

The Changing Global Nuclear Landscape

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August 1945 changed the world forever

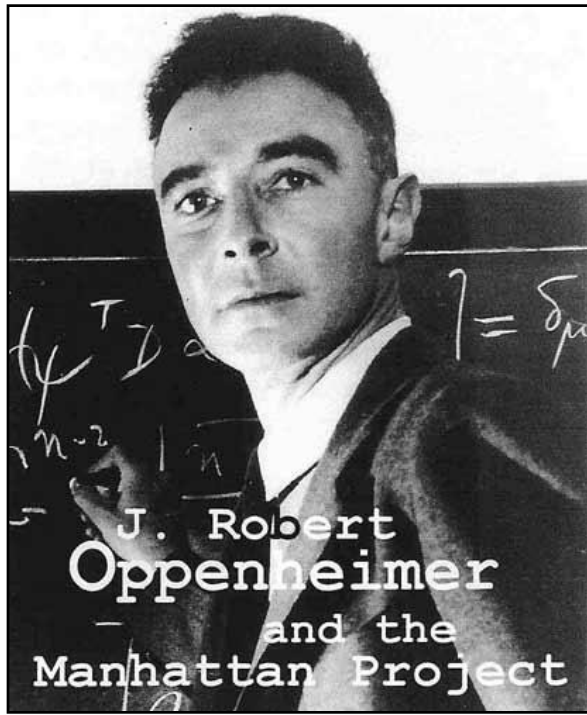


“A factor of millions”



**Mankind realized its own mortality with the devastation at
Hiroshima and Nagasaki –Richard Rhodes**

The Making of the Atomic Bomb

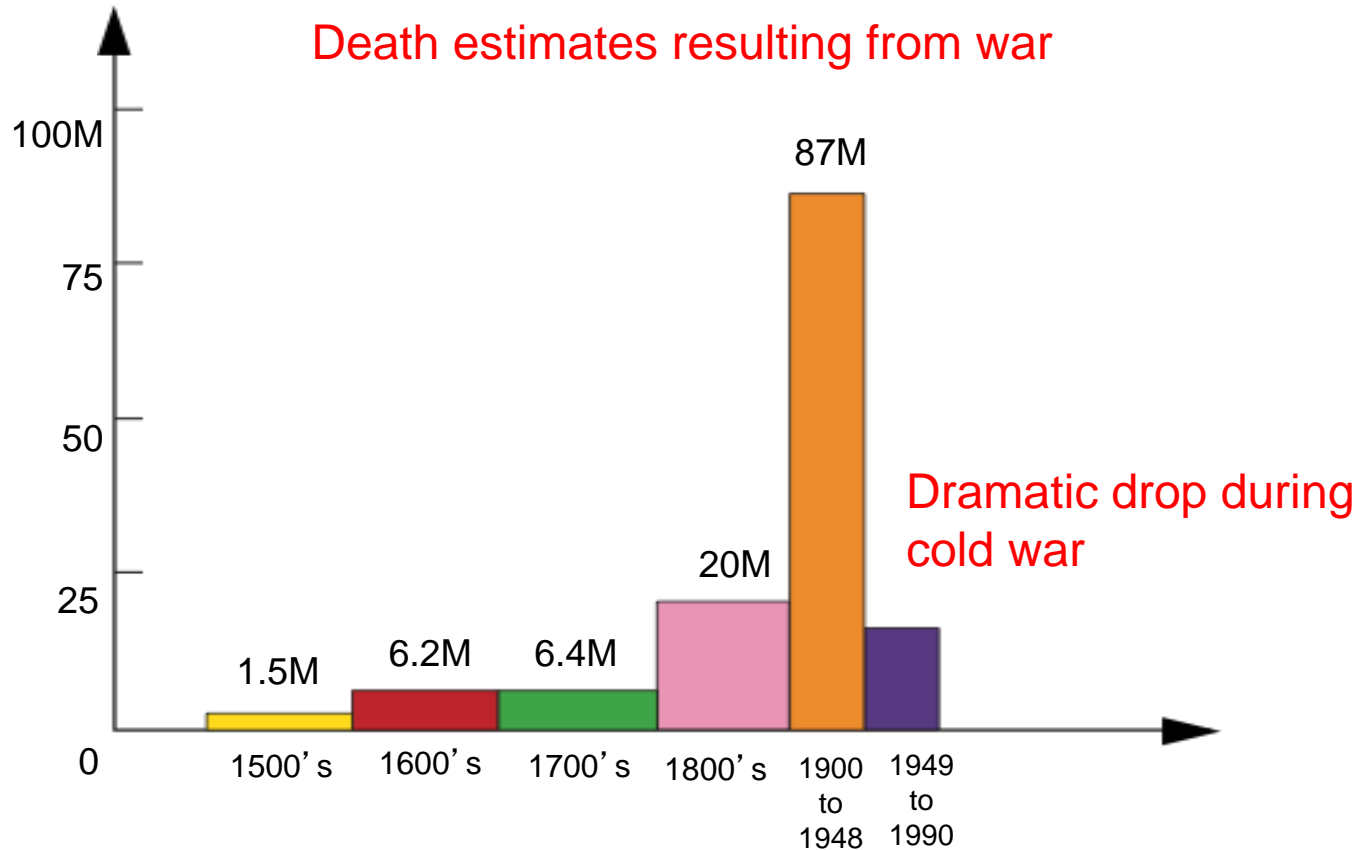


“But the atomic bomb was the turn of the screw. It made the prospect of future war unendurable. It has led us up those last few steps to the mountain pass; and beyond **there is a different country.**” 1946

J. Robert Oppenheimer
Director, Los Alamos Laboratory
Scientific Leader, Manhattan Project



Atomic bombs caused a discontinuity in world affairs



It did not necessarily have to be this way...

