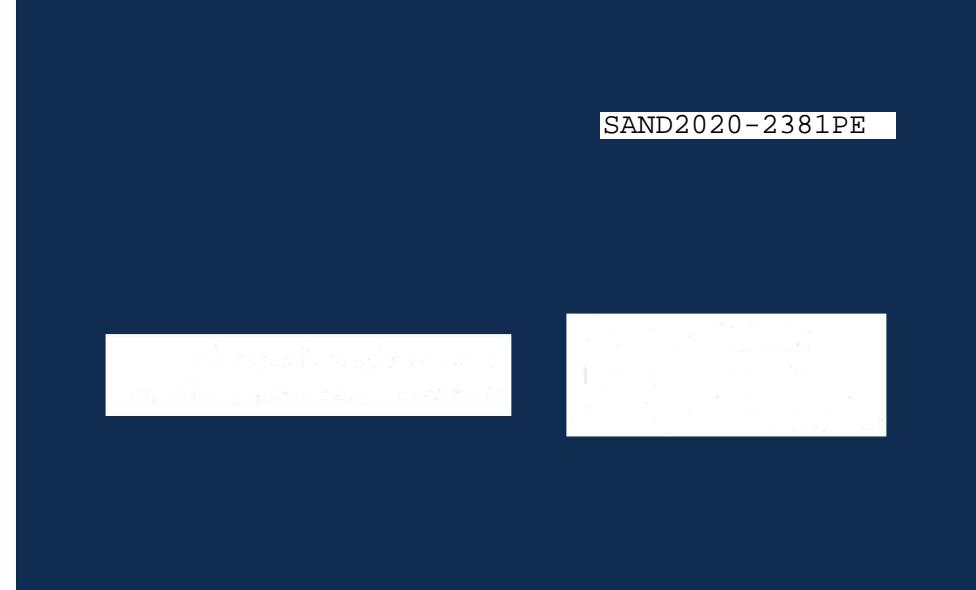


The U.S. Nuclear Triad

Jarret Lafleur, Ph.D.

Systems Analysis & Engineering
Sandia National Laboratories
Livermore, California

February 19, 2020



The Dawn of the Nuclear Triad

From Diad to Triad, 1957-1959

USS George Washington (SSBN-598)

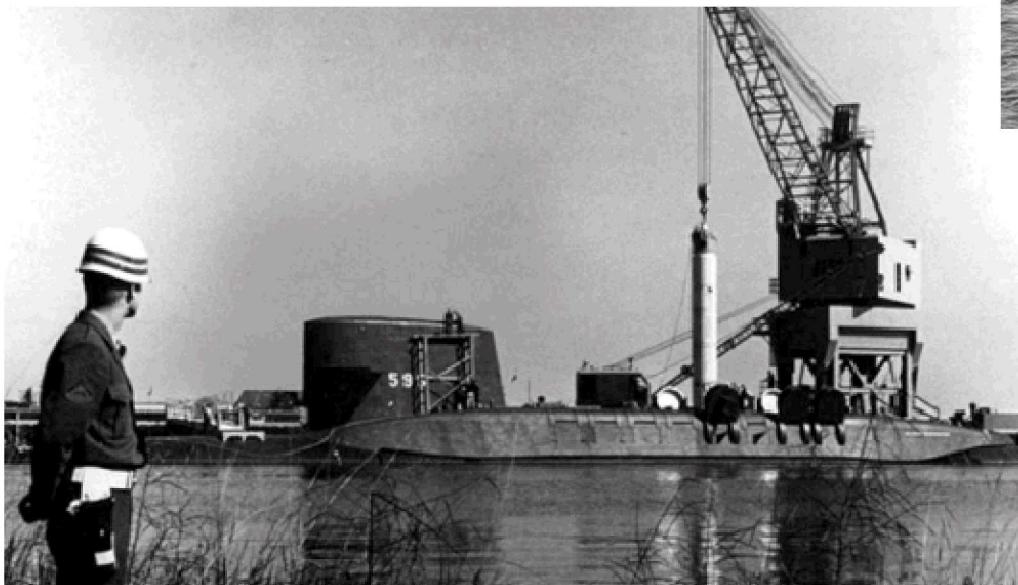
First U.S. Ballistic Missile Submarine

Formerly the USS Scorpion (SSN-589)

