NUCLEAR STABILITY THROUGH TIMES OF TRANSITION

STILL THINKING ABOUT THE UNTHINKABLE

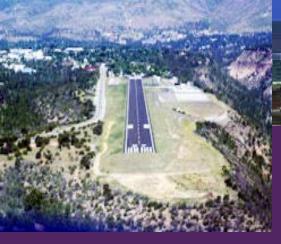
HOUSTON T. HAWKINS - SENIOR FELLOW

PRINCIPLE ASSOCIATE DIRECTORATE

GLOBAL SECURITY

LOS ALAMOS NATIONAL LABORATORY

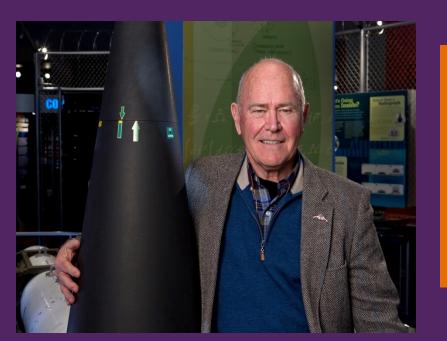




"LOOKING FOR A PLACE TO LAND"

STILL THINKING ABOUT THE UNTHINKABLE

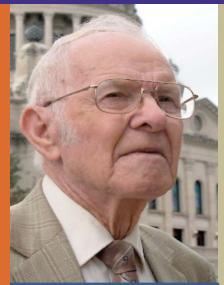
MAINTAINING NUCLEAR STABILITY THROUGH TIMES OF TRANSITION



HOUSTON T. HAWKINS
SENIOR FELLOW
PRINCIPAL ASSOCIATE DIRECTORATE
GLOBAL SECURITY
LOS ALAMOS NATIONAL
LABORATORY

BUT BEFORE WE START LET'S EXPLORE AN INTERESTING SIDE-BAR 1986

The Children's Milk Fund......



Al Gore, Sr. – First elected to the 76th Congress in1938 and to the Senate in 1953. "We flew over hundreds of troop transports. Good Tennessee boys were on those ships and I knew that many of them would never return home.

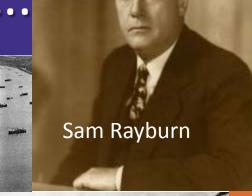
When we landed at Tinian, we saw new coffins stacked ten high along the mile long runway.

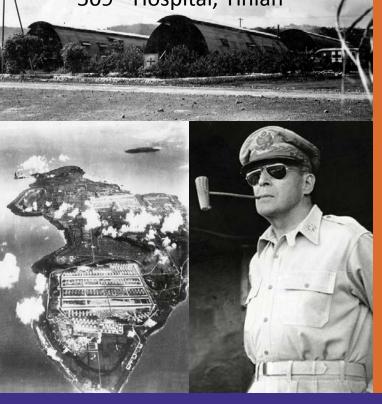
We were then briefed by some general that the new 4,000-bed* hospital was complete. We were heart broken.

Then within a halo of smoke, MacArthur strode in, dismissed the other general, and told us,

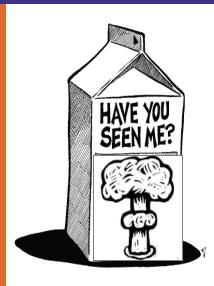
"Gentlemen, the war will be over before you get home."



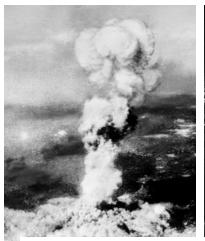


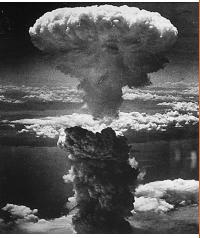


The Children's Milk Fund......









6 August 1945

9 August 1945







THE DAILY SENTINEL Arrangements Being Made For Signing of Surrender



The Children's Milk Fund......





Beginning at Guadalcanal, my Dad was involved in clearing Japanese naval mines for nine assault landings. His boat, YMS-363, was positioned to "sweep" mines before the Operation Olympic invasion of Japan. The probability of his surviving that action was about 20%. But thanks to the "Children's Milk Fund" my Dad came home as did six of my uncles.

The Enduring Legacy of the "Children's Milk Fund"

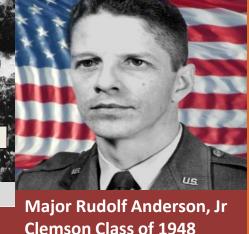
For 3.5 centuries, a major war had erupted in Europe every 11.9 years and lasted for 6 years. Death rates from these wars had escalated as the means to accurately deliver lethal force escalated. Ironically, this cycle ended with the introduction of nuclear weapons in 1945. In essence, the potential for nuclear weapons to deliver lethal force reached a scale that made war between the major combatants prohibitive.



Nuclear weapons have not prevented war but the escalation of war......







• Korean War 1950-1953

• Cuban Missile Crisis 1962



• Vietnam 1955-1975



• Desert Storm 1990-1991



- Desert Fox 1998
- Iraqi Freedom 2003-2011
- Afghanistan 2001-?

Nuclear weapons stalemated the Soviet Union until it died from within......





1989 Prague 1991 Moscow 1991 USSR Ends

Every year from 1450 until the advent of nuclear weapons in 1945, Russia had annually acquired approximately 13,000 square miles of new territory (~size of Belgium).