Global Nuclear Landscape

- Nuclear weapons
- Proliferation of nuclear weapons
- Nuclear terrorism
- Peaceful nuclear energy
- The battlefields of the Cold War
 - Health and environmental consequences

The landscape in three nuclear eras

Advancements in Nuclear Weapon Design

- Implosion devices were reduced by advances in design with nuclear testing from 1948 to 1956 by
 - **Factor of ~ 3 in diameter**
 - **Factor of ~ 30 in mass**
- This dramatic reduction in weight and size enabled a huge diversity of new delivery systems
 - Tactical Missiles
 - Depth charges
 - Artillery shells
 - Landmines
 - And many, many more



Mk48 Artillery Shell



B54 "Backpack" SADM



Mk7 Nuclear Depth Charge



Davy Crockett W-54 SADM
(Special Atomic Demolition Munition)

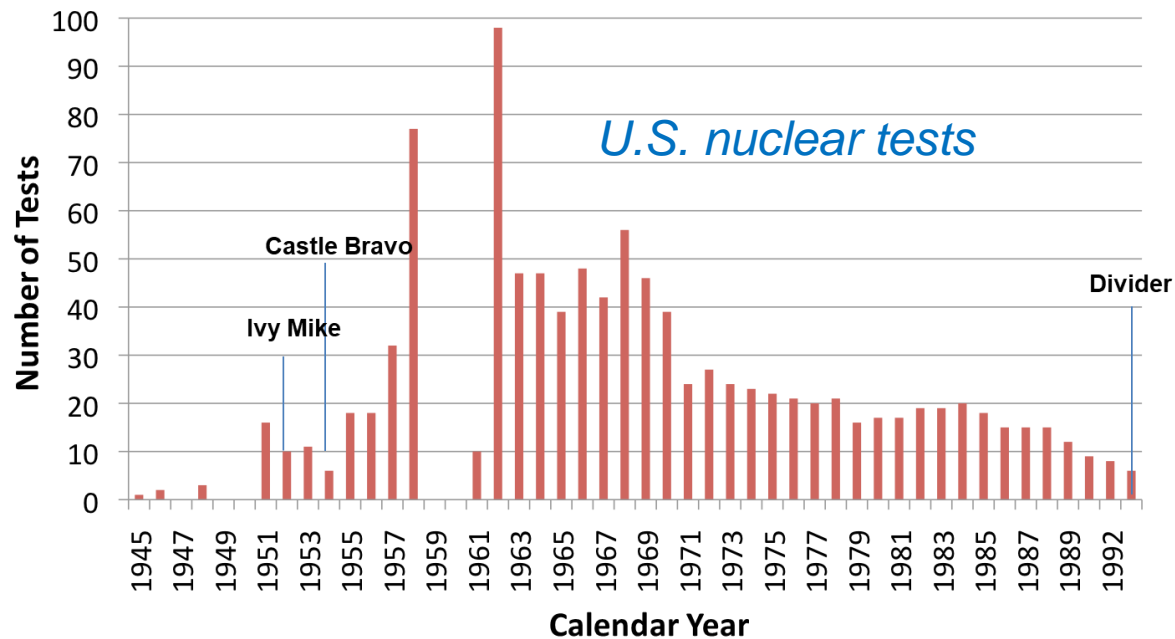
The Wild West of nuclear weapons development