Ordered: Dec. 31, 1957

Launched: June 9, 1959

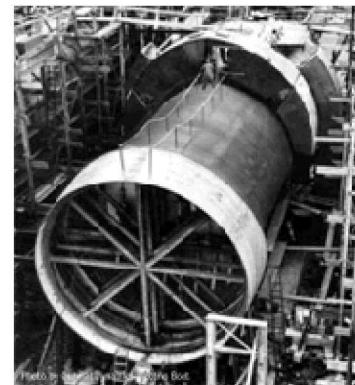
Commissioned: Dec. 30, 1959



Source: http://www.navy.mil/navydata/cno/n87/usw/usw_winter_09/george.html



Source: http://www.navy.mil/view_single.asp?id=79363



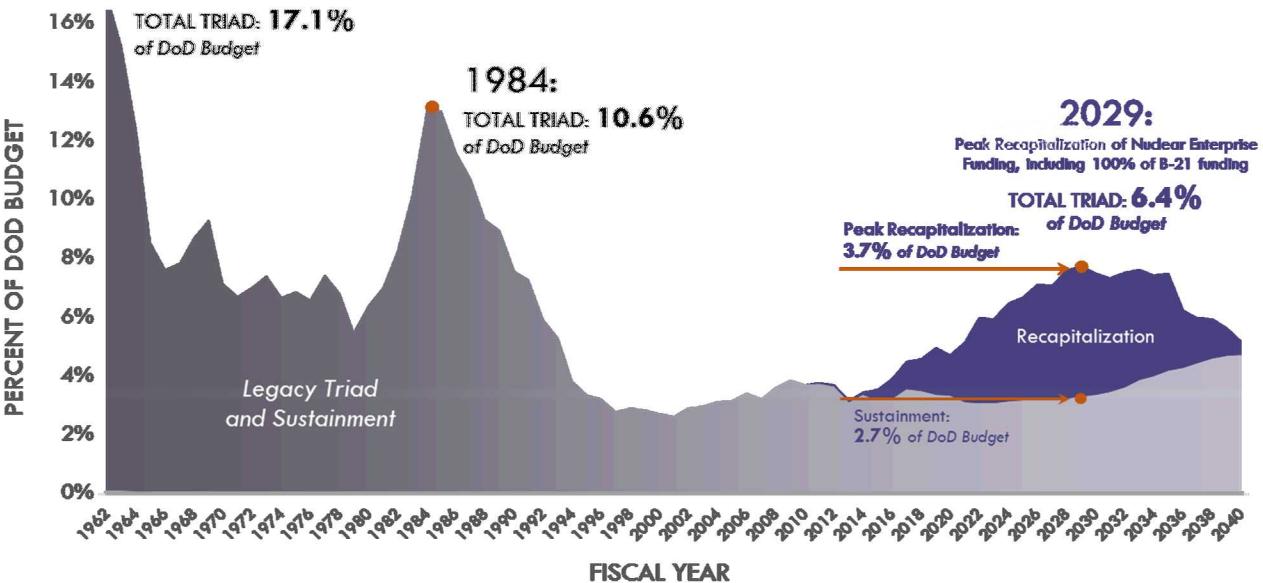
Source: http://www.navy.mil/navydata/cno/n87/usw/usw_winter_09/george.html



A Changing Nuclear Security Environment

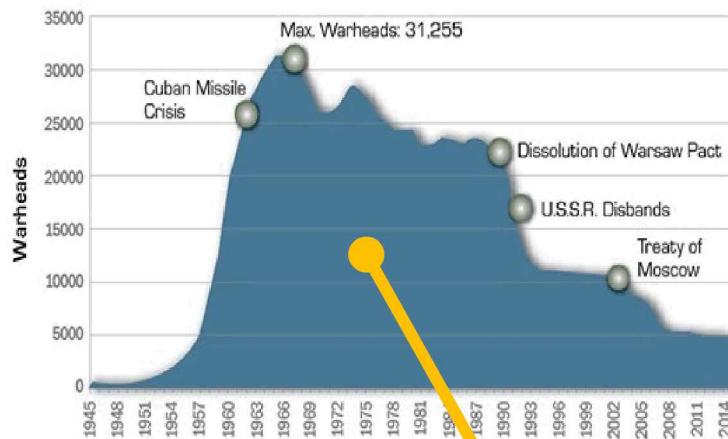
- During the Cold War, U.S. nuclear forces peaked at over 31,000 weapons and a variety of strategic and tactical delivery systems.
- By 2016, stockpile weapons numbered around 4,000, and delivery forces were primarily strategic.
- In 2010, the third Nuclear Posture Review (NPR) recognized two pressing threats: Nuclear Terrorism and Nuclear Proliferation
- In 2018, the fourth NPR recognized:
 - Reemergence of long-term, strategic competition
 - Reduced U.S. number and role of nuclear weapons has been met with others moving in the opposite direction.
 - Unprecedented range and mix of threats, including conventional, chemical, biological, nuclear, space, cyber, and violent non-state actors.