President Obama's New Nuclear Weapons Policy Statement, 19 June 2013



- We affirm that the US will maintain a credible deterrent.
- The US will only consider the use of nuclear weapons in extreme circumstances.
- We will examine and reduce the role of launch-under-attack in contingency planning.
- We will codify an alternative approach to hedging against technical or geopolitical risks.
- We reaffirm that as long as nuclear weapons exist the US will maintain a safe, secure, and effective nuclear arsenal that guarantees the defense of the US, our allies, and our partners.

Thinking about the Unthinkable...

 The smaller arsenal envisioned by President Obama possibly could be down to a third of the current arsenal or approximately 1,000 weapons. That said, the purpose of this lecture is not to question numbers. However if the nuclear arsenal of the United States is reduced, the direct and ancillary consequences of those reductions need to be carefully evaluated and hopefully addressed.

Also Thinking about the Unthinkable...





 In his 2013 end-of-year address to the Russian Parliament, **President Vladimir Putin** recently reported, "In our efforts to upgrade our nuclear arsenal, we are reaching new milestones successfully and on schedule. Some of our partners will have to hurry to catch up."

⁻⁻ The lion and the lamb may lie down together, but the lamb won't get much sleep. -- Woody Allen



DEFINING THE BACKGROUND FOR NEGOTIATIONS

- A. Major foreign force improvements, especially in strategic nuclear weapons and delivery systems
- B. Reemergence of confrontational strategies
- C. Growing proliferation of nuclear material pointing toward nuclear weapon production
- D. Expansion of international terrorism with hatred toward the United States and stated desires to obtain nuclear weapons
- E. Development of alliances and international cabals with ties to terrorist networks
- F. The "graying" and waning of American technology superiority

BACKGROUND A: Major Foreign Nuclear Force Improvements



By early 2017, new missile systems will constitute 80% of Russian ICBMs. This renovation will include the RS-24 Yars, a new liquid propellant ICBM each carrying up to 10 new RVs designed to counter any US ABM technology.* Also included will be a new rail-mobile ICBM and a new heavy-lift ICBM to replace the SS-18 Satan.

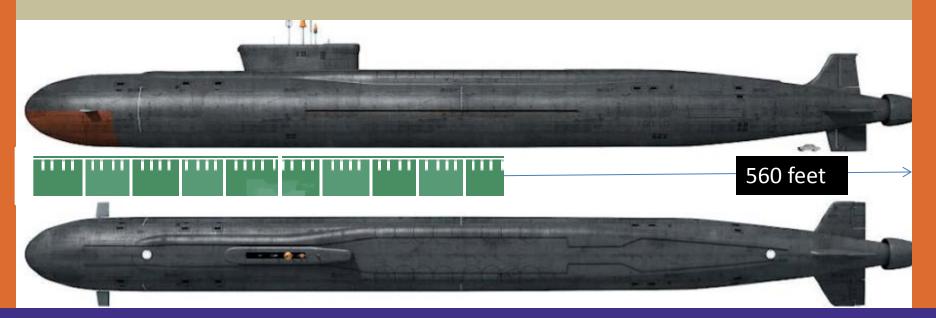




•Statements by Russia's Strategic Missile Force Commander, Col. Gen. Andrei Shvaichenko

BACKGROUND A (cont'd) Major Russian Force Improvements

- By 2020 the Russian Navy will have 8 new Borei-class SSBNs.
- Each of the Borei-class SSBNs will carry 16 new solid-fuel Bulava R-30 SLBMs with a range of over 10,000 km. Each Bulava "Mace" missile will carry 6 individually targeted RVs for a total of 768 newly designed and manufactured warheads.



BACKGROUND A: 2013 Major Russian Strategic Exercises



30 October 2013: Exercise included S-300 and S-400 defense systems; launches of 2 ICBMs (1 Topol and 1 SS-18); 2 SLBMs; 4 SRBMs (1 Islander and 3 Tochka-Us); 6 TU-95M and 2 TU-160 flights to Venezuela.

BACKGROUND A (cont'd) 2013 Major Russian Strategic Triggers



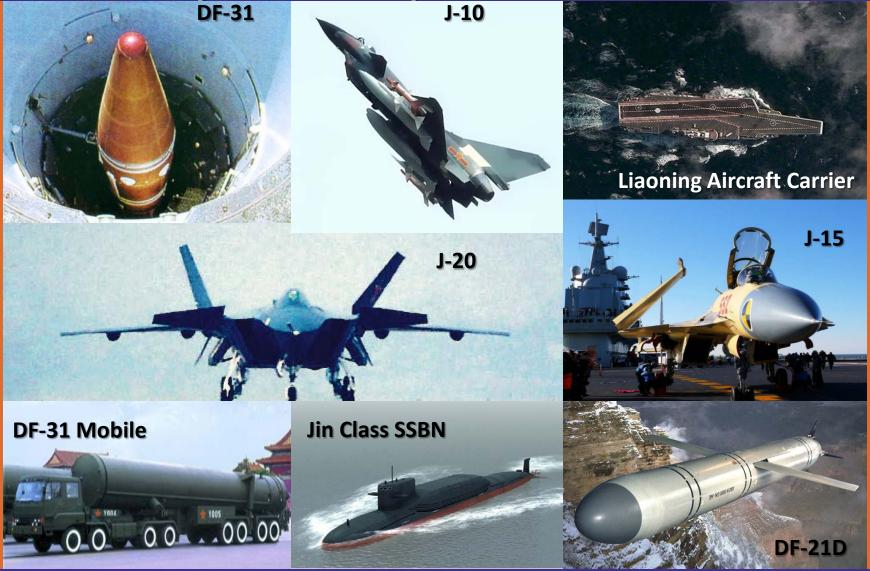




- US/NATO installation and expansion of the missile defense system in Europe
- US/NATO movements and actions to project "force" globally, in particular with regard to the Middle East.
- Attempts by US/NATO to militarize the Arctic
- Western "interference" in the Ukraine
- The US "Prompt Global Strike" program

BACKGROUND A:

Major Force Improvements China



BACKGROUND B: Reemergence of Confrontational Strategies



BACKGROUND B: Reemergence of Confrontational Strategies



BACKGROUND B: Reemergence of Confrontational Strategies



BACKGROUND C: Growing Problem of Nuclear Proliferation "Searching for Status and Hegemony"



²²

BACKGROUND D: Growth of Highly Networked International Terrorism



BACKGROUND E: New Alliances, International Relationships, and Cabals



BACKGROUND F: The "Graying" of American "Know How"



Crews are younger than the weapons they are servicing.