The nuclear triad – sea, land and air

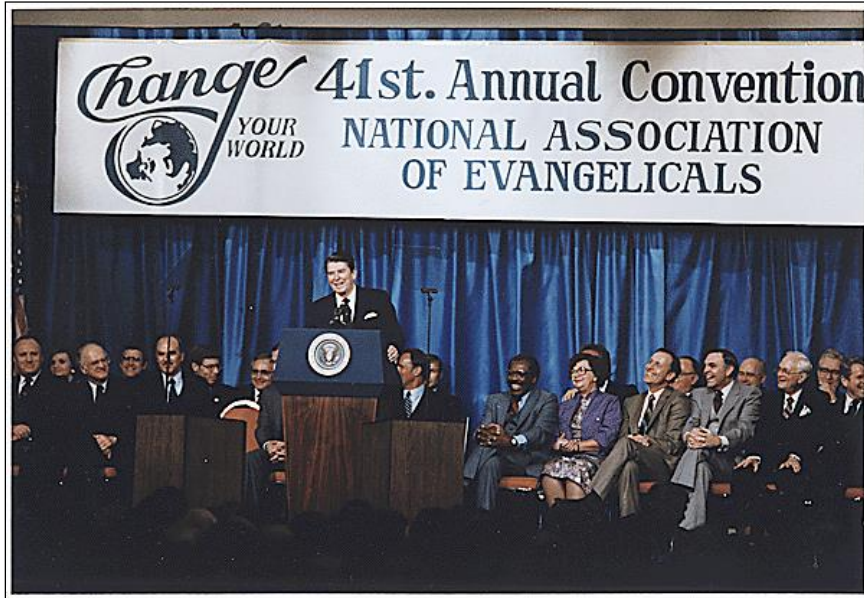


Nuclear testing was crucial to US nuclear arsenal

**Last U.S. test
9/23/1992**



President Reagan and the Evil Empire



March 8, 1983

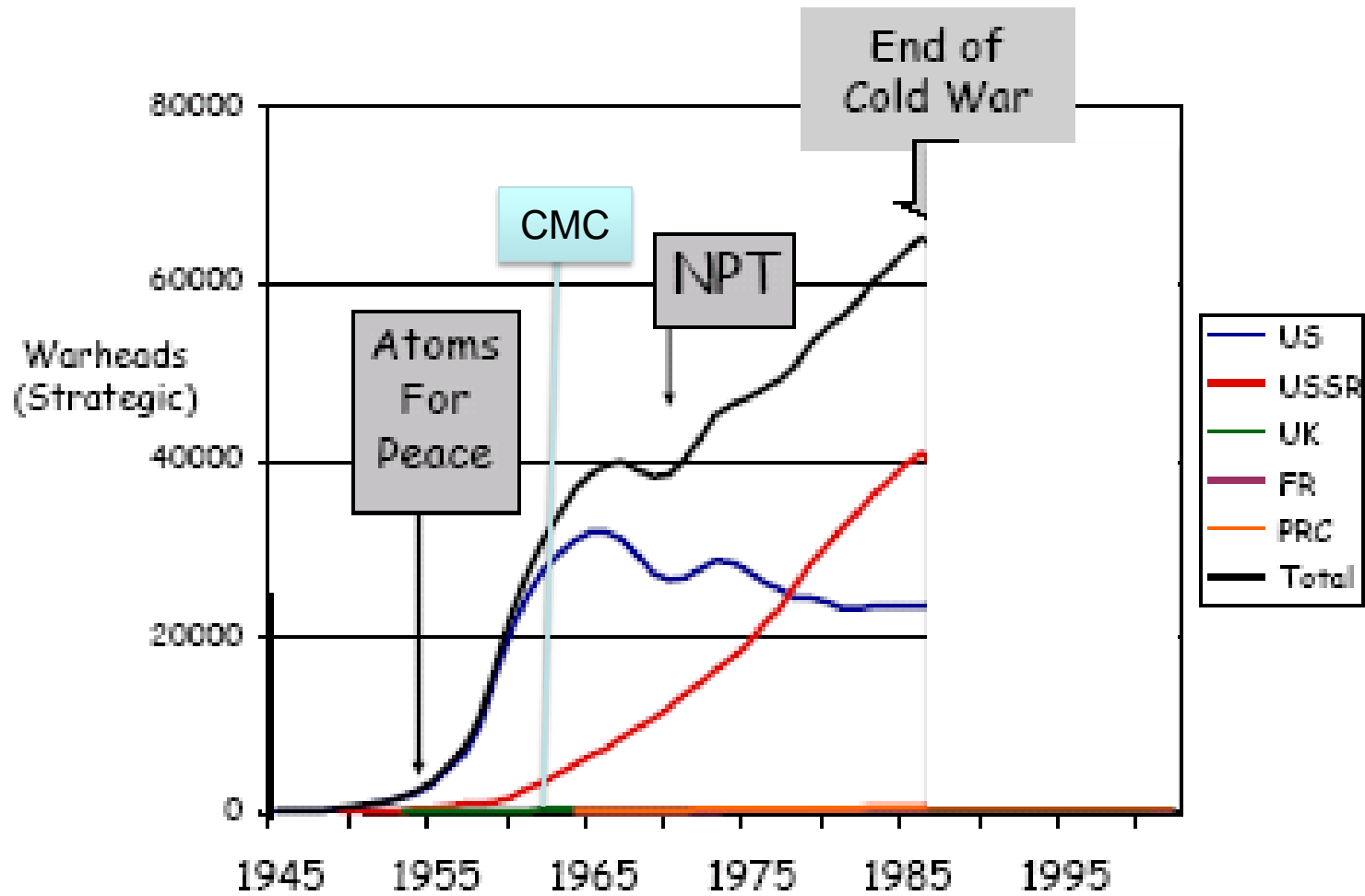
**“(not)..to ignore the facts
of history and the aggressive
impulses of an evil empire”**



March 23, 1983

“Star Wars” Speech

What Happened: Cold War Arms Race



Source: NRDC
Estimates

"A Report on the International Control of Atomic Energy". Acheson-Lilienthal Report, March 28, 1946

Some key findings:

- It is further recognized that atomic energy plays so vital a part in contributing to the military power, to the possible economic welfare, and no doubt to the security of a nation, that the **incentive** to other nations to press their own developments is **overwhelming**.
- The development of atomic energy for peaceful purposes and the development of atomic energy for bombs are in much of their course **interchangeable and interdependent**.
- These are weapons "in the employment of which **no single nation can in fact have a monopoly**." They argued for international control.

