an escalation spiral with the launch of many nuclear weapons can occur within a few minutes. It can be difficult to stop such a process in the available time of a few minutes and to limit the effects.

The direct consequences of such a deployment have been known since 1945. Other consequences may include an EMP (electromagnetic pulse) with the destruction of electronic equipment and a nuclear winter. An EMP could lead to the failure of important infrastructure

systems such as power supply. Even a limited nuclear war, e.g. between India and Pakistan, can lead to a prolonged nuclear winter, according to the latest climate research, which would cover the entire earth and ruin agriculture worldwide. In the event of a nuclear war, therefore, the survival of the entire human race is at risk.

Secondly

The deterrence doctrine states that the outbreak of nuclear war is prevented by having a second-strike capability. Whoever is attacked can wait for the impact of nuclear weapons and still have enough time and potential afterwards to carry out a devastating counter-attack. In the catchphrase: "He who shoots first, dies second". In the case of a vulnerable second-strike capability, a counter-strike could also be launched on the basis of early detection of an enemy attack (referred to as "launch on warning") before the attacking nuclear missiles strike, making a counter-reaction difficult or impossible. Early warning systems based on sensors and very complex computer networks have been developed for this purpose.

In early warning systems, false alarms can occur for a wide variety of reasons (e.g. hardware, software, operating errors or incorrect evaluation of sensor signals). In times of peace and phases of political detente, the risks are very low that the evaluation of an alarm message will lead to a nuclear attack. The situation can change drastically if there are political crisis situations, possibly with mutual threats, or if other events occur in temporal connection with a false alarm that could be related to the alarm message. Even if the deterrence strategy has so far prevented further deliberate nuclear weapons deployments, it does not protect against nuclear war by mistake. In the past, there have been some situations where it was only through great luck that nuclear war did not occur by mistake.

Thirdly

The risk of nuclear war is expected to rise sharply in the coming years and decades. Climate change will lead to more crises and new technical developments will increase the complexity of early warning systems to such an extent that the controllability of such systems will become increasingly difficult.

Climate change will probably lead to various regions becoming uninhabitable and thus cause more climate refugees. The available living space will become smaller, important resources, such as water, scarcer. As a result, there will be more frequent political crises and possibly even armed conflicts in the future. As a result, missile attack reports in early warning systems will become much more dangerous.

In recent years, a new arms race has begun in various military dimensions. Most of these developments are still in the early stages and the consequences are hardly calculable. This applies to new delivery systems for nuclear weapons, such as hypersonic missiles, the planned weaponisation of space, the expansion of cyber warfare capabilities and the increasing use of artificial intelligence systems up to autonomous weapon systems. All these aspects also play a role in early warning systems to detect attacks with nuclear missiles and will significantly increase the complexity of these systems. Potential cyber attacks are also incalculable, whereby components or data of an early warning system could be manipulated.

The further development of weapon systems with higher accuracy and ever shorter flight times (hypersonic missiles) will increasingly require artificial intelligence (AI) techniques to

make decisions automatically for certain subtasks. There are already calls in connection with early warning systems to develop autonomous AI systems that fully automatically assess an alert and, if necessary, trigger a counterattack, as there is no time left for human decisions. However, the data available for a decision are vague, uncertain and incomplete. Therefore, even AI systems cannot make reliable decisions in such situations. In the short time available, it will usually also not be possible to check the machine's decisions. The human being is only left to believe what the machine delivers. Due to the uncertain and incomplete data basis, neither humans nor machines will be able to reliably evaluate alarm messages.

In order to prevent a nuclear war by mistake in a false alarm in a crisis situation, all persons involved must act according to applicable rules and logically reasonable in the very short decision time. An example of unreasonable action in a crisis situation is the accidental shooting down of a Ukrainian passenger plane by Iran in January 2020. From a purely logical point of view, this should not have happened, because the radar signal was too large for a cruise missile and there was a valid and known flight plan of the passenger plane. But because of Iran's previous attack on American positions in Iraq, Iran had expected a counterattack. And this expectation was stronger than the purely logical, factual aspects.

A "nuclear war by accident" is not directly predictable. As with other accidents in technical systems, there is no advance warning. An accidental nuclear war can happen suddenly within a few minutes as a result of an escalation spiral and wrong assessments. Afterwards, no correction is possible. In normal accidents, measures are often taken afterwards to avoid such risks in the future. After a nuclear strike, there will hardly be such a future. In the case of nuclear war risk, we cannot wait until there has been a first "accident" in the form of "nuclear war by mistake" before taking measures to reduce this risk.