Airmen of the 62nd Airlift Wing strap down simulated B-61 nuclear bombs to a C-17 Globemaster III. The 62nd Airlift Wing received top honors as the nation's prime nuclear airlift force after a week-long inspection. (Defense Department photo/ Benjamin Faske)

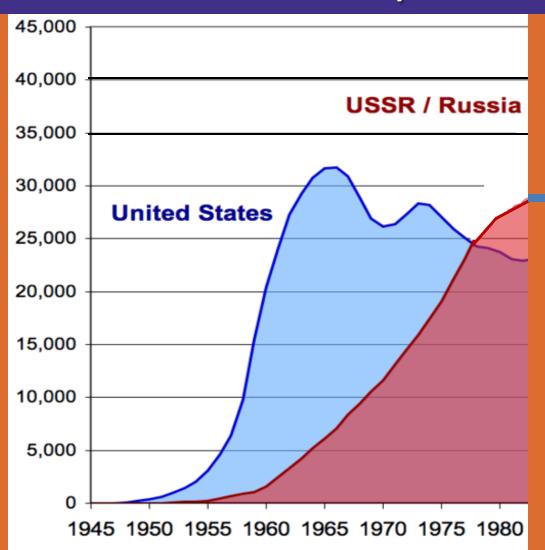


1. PROBLEMS WITH NUMBERS PER SE

- Historical errors in sizing foreign nuclear arsenals
- Bypassing "tactical" nuclear weapons in negotiations to reduce "strategic" nuclear arsenals
- At lower levels, a perceived inability for the US to provide "nuclear umbrellas" to nations capable of producing their own nuclear weapons



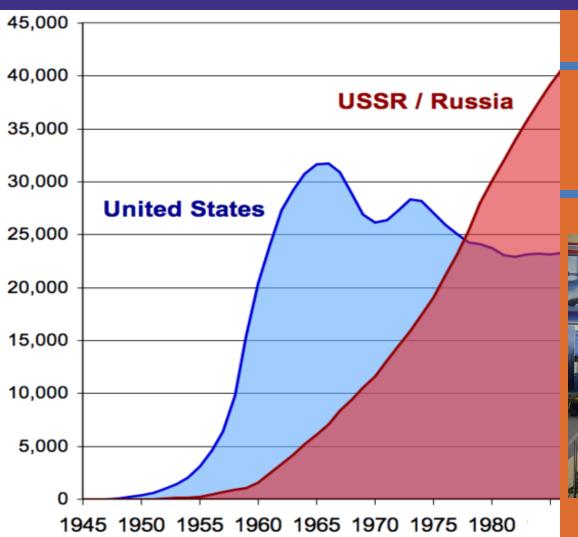
Underestimation of Nuclear Weapon Arsenals



ASSESSMENT = ~28,000 Russian Nuclear Weapons



Underestimation of Nuclear Weapon Arsenals



RUSSIA HAD 42,000 NUCLEAR WEAPONS ERROR = 14,000

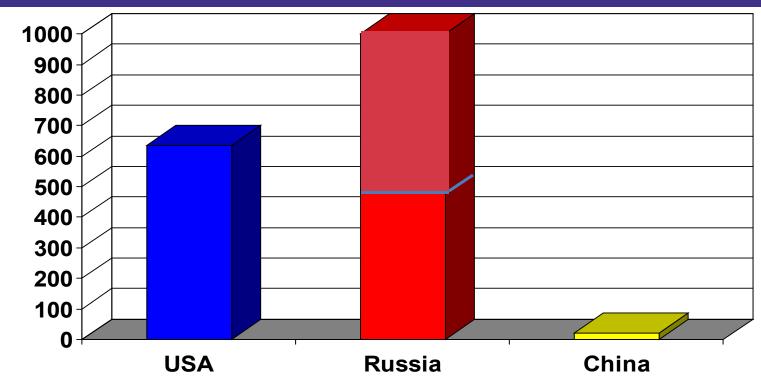


Undetected Changes in Important Nuclear-Weapon Related Technologies



In 1987, the Starbird Study – contrary to the US IC-- concluded that Russia had converted its diffusion enrichment plants to "dense packed" centrifuges.

Highly enriched uranium inventories, metric tonnes*



At the end of the Cold War, Russia's inventory of Highly Enriched Uranium was 500 metric tonnes larger than US intelligence estimates but consistent with estimates in the Starbird Study (1979).

*Albright and O'Neill, The Challenge of Fissile Materials Control, ISIS Reports, Washington DC

Bypassing Tactical Nuclear Weapons in Nuclear Arms Reduction Agreements



If a nation's people, allies, and interests are within range of tactical nuclear weapons, the difference between tactical and strategic is a non sequitor.

Perceived Inability for the US to Provide Allies with "Nuclear Umbrellas"



"It is vital to have a nuclear deterrent, whatever the cost. For us, it is not just one of a number of options but rather an inevitable necessity in a world that only understands the logic of power."