Concern about the inevitability of nuclear weapon proliferation

Nuclear proliferation - countries that considered the bomb

- Sweden
- Switzerland
- **Israel**
- Yugoslavia
- **India**
- **Pakistan**
- South Korea
- **North Korea**
- Japan
- Taiwan
- Argentina
- Brazil
- **South Africa**
- **Iraq**
- **Libya**
- **Iran**

Besides the P-5

- **U.S. - 1945**
- **USSR - 1949**
- **UK - 1952**
- **France 1960**
- **China 1964**

Attempts to limit the spread of nuclear weapons



United Nations, Dec. 8, 1953

“To pause there would be to confirm the hopeless finality of a belief that two atomic colossi are doomed malevolently to eye each other indefinitely across a trembling world. To stop there would be to **accept helplessly the probability of civilization destroyed, the annihilation of the irreplaceable heritage of mankind handed down** to us from generation to generation...”

“To hasten the day when fear of the atom will begin to disappear from the minds the people and the governments of the East and West -

... the United States pledges before you, and therefore before the world, its determination to help **solve the fearful atomic dilemma** - to devote its entire heart and mind to finding the way by which the **miraculous inventiveness of man shall not be dedicated to his death, but consecrated to his life.**”

**Dec. 8, 1953 Eisenhower proposed “Atoms for Peace” at UN
International cooperation rather than international control**

International Atomic Energy Agency (IAEA)



Vienna

1957



The goal of the Nuclear Nonproliferation Treaty (NPT) is to limit the spread of nuclear weapons.

Nuclear Weapon States (NWS)	Non-Nuclear Weapon States (NNWS)
Commit not to assist other states to acquire or develop nuclear weapons	Commit not to develop or acquire nuclear weapons and to implement IAEA safeguards
All agree not to export nuclear equipment or material to NNWS except under safeguards	
All agree to facilitate exchange of peaceful nuclear technology	
All agree to work towards future nuclear (and total) disarmament	

Three pillars – **nonproliferation**, **right to energy**, disarmament

Limited nuclear weapons proliferation during Cold War

Date of first nuclear test

Country

1945 (July 16) United States (Pu)

1949 (Aug. 29) Soviet Union (Pu)

1952 (Oct. 3) UK (Pu)

1960 (Feb. 13) France (Pu)

1964 (Oct. 16) China (U)

1968 (1970) NPT – Nuclear Nonproliferation Treaty

1974 (May 18) India (“peaceful”) (Pu)

1979 (Sept. 22) Enigma in South Atlantic
(South Africa? Israel?)

P-5

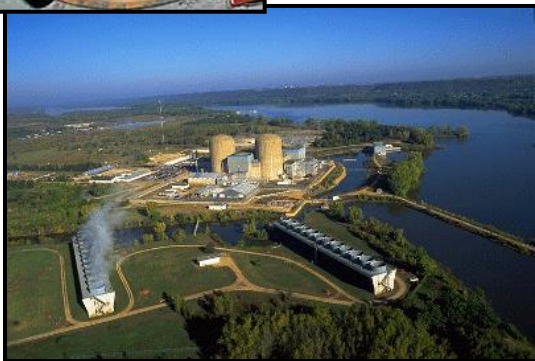
Three forms of nuclear terrorism



- Nuclear detonation – a real WMD;
massive, devastating, no analogue



- Radiological dispersal device – “dirty bomb.”
A weapon of mass “disruption”

