How Has The Emergence of Nuclear Weapons Changed Our World?

Contents -

Introduction

In this report, I will be looking at the emergence of one of the major advancements in technology used for warfare within the last century and the most devastating technology created by mankind; nuclear weapons systems, the threat that this technology poses and how advancements and proliferation in this field have impacted our society.

History

The first nuclear weapons were created in 1945 during World War Two as the result of the USA's Project Trinity and are probably the most disruptive technology mankind has ever created. Within a month of this new technology's emergence, the world would be changed forever when two nuclear bombs were dropped on Hiroshima on August 6th and Nagasaki on August 9th; with the total estimated death toll to be in the range of 220,000 people[1]. The bombings led to a Japanese surrender and ultimately the end of World War Two.

Emergence and Proliferation

Since 1945 eight other nations are known to have developed nuclear weapons. A report from the (Stockholm International Peace Research Institute, 2014)[2] details the amount of nukes, to their knowledge, that are held by each nation.

Table 1. World nuclear forces, 2014

Country	Year of first nuclear test	Deployed warheads*	Other warheads	Total 2014
USA	1945	1920	5380	7300
Russia	1949	1600	6400	8000
UK	1952	160	65	225
France	1960	290	10	300
China	1964		250	250
India	1974		90–110	90–110
Pakistan	1998		100–120	100–120
Israel	. .		80	80
North Korea	2006		6–8	6–8
Total		3970	12 350	16 300

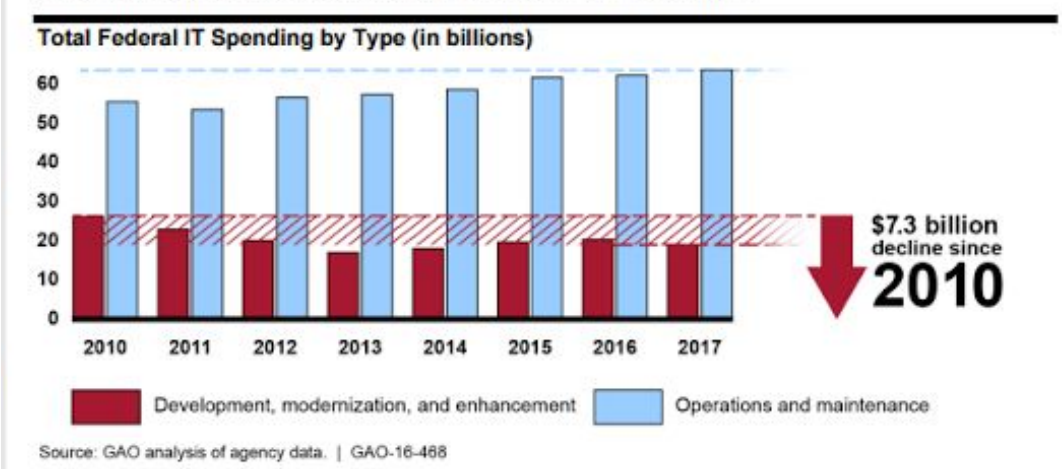
Source: ***SIPRI Yearbook 2014***

* 'Deployed' means warheads placed on missiles or located on bases with operational forces.

While only 3970 of the approximately 16,330 nukes on Earth are operational, this is still a very vast and scary increase within the last 71 years. In 'Proliferation of Nuclear Weapons' (Dr. Theador B Taylor, 2001)[3] explains how he believes that "*As long as we believe nuclear weapons are an important part of our security, we cannot expect the rest of the world to think or act differently.*" Around the world different nations are pushing to develop these weapons in order for them to act as a deterrent against them being targeted by a nuclear warhead. A vicious cycle we are almost powerless to control as the nations involved are not under our direct command. Dr. Taylor goes on to conclude that "*If we succeed in changing our own behavior, there is hope for the rest of the world. If we do not, we have no one to blame but ourselves as nuclear weapons proliferate.*" A statement that I wholeheartedly agree with.

Technical Issues

Alongside owning these weapons come many technical, political and societal issues. For example, this report by the (United States Government Accountability Office, 2016)[4] details that the US Nuclear Weapons System still relies on an IBM Series 1 computer from the 1990's alongside a series of floppy discs. While technically safe, the report also details that the maintenance of out of date legacy systems such as this cost US taxpayers upwards of $60 billion a year.