2. PROBLEMS WITH TECHNOLOGY SURPRISE

- Significant, but undetected changes in important nuclear weapon related technologies (e.g. the previously mentioned enrichment by centrifuges vice diffusion barrier)
- The faulty assumption that every nuclear weapon aspirant will follow the path that we have explored
- Deployment of "new-class" weapons (e.g. Soviet ERW)
- Unknown but critical vulnerabilities (e.g. x-ray induced explosive blow-off of heat-shield ablatives)
- The dangerous belief that all important nuclear weapon discoveries have already been made
- A few other technological surprises

Faulty Assumption: All Nuclear Weapon Aspirants Will Follow Our Paths



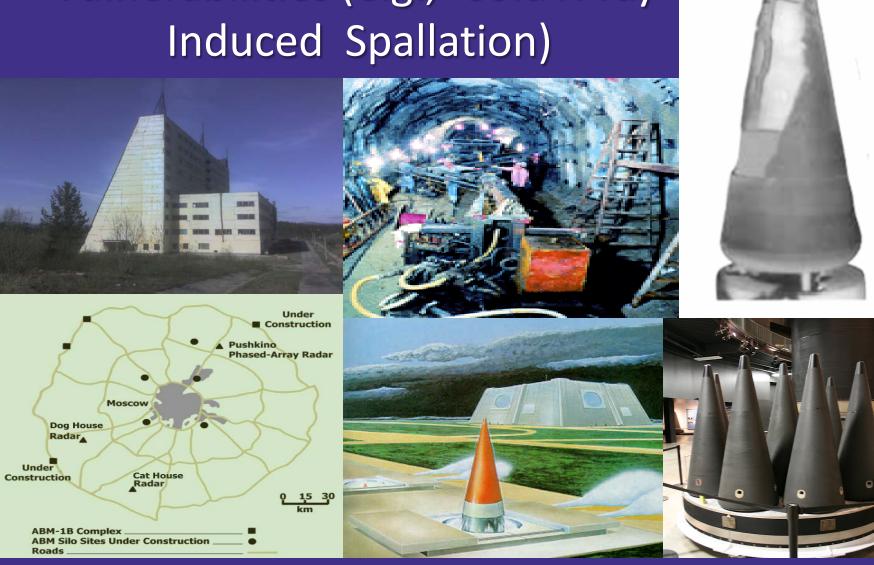
Andrei Sakharov Igor Kurchatov

"Layer Cake" Design Joe-4 (~400 KT)



1962

Unknown But Critical Vulnerabilities (e.g., Cold X-ray Induced Spallation)



A Dangerous Belief: All important nuclear weapon discoveries have already been made...



We do not know specifically what might have been tested in the Novaya Zemblya kolbas, but...



Dmitry Rogozin



lvan Kamenskikh

In early March 2012, a day before the visit of Deputy Prime Minister Dmitry Rogozin, a first series of awards were presented to VNIITF employees. First Deputy Director General of Rosatom Ivan Kamenskikh presented the awards and noted that "this is the conclusion of eight years of work on a new weapons set; it was accepted and today we give awards".

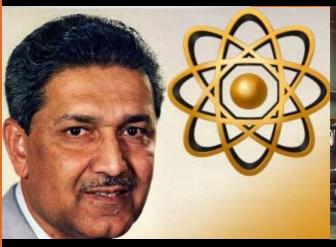
A Few Other Important Technological Surprises

