

Emerging technologies and nuclear security: risks and responses

A guest piece by Natalya Samoylovskaya, Chair of Russian Student/Young Pugwash, published on 4th October 2018

Introduction

In this paper, I analyze two technological trends that may impact on traditional nuclear security. The first is cyber security. The second is new challenges to nuclear facilities from small, unmanned aerial vehicles (UAVs). Regulation of these areas is a complex emerging process mostly based on the national level but there is a requirement for greater attention from international society to modernize our approach to nuclear security.

At the end of the 19th century the discovery of X-rays became a sensation for medical society. Doctors all over the world quickly started using the technology for diagnosis in their medical practice. But it took them some time to realize all the dangers. Accordingly, the first victims of radiation were patients. However, this tragic experience of the devastating effects of radiation on human beings did not prevent the creation of the most dangerous weapons in the history of mankind. At the same time, a better understanding of radioactivity opened the way to a new era of space exploration for humanity.

Whether atoms are used for peaceful or military purposes always balances on the brink. The first serious radiation accidents occurred at the national nuclear weapons complexes of the "nuclear club" countries, first of all in the USSR, the USA and United Kingdom¹. No less dangerous were accidents at nuclear power plants and crashes of space objects equipped with nuclear facilities.

The nuclear accidents of the 20th century revealed a complex set of problems concerning the responsibility of scientists and governments towards civilian population. These issues are still urgent including the problem of transparency of the "nuclear club" countries' policies and civilian control on the one hand and the problem of their legal responsibility towards the international community on the other hand.

The 21st century started with new technologies and at the same time new nuclear threats. Sufficient progress in the UAV industry and widespread application of this technology includes its potential misuse, thus entailing possible incidents in the nuclear industry. Equally important is the issue of cyber vulnerabilities of nuclear facilities. Such security shifts demand new approaches to maintaining as well as updating existing multilateral agreements.

Nuclear security in the digital era

The new digital era has affected all aspects of human life: the Internet has provided benefits that have significantly changed modern society but at the same time made it more interdependent and vulnerable. Thus world-leading states are paying more and more attention to cyber security issues and the nuclear field is no exception here.

In the opinion of A. Lukatskiy, one of the leading experts on informational security at Cisco, the informatization process of historically isolated computer systems at nuclear facilities has increased the risk of cyber threats. This has led to the adoption of new normative policies and processes on cyber security at nuclear facilities since around 2005². As A. Lukatskiy pointed out, these recently developed approaches have not eliminate all risks and require further research studies to assess the effectiveness of protective measures designed by the International Atomic Energy Agency (IAEA) and national nuclear legislations. In the view of A. Lukatskiy these research efforts could result in the creation of new tools to identify deficiencies in protective measures and give possible recommendations for their elimination.

One of such research study was an investigation undertaken by the International Security Department at Chatham House, with the support of the John D. and Catherine T. MacArthur Foundation. The working group of analysts interviewed about 30 industry practitioners,

1 Mityunin A. Furious Atom. Tragic Chronicle of Atomic Age // Civilian Defense. 2006, № 6-12; 2007, № 1-2

2 Lukatskiy A. Cyber security of nuclear facilities // Security Index. 2015, № 4. Pp. 113-126. URL: <http://www.pircenter.org/media/content/files/13/14513827960.pdf>

requesting specific recommendations. The study found that “the nuclear industry, regulatory bodies, security establishments, governments and international organizations needed to engage with cyber security experts and academics, on a sustainable basis, to formulate robust policy responses through coordinated plans of action to deal with the technical, managerial and cultural shortfalls identified in report”³.

Nuclear security in the era of drones

Another technological trend is the widespread use of low-cost UAVs for both military and civilian purposes. Rapid and uncontrolled spread of this technology led to different incidents indicating new challenges for nuclear security. In the opinion of M. Bunn, an expert at the Belfer Center for Science and International Affairs, “drones could provide detailed images of the facility layout... real-time monitoring of guard responses... could also be used for more active, potentially violent assistance to an attack”⁴. In the article “Analyzing the threat of unmanned aerial vehicles (UAV) to nuclear facilities” a group of experts tried to analyze new nuclear security challenges from UAVs using the traditional approaches to nuclear security of the IAEA. In their opinion, the existing ‘Design Basis Threat’ should be revised taking on board a deep analysis of the “evolving threat capabilities of new technologies, like UAVs”⁵.

Most experts emphasize the need for legal regulatory instruments in the use of drones. As C. Baylon, an expert at Chatham House, pointed out, “if the technology is harnessed properly, drones might not only be able to solve the problems they have created but also provide additional security benefits”⁶. Put differently, drones as well as other emerging technologies may be used both as a threat or opportunity for nuclear facilities security. In this process, governments and scientists can play an important role in finding timely decisions to prevent new challenges and develop new opportunities.

3 Baylon C., Brunt R., Livingstone D. Cyber security at civil nuclear facilities: understanding the risks. Chatham House Report. 2015. P. 4. URL: <https://tinyurl.com/z9kytks>

4 Bunn M. Drones: Good News and Bad News for Nuclear Security. 2015. URL: <https://tinyurl.com/y8x96hg3>

5 Solodov A., Williams A., Hanaei S.A., Goddard B. Analyzing the Threat of Unmanned Aerial Vehicles (UAV) to Nuclear Facilities // Security Journal, April 2017. URL: <https://tinyurl.com/y9gml2lw>

6 Baylon C. Leveraging Drones to Improve Nuclear Facility Security and Safety. Chatham House expert comment, January 2015. URL: <https://tinyurl.com/y7pfmcp>

Responses

While new technological trends impact on traditional physical nuclear security, they are not currently critical. These trends need to be met with a common international dialogue of experts on how to adapt existing norms on physical nuclear security, to prevent emerging cyber security threats and small UAVs to challenge physical nuclear security.