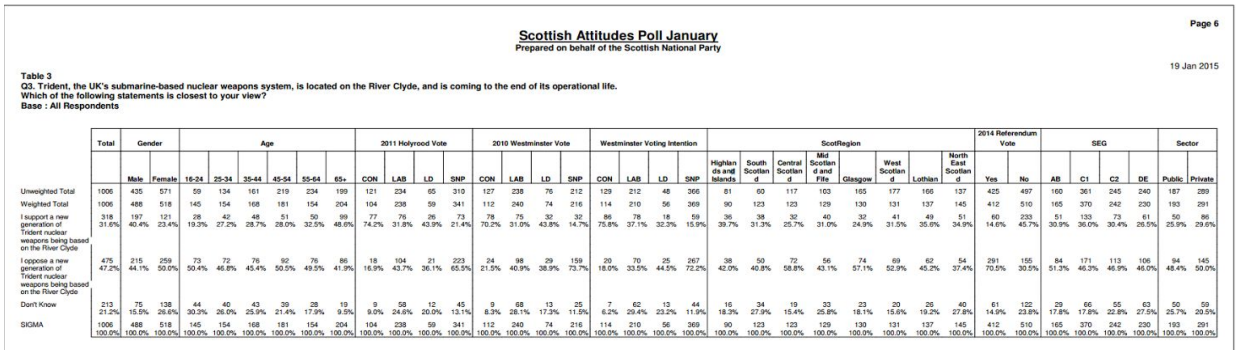
In "*Cyber Threats and Nuclear Weapons*", (Andrew Futter, 2016)[5] poses the question could an unauthorized malicious party cause a nuclear strike? There are numerous ways that he poses to possibly achieve this, such as breaching firewalls to send launch orders to launch crews and tricking warning networks into reporting false alerts in order to cause a retaliatory strike. Due to the enormous destructive power of nuclear weapons, there are various systems in place to safeguard against these attacks. However, all of which are real and distinct possibilities.

For example on June 3rd, 1980 an automated warning system at a US command post in Nebraska indicated that there were multiple ballistic missiles heading towards the US and forces were quickly mobilized in response. However, this was a false alert caused by the failure of a single integrated chip circuit. There have been many other false alerts with causes ranging from hardware failures to mistakenly interpreting a flock of geese as a Soviet bomber[6]. While not intended attacks, these situations highlight that there are various technical vulnerabilities in the systems used to manage a nation's nuclear weapon stockpile. Due to the short warning times involved these computer systems are critical when it comes to managing nuclear weapons. With incidents such as Chernobyl to remind us of the devastation that a technological failure can cause, vulnerabilities such as these serve as a stark reminder of the limitations of technology. Alan Borning discusses the reliability of the computer systems involved with handling nuclear stockpiles in "*Computer System Reliability and Nuclear War.*" (Alan Borning, 2001)[7] Stating that when it comes to these such systems their reliability extends to the system's intentions and poses the question "*To what extent are we able to state and codify our intentions in computer systems so that all circumstances are covered?*". I believe it is truly scary that we place so much reliance on life-critical systems such as this, as due to technical limitations we cannot ensure that the system will always work to our intentions. It is a terrifying prospect that computer systems now have the power to start large-scale nuclear wars. In his conclusion, Borning goes on to say that "*The problems are fundamental ones due to non testability, limits of human decision making during high tension and crisis, and our inability to think through all the things that might happen in a complex and unfamiliar situation.*" The limits of technology currently prevent us from developing a system advanced enough to mimic anything close to adequate human sentience in order to control these systems reliability. Even if there were no such technological limitations, I believe that these weapons being under the control of anybody, even be it an advanced artificial intelligence, is an extremely daunting prospect. This is why I

agree with Borning when he goes on to conclude finally that "*The threat of nuclear war is a political problem, and it is in the political, human realm that solutions must be sought.*"

Political and Societal Issues

Nuclear weapons have caused many political issues since their creation, for example, the tension that they added to The Cold War as the USA and USSR raced to develop the Hydrogen Bomb[8]. However, a large number of historians believe that their involvement actually prevented The Cold War from escalating due to the prospect of mutually assured destruction. More recently the UK's nuclear weapons system, Trident; a nuclear submarine located off of the coast of Faslane in Scotland, has played a large role in the SNP's push for a second Scottish referendum. After 58 of 59 Scottish MP's voted against the renewal of Trident in 2015[9] I believe that it is to no surprise that there are calls for a second referendum. This survey by (Survation, 2015)[10] on behalf of the SNP carried out on the Scottish public gives some insight into general attitudes towards the renewal.