First Russian Test 1949 First Chinese Test 1964 First

First Indian Test 1974









A.Q. Khan Network 1980-2001 Tarmiya Ir

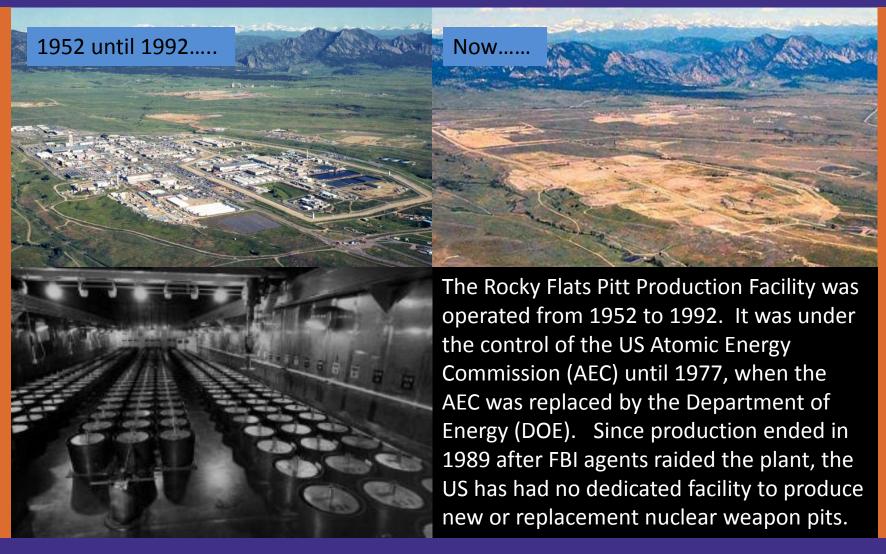
Tarmiya Iraq EMIS 1991

Iraqi Aluminum Tubes 2003

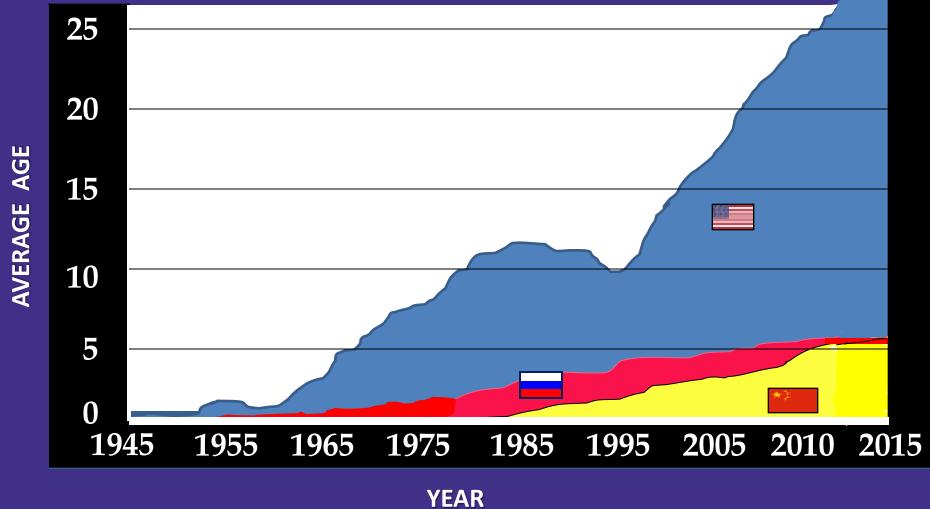
3. PROBLEM WITH INEQUITIES IN THE AGE OF WEAPONS AND CAPABILITIES TO MAINTAIN & CERTIFY THEM

- Since the closure of the Rocky Flats Facility, the US has employed a certification strategy based on assured maintenance of increasingly aged components
- Russia and China continue to base certification on replacement of older weapons with new ones
- Some tools and materials necessary for maintaining our aged components are no longer being manufactured
- Only two of the major nuclear weapons states (Russian and China) have continuous underground test programs
- The edge that the US once enjoyed in computing and material sciences has been lost.

The Closing of the US Pit Production Facility, Rocky Flats, Colorado



Approximate Age of US, Russian, and Chinese Nuclear Weapon Stockpiles

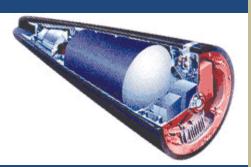


Examples of Older US Weapons Under Life Extension Programs...........



The B-61 was developed and tested in 1963. It has had eleven modifications. Some of the materials used in the B-61 such as certain plastics, lubricants, and ceramics are no longer

being produced.



Development of the W76 began in 1973 and manufacturing from 1978 to 1987. It is currently undergoing Modification 6.6.





The W78 was designed in 1974 and used with the USAF Minuteman ICBM. Deployment began in 1979. It is currently undergoing Modification 6.2.





Examples of Age Related Changes in Nuclear-Weapon Materials

- a. Los Alamos metallurgists have repeatedly observed that the density of plutonium spontaneously changes over the duration of the average age of weapons in the US stockpile. Since density is a fundamental contributor to weapon performance, what effect – if any – do these changes have on weapon performance?
 - b. Most polymers are inherently unstable. Their crosslink structures spontaneously change, as does the distribution of plasticizers. Both effects are compounded by the fact that the materials are continuously irradiated within the weapons as they age.
 - c. Under irradiation and decay over the average age of weapons in the US inventory, the mechanical properties of some metals have changed. At least some of these metals become more brittle in this regime and are thus more prone to failure during transport.

Before negotiating lower nuclear weapon levels, we need to fully understand where our own capabilities are today (especially for increasingly older weapons)

DO WE REALLY KNOW?

"Over the decades of nuclear weapons development, neither NNSA nor its sites have treated the maintenance of original nuclear weapon information as a priority. Data and drawings for US nuclear weapons have not been maintained in a dependable manner. Officials were unable to explain to the inspectors why these [undocumented] changes had been made, but reported that they had 'assumed' the changes were needed."

Report from DOE IG/06 Apr 2014

Additional Troubling Trends*.....

After the FY14 program was issued, DOE concluded that the revised plan could not be achieved with the planned resources including several billion dollars a year in direct funding that already had been transferred to NNSA. As a result, the FY15 program further delayed these critical programs:

- W78/88-1 LEP** was delayed 5 years (2025 to 2030).
- Long Range Standoff (LRSO) warhead was delayed to 2025-27 and the USAF's LRSO missile may not reach IOC until ~2030.
- CMRR*** facility was zeroed out at LANL and the alternate plutonium strategy, advanced and funded in the FY14 request was delayed an additional 5-years in the FY15 program.
- Management problems and cost overruns at the Uranium Processing Facility slowed down that effort; per a recent "Red Team" report, the entire concept is now being rethought.