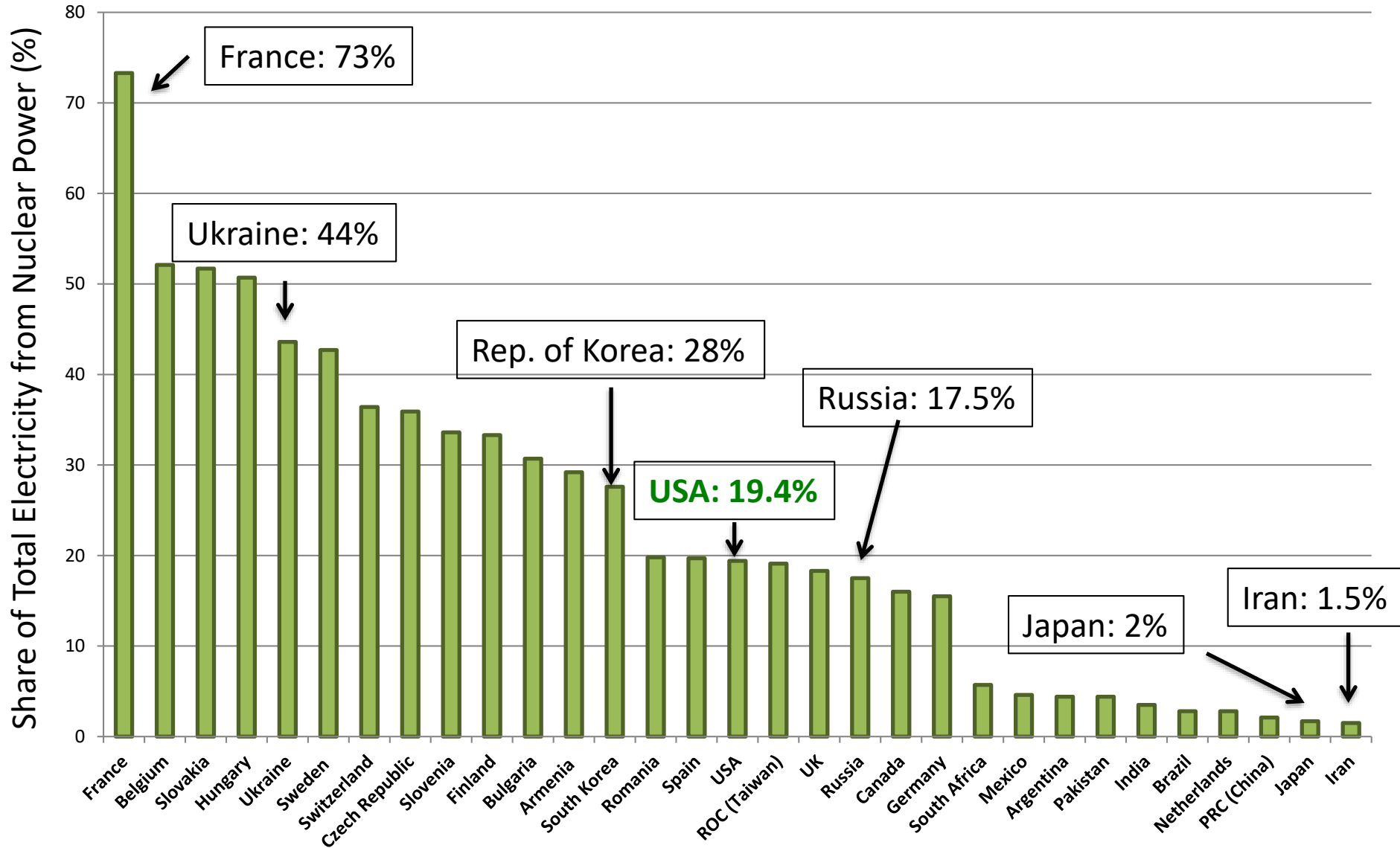


- Radiological sabotage – nuclear facilities.
Radiation release concerns

After initial interest in radiological warfare, the US, UK and Soviet Union abandoned programs.

Nuclear Energy began to electrify the World

Nuclear Share Figures, 2003-2013 - IAEA



The battlefields of the Cold War expanded, but stayed cold

- Uranium mining
- Nuclear materials production
- Nuclear waste
- Nuclear testing
 - 1958 – 1961 nuclear test moratorium
 - 1963 Limited test ban treaty
 - 1974 (1990) Threshold test ban treaty
 - 1996 Comprehensive test ban treaty

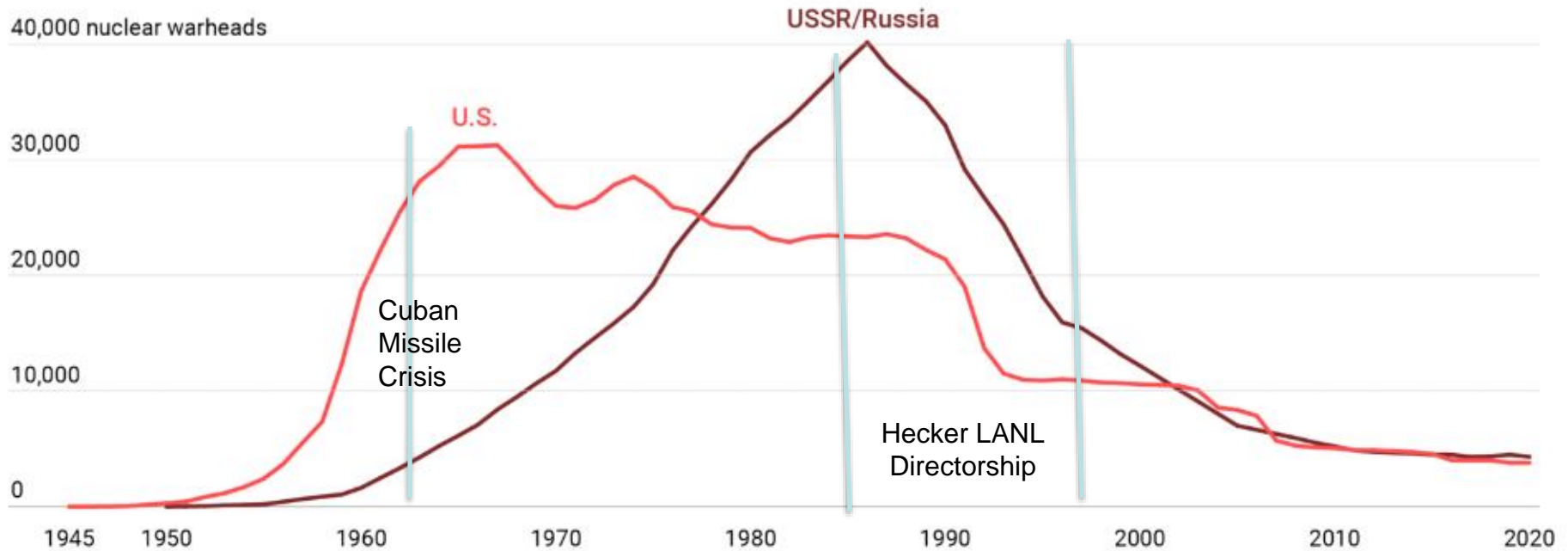
Military nuclear complexes grew enormously