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Scottish Attitudes Poll January
Prepared on behalf of the Scottish National Party

19 Jan 2015

Table 3
Q3. Trident, the UK's submarine-based nuclear weapons system, is located on the River Clyde, and is coming to the end of its operational life. Which of the following statements is closest to your view?
Base : All Respondents

	Total	Gender		Age						2011 Holyrood Vote				2010 Westminster Vote				Westminster Voting Intention				ScotRegion								2014 Referendum Vote		SEG				Sector	
		Male	Female	16-24	25-34	35-44	45-54	55-64	65+	CON	LAB	LD	SNP	CON	LAB	LD	SNP	CON	LAB	LD	SNP	Highlands and Islands	South Scotland	Central Scotland	Mid Scotland and Fife	Glasgow	West Scotland	Lothian	North East Scotland	Yes	No	AB	C1	C2	DE	Public	Private
Unweighted Total	1006	435	571	59	134	161	219	234	199	121	234	65	310	127	238	76	212	129	212	48	366	81	60	117	103	165	177	166	137	425	497	160	361	245	240	187	289
Weighted Total	1006	488	518	145	154	168	181	154	204	104	238	59	341	112	240	74	216	114	210	56	369	90	123	123	129	130	131	137	145	412	510	165	370	242	230	193	291
I support a new generation of Trident nuclear weapons being based on the River Clyde	318 31.6%	197 40.4%	121 23.4%	28 19.3%	42 27.2%	48 28.7%	51 28.0%	50 32.5%	99 48.6%	77 74.2%	76 31.8%	26 43.9%	73 21.4%	78 70.2%	75 31.0%	32 43.8%	32 14.7%	86 75.8%	78 37.1%	18 32.3%	59 15.9%	36 39.7%	38 31.3%	32 25.7%	40 31.0%	32 24.9%	41 31.5%	49 35.6%	51 34.9%	60 14.6%	233 45.7%	51 30.9%	133 36.0%	73 30.4%	61 26.5%	50 25.9%	86 29.6%
I oppose a new generation of Trident nuclear weapons being based on the River Clyde	475 47.2%	215 44.1%	259 50.0%	73 50.4%	72 46.8%	76 45.4%	92 50.5%	76 49.5%	86 41.9%	18 16.9%	104 43.7%	21 36.1%	223 65.5%	24 21.5%	98 40.9%	29 38.9%	159 73.7%	20 18.0%	70 33.5%	25 44.5%	267 72.2%	38 42.0%	50 40.8%	72 58.8%	56 43.1%	74 57.1%	69 52.9%	62 45.2%	54 37.4%	291 70.5%	155 30.5%	84 51.3%	171 46.3%	113 46.9%	106 46.0%	94 48.4%	145 50.0%
Don't Know	213 21.2%	75 15.5%	138 26.6%	44 30.3%	40 26.0%	43 25.9%	39 21.4%	28 17.9%	19 9.5%	9 9.0%	58 24.6%	12 20.0%	45 13.1%	9 8.3%	68 28.1%	13 17.3%	25 11.5%	7 6.2%	62 29.4%	13 23.2%	44 11.9%	16 18.3%	34 27.9%	19 15.4%	33 25.8%	23 18.1%	20 15.6%	26 19.2%	40 27.8%	61 14.9%	122 23.8%	29 17.8%	66 17.8%	55 22.8%	63 27.5%	50 25.7%	59 20.5%
SIGMA	1006 100.0%	488 100.0%	518 100.0%	145 100.0%	154 100.0%	168 100.0%	181 100.0%	154 100.0%	204 100.0%	104 100.0%	238 100.0%	59 100.0%	341 100.0%	112 100.0%	240 100.0%	74 100.0%	216 100.0%	114 100.0%	210 100.0%	56 100.0%	369 100.0%	90 100.0%	123 100.0%	123 100.0%	129 100.0%	130 100.0%	131 100.0%	137 100.0%	145 100.0%	412 100.0%	510 100.0%	165 100.0%	370 100.0%	242 100.0%	230 100.0%	193 100.0%	291 100.0%

47.2% compared to 31.6% of the public opposed the renewal of Trident. At the time of these discussions last year I was fully for the renewal of Trident, but now my opinion has changed after having greater insight and I can see why the majority of the Scottish public were against it. At an expected cost of £31 billion[11], I and many others do not believe it is economically viable to renew the system. With a crippled NHS and economy on the downturn, I think the money would be far more useful elsewhere than on the renewal of a relic from The Cold War. There are also many moral reasons involved, as I am going to refer back to the topic of proliferation and Dr. Taylor ''If we succeed in changing our own behavior, there is hope for the rest of the world.' Currently, as time passes while we hold on to our nuclear weapons and more nations may develop them, it seems we have little hope as the threat of nuclear fallout still looms above us.

Conclusion

Since their creation nuclear weapons and the various issues they bring have had a huge impact on our society. With this report I hope to have provided some insight on the some of the many issues that this technology brings, and as to why I believe that they are detrimental to society. Providing so many technological, political and ethical debates I believe mankind will never create another technology so disruptive or devastating. Serving as key instruments in events that have shaped international affairs and the world as we know it; such as World War Two and The Cold War, it is hard to imagine a history without them, but maybe even harder so to imagine a future with them.