^{*}Peter Huessy Breakfast Seminar Series; John R. Harvey; 5 June 2014

^{**}Life Extension Program

^{***} Chemistry and Metallurgy Research Replacement Facility

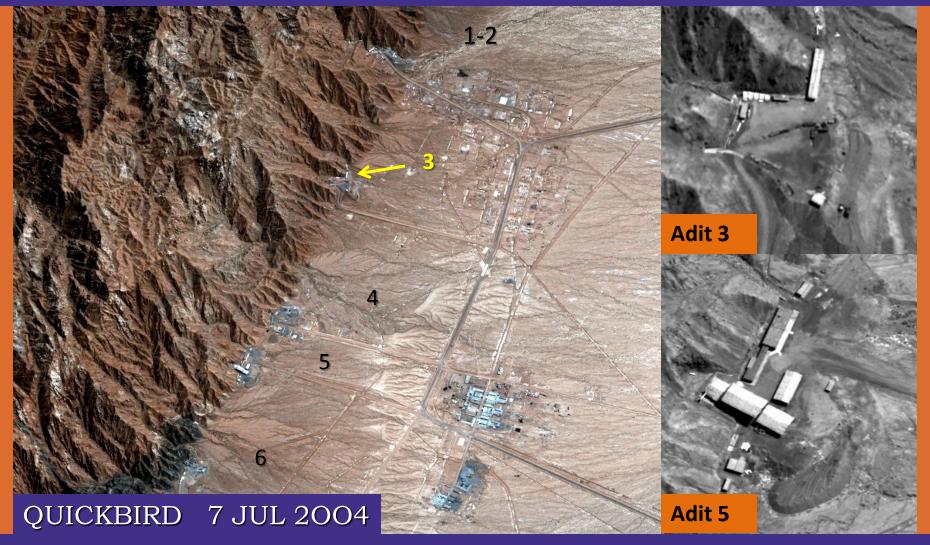


Novaya Zemlya (NZ) (Complex, Continous Activities)





China's Lop Nur Qingger Site, (Complex, Continous Activities)





Losing the US Technology Edge (e.g., Computing and Materials Science)



China's 33.68 petaflop Tianhe-2 super computer has 16,000 computer nodes each having two **Intel Ivy Bridge** processors and three Xeon Phi micro-processors. By 2015, the Tianhe-2 is expected to reach 100 petaflops.

4. PROBLEMS WITH MAJOR DIFFERENCES IN PRODUCTION CAPABILITIES

- Since 1989 when production ended at the Rocky Flats facility, the US has lacked the ability to accelerate new builds were that to become necessary.
- Russia and China continue to depend on certification based on continuous new nuclear weapon component builds.
- This approach provides Russia and China with significant potentials to reconstitute or to grow the size of their nuclear arsenals and to introduce new technology.
- Any arms control agreement dealing with nuclear weapon inventories must include production potentials including components (e.g., pits) and the nuclear weapon materials plutonium, highly enriched uranium, and tritium.

⁻⁻⁻In the long run, the greatest weapon of mass destruction is stupidity. - Thomas Sowell---



Los Alamos PF-4 (small section now used as the US Pit Production Facility)



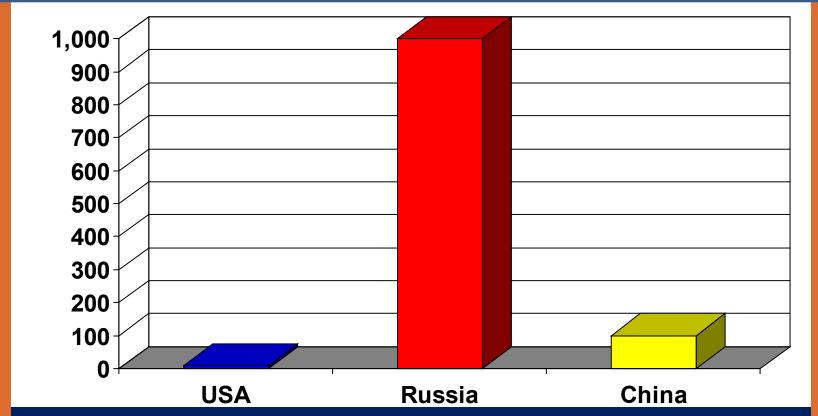


Russian Pit Production Facilities

For example: Seversk, Mayak, Lesnoy, Penza, and others

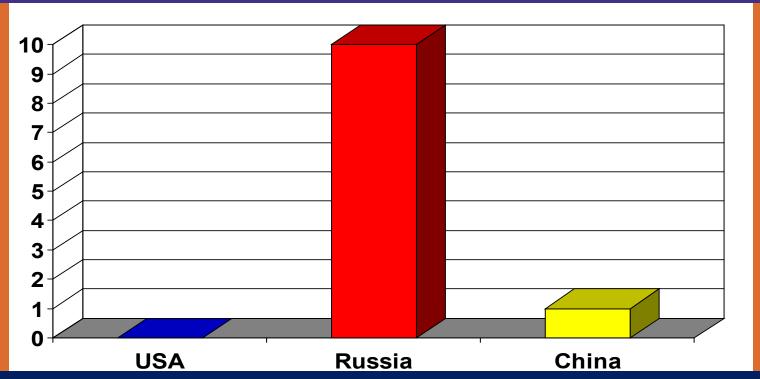


Annual Nuclear Weapon Pit Production Estimates 2013



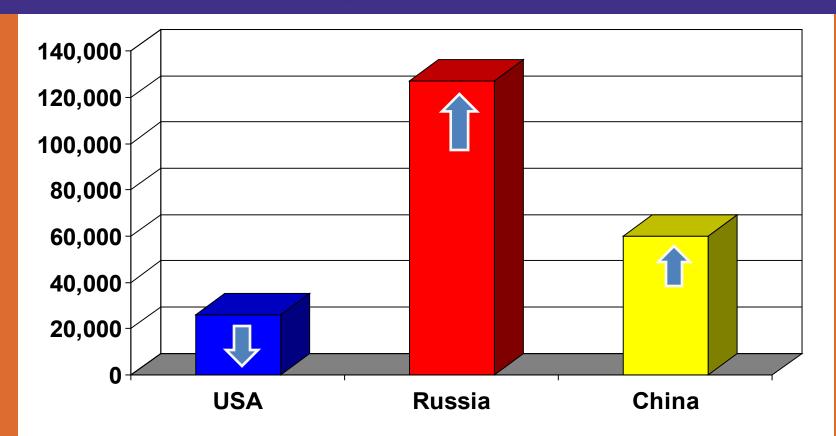
Russian has several facilities actively involved in pit production. Other pit production facilities have been "mothballed" but are still useable if needed. China is building new pit production facilities that will significantly increase pit output and the number shown is probably an underestimation.