Ending the Cold War – entering a new era

Reagan-Gorbachev Reykjavik Oct. 1986



NUCLEAR ARSENALS OF THE U.S. AND USSR/RUSSIA SINCE 1945



Source: *The Bulletin of the Atomic Scientists' Nuclear Notebook*, written by Hans M. Kristensen and Robert S. Norris, Federation of American Scientists

Arms race, close calls, deterrence + arms control, ballistic missile defense



- **Loose nukes**
- **Loose nuclear materials**
- **Loose nuclear experts**
- **Loose nuclear exports**

Rather than threatened by nuclear weapons in hands of Soviet government, we were threatened by them getting out of hands of Russian government.

Clear and present danger in Russia - 1992

- **Loose nukes**
 - **~ 40,000 nuclear weapons**
- **Loose nuclear materials**
 - **~ 1,400,000 kg fissile materials**
- **Loose nuclear people**
 - **~ 1 million people in nuclear complex**
- **Loose nuclear exports**
 - **Huge complex, with economy in chaos**

It had the making of a perfect nuclear storm

Cooperative U.S.- Russia nuclear threat reduction

- **Nuclear weapons**
- **Nuclear materials**
- **Nuclear workers**
- **Nuclear infrastructure**
- **Nuclear terrorism**
- **Nuclear energy and environmental issues**
- **Scientific research**

From confrontation to cooperation

Yu. B. Khariton greets Los Alamos and
Livermore Visitors in Sarov, 23 February 1992



Edited by
Siegfried S. Hecker

DOOMED
TO COOPERATE



Side by Side as Equals

Keeping fissile materials out of terrorists' hands

Much more difficult than appreciated

- There is a lot of material
- It is in many locations
- It is in many different forms
- It is difficult to handle and count
- Secrecy hampers safeguards

You can't just "lock it down" like the gold at Fort Knox or the Kremlin treasures at the Armory

Semipalatinsk Test Site – April 19 - 20, 1998

US-Russia_Kazakhstan cooperation to keep fissile materials out of the hands of terrorists



Was it worth it?

- **Loose nukes**
 - **Tens of thousands of nukes**
 - **No loose nukes**
- **Loose nuclear materials**
 - **More than 1 million kg of fissile materials**
 - **Very little “leakage”**
- **Loose nuclear experts**
 - **Several hundred thousand nuclear experts**
 - **Little to no nuclear brain drain**
- **Loose nuclear exports**
 - **Huge complex, with economy in chaos**
 - **Some early problems, but much better now**

30 years later: No nuclear disaster

India, Pakistan and North Korea declare nuclear status

Still fewer than 10 countries with nuclear weapons

<u>Date of first nuclear test</u>	<u>Country</u>
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1968	(1970) NPT – Nuclear Nonproliferation Treaty	
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Permanent extension of the NPT in 1995

Signing of Comprehensive Nuclear Test Ban Treaty 1996

BUT

1998	(May)	India (Pu) and Pakistan (U)
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2006	(October)	North Korea (Pu)
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President Bush focused on nuclear terrorism after the tragedy of 9/11