On the national level, regulation of the cyber security of nuclear facilities needs to implement international best practice, with IAEA feedback. Intensification of dialogue on international regulation and norms of cyberspace vis-a-vis traditional approaches to nuclear facilities security will play a great role in potential threat prevention.

The main problem regarding small UAVs is the absence of special attention on nuclear facilities security at the national level. It requires a dialogue of national expert communities on the IAEA platform on adaptation of the IAEA “detect-delay-respond” approach, with new technical recommendations on UAVs detection, identification and neutralization for national governments.

We can see that mass communication used to be a powerful tool in the hands of politicians to alter public opinions to their favour, even on issues as serious as WMD. Now, with the introduction of the internet and social media, things have changed dramatically. In the next part, we will see some of the implications of these new media technologies.

Advanced technologies – old nuclear issues

In the article “The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence” K. A. Lieber and D.G. Press pointed out that changes in technology, rooted in the computer revolution, “were eroding the foundation of nuclear deterrence”⁷. The authors emphasized the increasing risk of using nuclear weapons in military conflicts and analyzed the possible US policy options to prevent it. The main conclusion was the idea that any further reduction of nuclear arsenals might become a destabilizing factor.

This idea was strongly criticized by leading Russian

7 Lieber K. A., Press D.G. The new era of counterforce: technological change and the future of nuclear deterrence // International security. Vol. 41, 2017. Issue 4. Pp. 9-49. URL: http://www.mitpressjournals.org/doi/full/10.1162/ISEC_a_00273

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experts on nuclear security issues, V. Dvorkin and A. Arbatov, during the joint Russian-American international seminar "Disruptive Technologies, Strategic Vulnerability, and the Future of Deterrence"⁸. V. Dvorkin stressed the fact that mutual reduction of nuclear weapons decreased the possibility of a disarming strike regardless of the new technological realities, and "strategic stability could be most reliably achieved on the basis of contractual relationship when mutual monitoring of the strategic forces was used"⁹.

A. Arbatov also pointed out the risk of cessation of negotiations on further reductions and limitation of strategic and other weapons in view of the crisis of the nuclear non-proliferation regime. In his opinion, "it will be the unwillingness to sign new agreements, which are needed in the negotiations on missile defense system, high-precision conventional weapons, hypersonic system that will end nuclear deterrence and strategic stability in course of the upcoming multilateral unlimited arms race and their proliferation, not excluding terrorists"¹⁰.

Most Russian leading experts from IMEMO RAS, Institute for the US and Canadian Studies RAS agree that the concept of "strategic stability" is being transformed under new realities, including the technological aspect. They contend there is need for new approaches but at the same time still a requirement for continued dialogue on the reduction of nuclear weapons and preserving the existing agreements on nuclear arms control¹¹.

The current crisis in Russian-American relations has a much stronger influence on the future of dialogue on the reduction of nuclear weapons than the recent technological trends. The cessation of nuclear arms reductions and the build-up of military nuclear technologies, which enhances the ability to resist contemporary efforts of non-proliferation, can threaten

8 International seminar «Disruptive technologies, strategic vulnerability, and the future of deterrence», organized by PIR-Center, Diplomatic Academy of Russian Ministry of international relations and Diplomatic School of Edmund A. Walsh School of Foreign Service in Georgetown University. The 14th June 2017, Moscow. URL: <https://tinyurl.com/y7k8ldg6>

9 Round table paper «Prompt global strike concept in new era». The 14th June 2017, Moscow. URL: <http://pircenter.org/media/content/files/14/15003867470.pdf>

10 Ibid.
11 Read more: Strategic stability after cold war/ Auth. group – Arbatov A.G., Dvorkin V.Z., Pikaev A.A., Oznobishchev S.K. M.: IMEMO RAS, 2010; Nuclear weapon and strategic stability: in the search for Russian-American consensus in the XXI century. M.: Spetskniga, 2012. URL: <https://tinyurl.com/y87wf2j8>

Article VI of the NPT. Such an approach may become the most dangerous challenge to the NPT as the foundation of the non-proliferation regime.

Recent discussions at the VI All-Russian Congress of political scientists about overcoming crises in the area of arms control and nuclear non-proliferation are instructive here¹². Stimulating debates via different international platforms about emerging technology issues, for example on nuclear cyber security and on legal UAVs regulation for nuclear facility security, may have positive effects on crucial nuclear security issues. Against the backdrop of the Russian-American negotiating crises on nuclear disarmament, discussing new trends may be helpful to encourage dialogue on nuclear security issues as a whole and for the restoration of confidence measures.

On cyber security issues, it may be dialogue on normative adaptation for nuclear security facilities and intensification of dialogue with national expert communities on the platforms of the IAEA or the UN Group of Governmental Experts on Developments in the Field of Information and Telecommunications in the Context of International Security. On small UAVs, it may be an adaptation of the IAEA "detect-delay-respond" approach with wide technical recommendations on UAVs detection, identification and neutralization for nuclear facilities. Both spheres need intensification of dialogue with national expert communities, such as representatives from private IT companies, engineers and technical professionals, on these issues.

12 Arms control: does it have a future? / ed. by S.K. Oznobishchev and A.I. Nikitin. M.: RPSA, ROSSPEN, 2013. 279 p.

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This article is the second in a series of think pieces and research papers around new and emerging technologies, published by Student/Young Pugwash UK. All views are those of the author.

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