Annual Tritium Production for Weapons, Kilograms



After shutting down its production reactors, the US is now using three civil nuclear power reactors in Tennessee to produce replenishment tritium. Russia uses two reactors at Mayak (Ruslan and Lyudmila) to produce tritium for nuclear weapons but can also employ its RBMK power reactors for that purpose if needed.

Estimated Staffing of Nuclear Complexes, 2012



Differences in staffing levels could reflex differences in efficiencies but are primarily due to retention of production capabilities in Russia and China and the dismantlement of such capabilities in the US.

5. PROBLEM WITH ANCILLARY DANGERS DURING TRANSITIONS TO LOWER STOCKPILES

- With the end of collaborative programs to secure the fissile materials excessed during builddowns, the threat of diversion of these materials could increase.
- The role of a small number of nuclear weapons as a path to regional hegemony will be heightened.
- Transition to deterrence involving multi par-actors with a few hundred nuclear weapons will be more complicated.
- Replication of "cheap" nuclear weapon material production
- Changes in targeting strategies, e.g. back to "MAD."
- Further cuts in nuclear intelligence programs could be substantially more problematical at lower levels.
- Is the demise of greatness upon us?

⁻⁻He who beats all his swords into plowshares might have to plow for him who does not.-

Greater Threat of Diversion of Special Nuclear Materials





Pu



First Plutonium 7/5/1941





Russia Ends Nunn Lugar Program 2012



Transition to Multi-par Nuclear Deterrence with Several Actors Holding a Few Nuclear Weapons

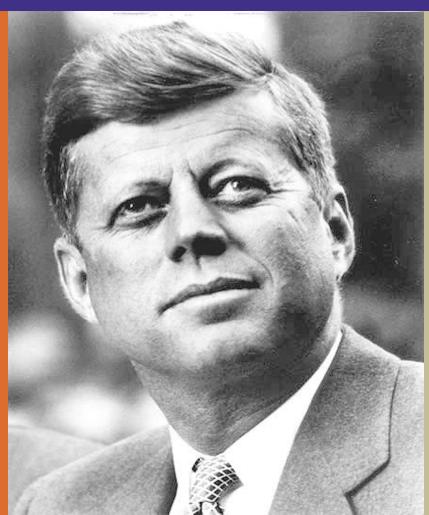








Address to the Nation on the Nuclear Test Ban Treaty 26 July 1963



I ask you to stop and think for a moment what it would mean to have nuclear weapons in so many hands, in the hands of countries large and small, stable and unstable, responsible and irresponsible, scattered throughout the world. There would be no rest for anyone then, no stability, no real security, and no chance of effective disarmament. There would only be the increased chance of accidental war, and an increased necessity for the great powers to involve themselves in what otherwise would be local conflicts.

Replication of Extant Nuclear Weapon Materials Production

Gas Centrifuge
Plant at Kahuta,
Pakistan

Heavy Water
Plant at Khushab,
Pakistan

40 MWt D₂O Reactor at Khushab, Pakistan

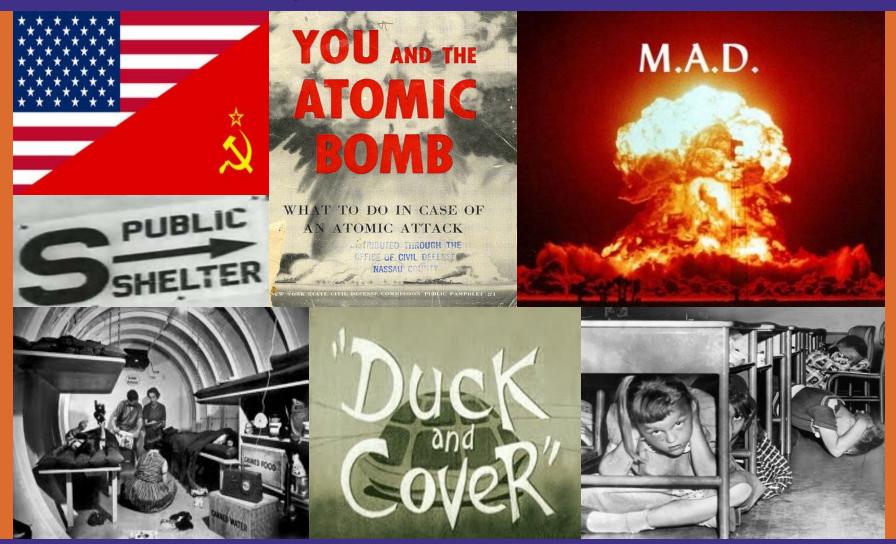


Gas Centrifuge Plant Natanz, Iran

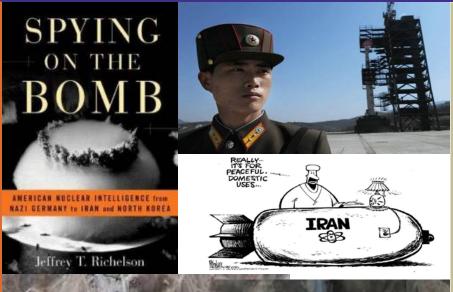
Heavy Water Plant at Arak (Khondab), Iran

40 MWt D₂O Reactor at Khondab, Iran

Changes in Targeting Strategies? Back to "Mutually Assured Destruction"



Further Cuts in Nuclear Intelligence





- The "nuclear" titled divisions in both the CIA and DIA no longer exist.
- Since the late 1980s, US nuclear intelligence programs have been significantly reduced.
- Where growth has occurred in the IC, it has primarily been in coordination and control bureaucracies and away from the core nuclear and related intelligence assessments.
- Meanwhile, "nuclear proliferators and terrorists" will not be at the negotiation table, likely will have greater access to fissile nuclear materials, and will be looking for exploitable opportunities

6. PROBLEM OF HEIGHTENED CONFLICTS IN A NUCLEAR WEAPONS FREE WORLD

- Competition for resources and technological advantages has led to global war, is taking place today, and will likely intensify.
- Historical regional enmities -- kept at bay for decades -- are now reemerging.
- The international terrorists seeking nuclear weapons will not be part of the negotiations.
- Other weapons of mass destruction could become compounding threats.