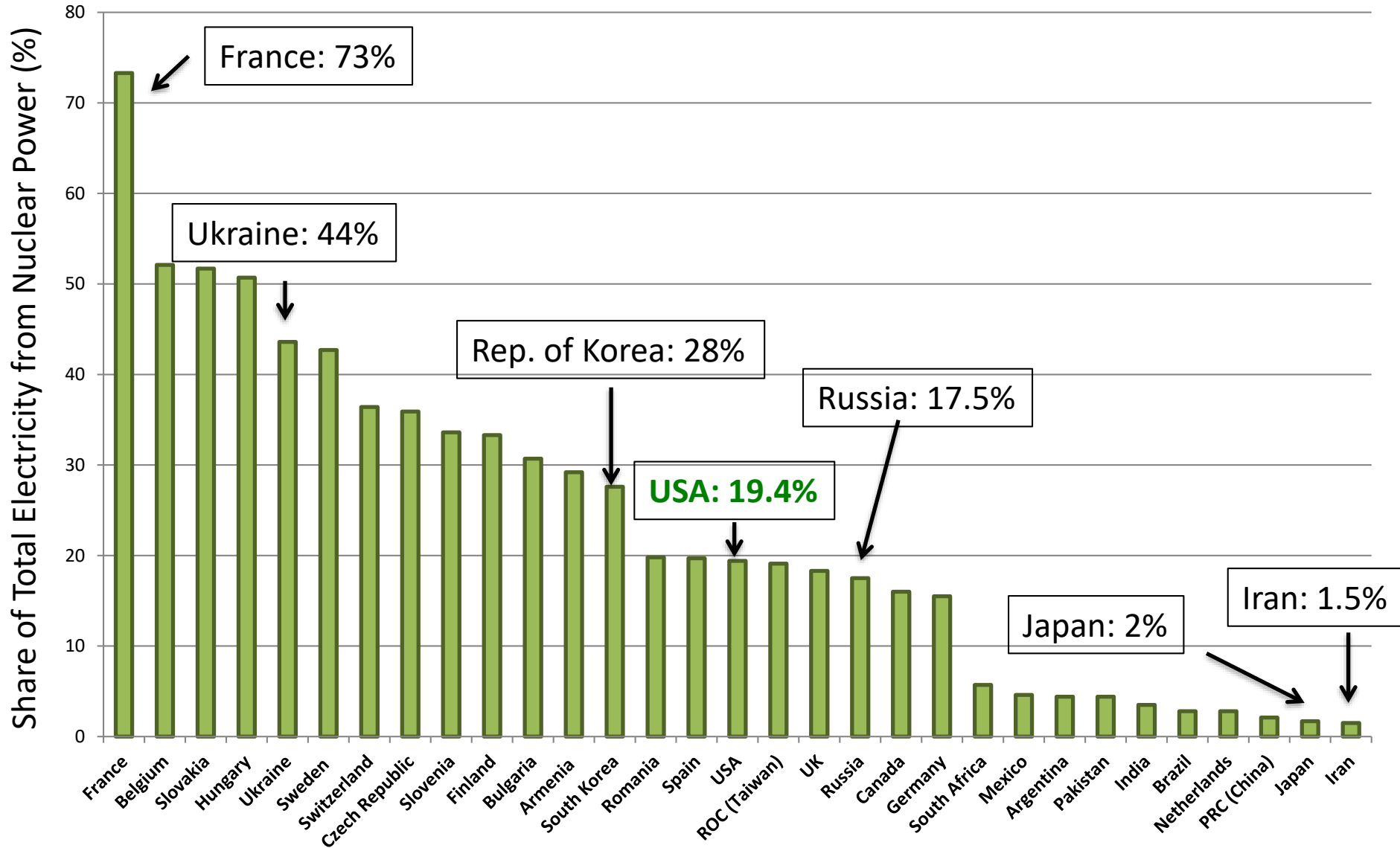
President Obama did as well



**Seoul Summit
March 67-27, 2012**

The early boom in nuclear energy faded

Nuclear Share Figures, 2003-2013 - IAEA



Fukushima Daiichi in 2011

Goji Sasahara / Pool / Reuters



Dealing with the battlefields of the Cold War



DOE environmental cleanup obligations are huge



Photo by Jewel Samad/Getty

June 17, 2013

Signs of heading into a new and bad era

Global nuclear order

- **No-use of nuclear weapons**
 - **No nuclear weapons in war since 1945**
- **Limited proliferation of nuclear weapons**
 - **Less than 10 nations with nuclear weapons**
- **Avoidance of nuclear terrorism**
 - **No nuclear explosions, no dirty bombs**
- **Civilian nuclear power and nuclear medicine**
 - **Electricity without carbon, tens of millions benefit from nuclear diagnostics & treatment**

2014 – Putin makes his first move



Crimea & Russia Together forever

2014 – Crimea and the Donbas

February 24, 2022: Putin blows up the Global Nuclear Order



Zaporizhia NPP

RUSSIA-UKRAINE WAR

Which Ukrainian regions is Russia annexing?

Four partially Russian-controlled regions of Ukraine - **Donetsk, Luhansk, Kherson and Zaporizhia** - will be incorporated into Russia following 'referendums' held in the regions, the Kremlin has said.



The world changed on Feb. 24, 2022



Putin warns that:

- West is playing a dangerous, bloody game
- West will have to talk to Russia
- Accuses West of nuclear blackmail
- Says its dominance is coming to an end