Word Count: 1383 (Non-including pictured graphs)

References

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[6] *Linn I. Sennott, 2001 Academic Paper "Overlapping False Alarms: Reason for Concern?" - https://www-ee.stanford.edu/~hellman/Breakthrough/book/chapters/sennott.html*

[3] *Theodore B. Taylor, 2001 Academic Paper ""Proliferation of Nuclear Weapons"* https://www-ee.stanford.edu/~hellman/Breakthrough/book/chapters/taylor.html

[4] *United States Government Accountability Office, 2016 Report to Congressional Requesters - http://www.gao.gov/assets/680/677436.pdf*

[9] *Press Association, Tuesday 19 July 2016, "SNP push again for Scottish independence vote after Trident result", The Independent -* https://www.theguardian.com/uk-news/2016/jul/19/snp-push-again-for-scottish-independence-vote-after-trident-result

[10] *Survation, 2015 Poll "Scottish Attitudes Poll" -* http://survation.com/wp-content/uploads/2015/01/SNP-Tables-Trident.pdf

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[11] *Full Fact, 2016 Article "How Much Does Trident Cost?" - https://fullfact.org/economy/trident-nuclear-cost/*

[2] *Stockholm International Peace Research Institute, 2014 Report - https://www.sipri.org/media/press-release/2014/nuclear-forces-reduced-while-modernizations-continue-says-sipri*

Mark Scheme (out of 28+2 marks total)

Note: to reach each mark boundary, all the requirements for previous mark boundaries must also be met. For example, to receive 3 marks for spelling, you must meet all the criteria for 3 marks and not have spelling errors that a spell checker would find (a criteria for 2 marks)

Spelling and grammar (3 marks)		
Grade boundary	**Description**	**Self-assessment**
3	The report reads well throughout with none of the issues identified below ever appearing. The writing would not look out of place in an academic publication	x
2	The report does not contain spelling or grammatical mistakes but it is not easy to read. Sentence construction is awkward and/or there are comma splices, imprecise language, copy splices or awkward phrases used	
1	The report is poorly written or contains spelling or grammatical mistakes that a spellchecker would find	

IF YOU HAVE A REGISTERED DISABILITY THAT AFFECTS YOUR ABILITY TO BE ASESSED FOR SPELLING AND GRAMMEAR (FOR EXAMPLE, DYSLEXIA) PLEASE INDICATE IT AT THE START OF THE DOCUMENT AND IN THE ABOVE SECTION

Use of Sources (6 marks)

Grade boundary	Description	Self-assessment
5-6	The report backs up all claims that it makes with appropriate references, and includes at least 8 different sources including four from books or academic sources	x
3-4	Six different sources including at least one book and two academic paper used correctly in the document and the reference section indicates what each reference is. The formatting of the reference section and citations is consistent	
1-2	The references includes at least one appropriate academic paper the content of which is analysed, the report includes some other types of sources	

Information Presentation and Structure (7 marks)		
Grade	**Description**	**Self-**

boundary		**assessment**
6-7	The report consistently uses formatting appropriately. The document includes some graphical information produced by the student to help emphasise their point. Information consistently presented in graphical form where appropriate. The document is very easy to follow and looking at the contents page of the document should give a good level of insight into the report	
4-5	The report generally makes use of formatting to clarify its information (bolded text, subtitles, italicised text, bulleted or numbered lists where appropriate) and presents information in forms besides text such as graphs, tables or images. The document escapes the “Intro->Method->Results->Conclusion Trap” we discuss in class on the topic of report writing	x

2-3	The report intermittently makes use of formatting but it detracts from the overall message sometimes. As a reader, I could read the sections in any order and it would make little difference.	
1	The report makes no use of anything other than written text to present its information, formatting is inconsistent. There are appropriate subheadings but they are poorly related to each other. The document is relatively unstructured, there is little to no use of sections to segment the information and help the reader	

Quality of Analysis (12 marks)		
Grade boundary	**Description**	**Self-assessment**
10-12	The document includes many non-obvious insights into the topic being discussed that are clearly grounded in evidence. The student consistently makes the distinction between fact and opinion clear	
8-9	The document explains the domain being presented clearly and in great depth. The document includes a good amount of discussion and analysis coming in just below or at the word count. Some non-obvious insight is presented by the student. The student clearly critiques and compares their sources whenever it is appropriate	x
6-7	The document explains the domain being presented. The document includes a good amount of discussion and analysis coming in just below or at the word count. Some non-obvious insights are presented by the student. The student rarely confuses opinion and fact in their discussion. The student only infrequently engages critically with their source	
4-5	The document includes a limited amount of discussion and analysis. The document generally lacks insights into the problem area only repeating others' information or does not make the topic area clear. The student only engages critically with their source on an infrequent basis	

1-3	The document includes limited to no discussion and analysis coming in well below the word count or over it. The document presents little to no critical analysis. The writing sometimes confuses fact with opinion	