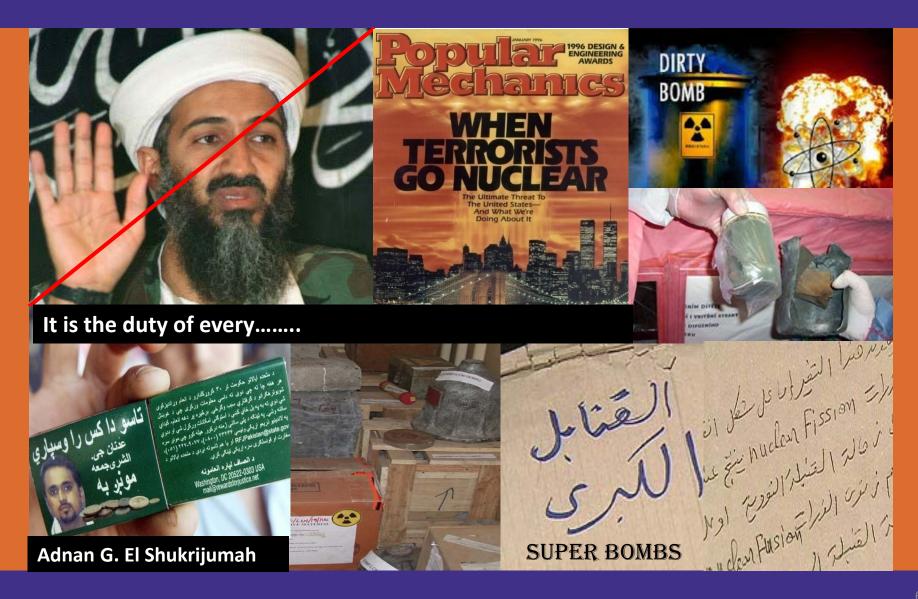
Historical Regional Enmities Remerge



Competition for Resources



Nuclear Terrorism

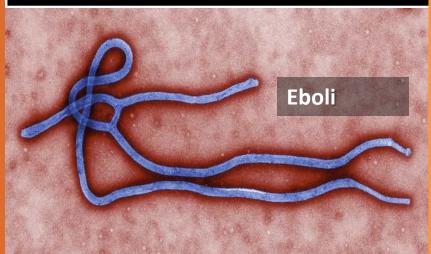


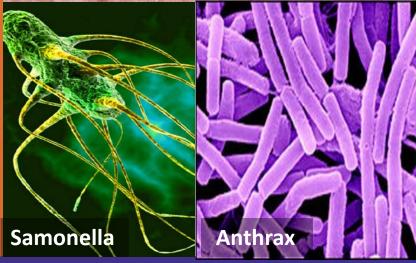


Reverting to Other WMDs



Biological Agents, (below)





Chemical Agents, e.g. Sarin, VX, Novichok



Iraqi Kurds-1988

Syria-2013

Critical Infrastructure Attacks





Is a "Demise of Greatness" beginning to cast shadows upon us?



- In 2007, an Air Force *B-52* bomber flew across the central United States with nuclear weapons mistakenly attached to its wings.
- An investigation of the use of illegal narcotics involving 11 officers at six bases, including Malmstrom AFB launch control officers, is underway.
- In April 2013, seventeen officers at Minot AFB in North Dakota were deemed temporarily unfit for duty for cheating on tests.
- At least twice in 2013, Air Force officials punished officers who left blast doors open in their underground command posts while they were sleeping — a breach that could allow a compromise in security.
- The Commander of the USAF's 20th ICBM Command was relieved of his command in October 2013 for binge drinking and acting rudely during a trip to Moscow.
- The Commander of 341st Missile Wing, Malmstrom USAF Base resigned and nine officers were removed from their jobs due to a test-cheating scandal.
- A recent RAND Corporation report concluded that members of the nuclear missile force were feeling "burnout" and stress.
- Court marshals of airmen and officers in missile operations are twice that of other USAF elements.

CONCLUSIONS

- No one is advocating a return to the Cold War.
- Migration to lower levels of nuclear weapons is a reality that is going to happen
- However, in achieving reductions, we cannot afford to move down paths that may not be fully mapped. Otherwise the new world we create could be more unstable and dangerous than the one we left.
- WHEN IT COMES TO NUCLEAR WEAPONS, WE **NEED TO BE ALERT AND AGILE FOR WE CAN NEVER AFFORD TO BE SURPRISED.**
 - --- Beware of the man who works hard to learn something, learns it, and finds himself no wiser than before. --- Kurt Vonnegut

ONE FINAL OMINIOUS THOUGHT

"Russia is the only country in the world that is realistically capable of turning the United States into radioactive ash," television presenter Dmitry Kiselyov said on his weekly current affairs show.

Behind Kiselyov was a backdrop of a mushroom cloud following a nuclear blast.

Kiselyov was named by President Vladimir Putin in December 2014 as the head of a new state news agency whose task will be to portray Russia in the best possible light.