Problem is much deeper than Putin



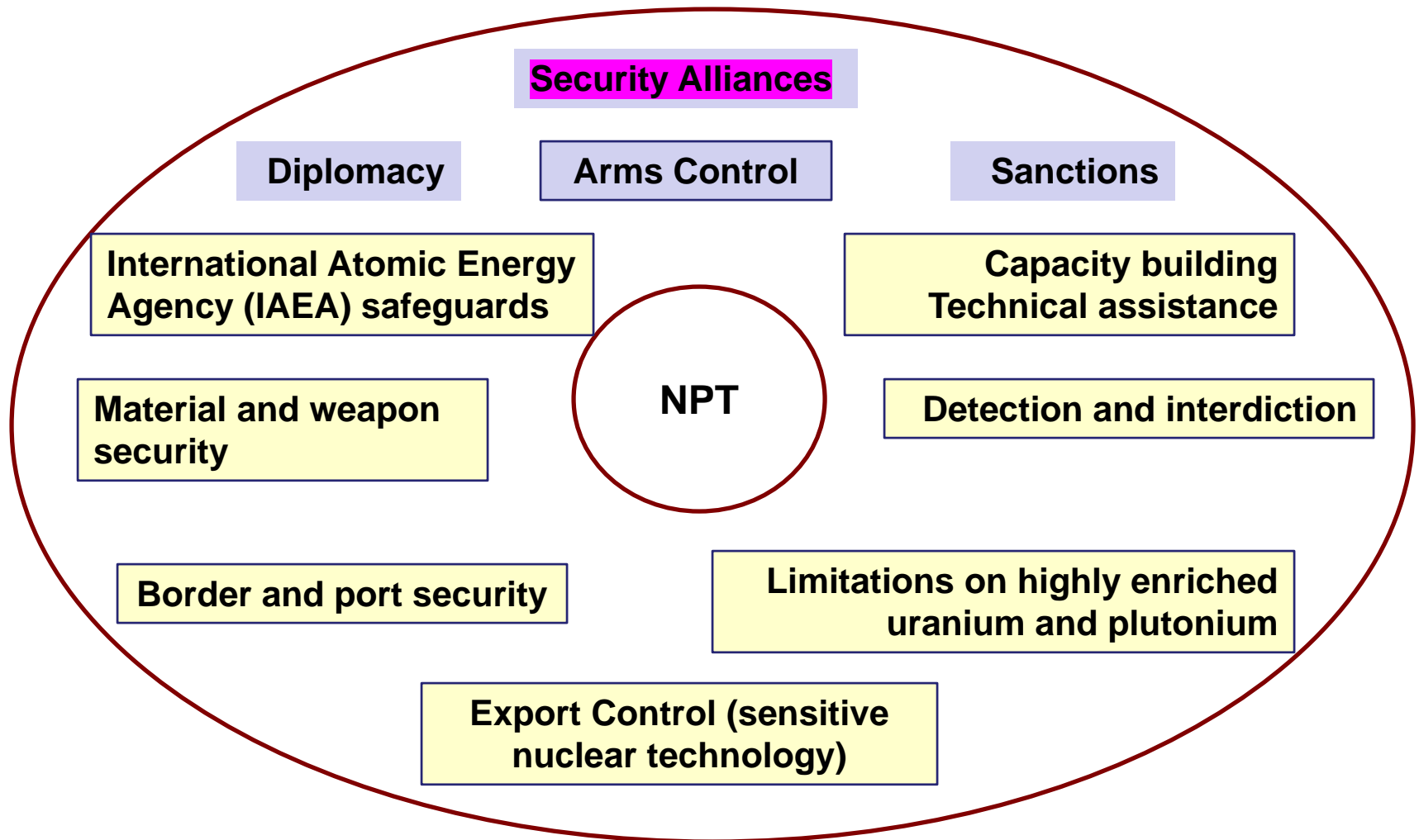
[Sergei Karaganov](#), Dean, Faculty of World Economy and International Affairs at Moscow's Higher School of Economics. Heads the Council on Foreign and Defense Policy.
In RIA Novosti, June 26, 2023:

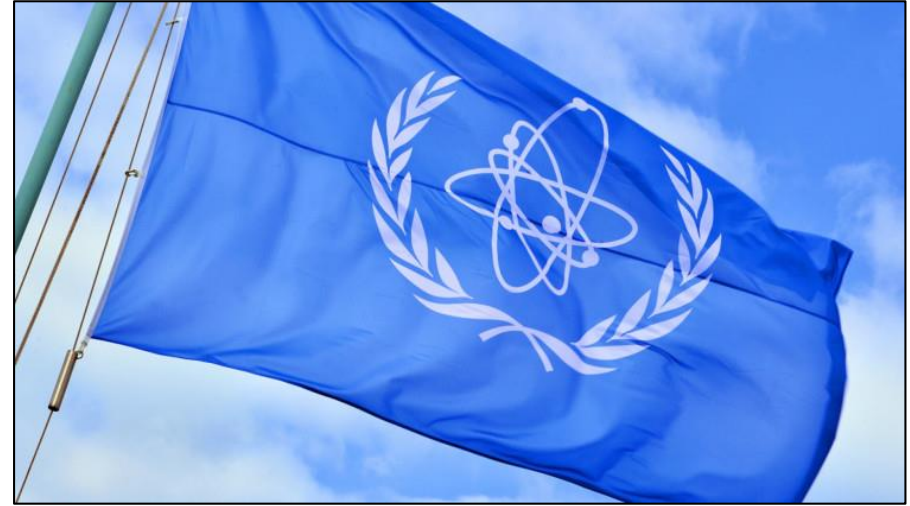
"There is no choice: Russia will have to launch a nuclear strike on Europe".

Putin's war threatens the nonproliferation regime

The regime relies on leadership by **responsible** nuclear states.

Putin's war threatens entire nonproliferation regime





IAEA's Grossi at Zaporizhzhia

Rafael Grossi, Director General of the IAEA, issued the “Seven Indispensable Pillars of Nuclear Safety and Security,” a thoughtful set of self-evident guidelines for nuclear power plants. Yet Moscow has repeatedly violated these principles, just as it has ignored international law on the battlefield.

Russia commits state-sponsored nuclear terrorism

Nuclear power futures post Ukraine

- Hardening NPPs against foreign military incursions
- Negotiate agreements to make NPPs off limits to military attack
- Invasion and sanctions have countries revisit nuclear power to lessen reliance on Russian fossil fuels. Others have heightened their fears.
- Putin has jeopardized Russia's global role in NPPs and fuel cycle services
- Will Russia be a reliable and responsible nuclear supplier?
- What about access to Russian nuclear test facilities?
- What about its contracts with Russian VVER's in Turkey, Bangladesh, Belarus, India, Iran, China, and Egypt?
- What about Russia's relation with IAEA and other international organizations?

Global nuclear power world has turned upside down