DoD Nuclear Enterprise Funding



Size of the U.S. Nuclear Weapons Stockpile

4,018 weapons as of 2016



System	Weapon Designation	Cold War	Current
STRATEGIC			
ICBMs	Warhead	Yes	Yes
SLBMs	Warhead	Yes	Yes
Heavy Bombers	Bomb Warhead	Yes Yes	Yes Yes
NON-STRATEGIC			
DCA	Bomb	Yes	Yes
GLCMs	Warhead	Yes	
GLBMs	Warhead	Yes	
Artillery	Warhead	Yes	
Air Defense	Warhead	Yes	
ADMs	Bomb	Yes	
NDBs	Bomb	Yes	

The Enduring U.S. Nuclear Triad

Air



B-2 Spirit

Source: <http://www.af.mil/information/factsheets/factsheet.asp?fsID=82>



B-52 Stratofortress

Source: <http://www.af.mil/information/factsheets/factsheet.asp?id=83>



**B61
Bomb**



**B83
Bomb**



**Air Launched
Cruise Missile**

Land



Source: <http://www.af.mil/information/factsheets/factsheet.asp?id=113>



**LGM-30G
Minuteman III**



**Ohio-Class Ballistic
Missile Submarine**

Source: <http://www.navy.mil/navydata/cno/n87/today/ssbn.html>



**Trident II D5
Fleet Ballistic Missile**

Source: <http://www.lockheedmartin.com/us/products/trident-ii-d5-fleet-ballistic-missile-fbm-.html>

Why a Triad?

The Complementary Advantages of Each Leg

Land
(ICBMs)



Sea
(SLBMs)



Air
(Bombers)



Relative Pros

- **High Alert Status**
- Prompt Strike
- **Act as Aimpoints**
- Connectivity

Relative Cons

- Potential for Third Nation Overflight
- **Fixed Launch Points**
- Ballistic, Predictable Paths

- **Survivability**
- High Alert Status
- Rapid Strike Time

- Potential for Third Nation Overflight
- Ballistic, Predictable Paths
- Steam Time
- Connectivity

- **Man-in-the-Loop / Recallability**
- **Flexible Forward Posturing**
- Largest Payloads
- Third Nation Overflight Avoidable
- Only Earth Penetrating Weapon

- **Responsiveness**
- **Target Overflight and Defense Avoidance**
- **Non-Generated Survivability**

Why a Triad?

The Complementary Advantages of Each Leg



Gen. C. Robert Kehler

Council on Foreign Relations, May 30, 2012

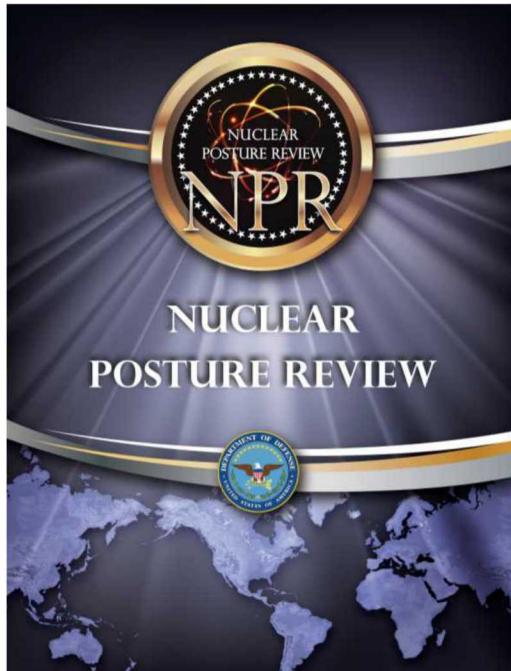
I do not believe that we need a triad because we've always had a triad. I do believe, though, that in the ... position we find ourselves today, that it is, in fact, the appropriate mixture of forces to meet our needs.

It may not always be so ... But I believe today, for the **mixture of attributes** that I cited in my prepared remarks, **as well as the ability that we have with the triad to hedge against technical failure**, for example -- I think that it has served us well and continues to serve us well in this set of scenarios.

Why a Triad?

The Complementary Advantages of Each Leg

2018 NPR on the Triad



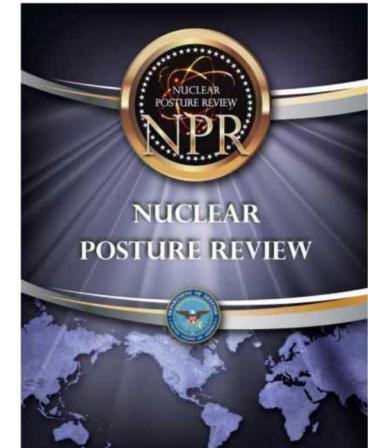
“... this review confirms the findings of previous NPRs that the nuclear triad ... is the **most cost-effective and strategically sound means of ensuring nuclear deterrence**. The triad provides the President **flexibility while guarding against technological surprise or sudden changes in the geopolitical environment**.

“The triad’s synergy and overlapping attributes help **ensure the enduring survivability of our deterrence capabilities against attack and our capacity to hold at risk a range of adversary targets throughout a crisis or conflict**. **Eliminating any leg of the triad would greatly ease adversary attack planning** and allow an adversary to concentrate resources and attention on defeating the remaining two legs.”

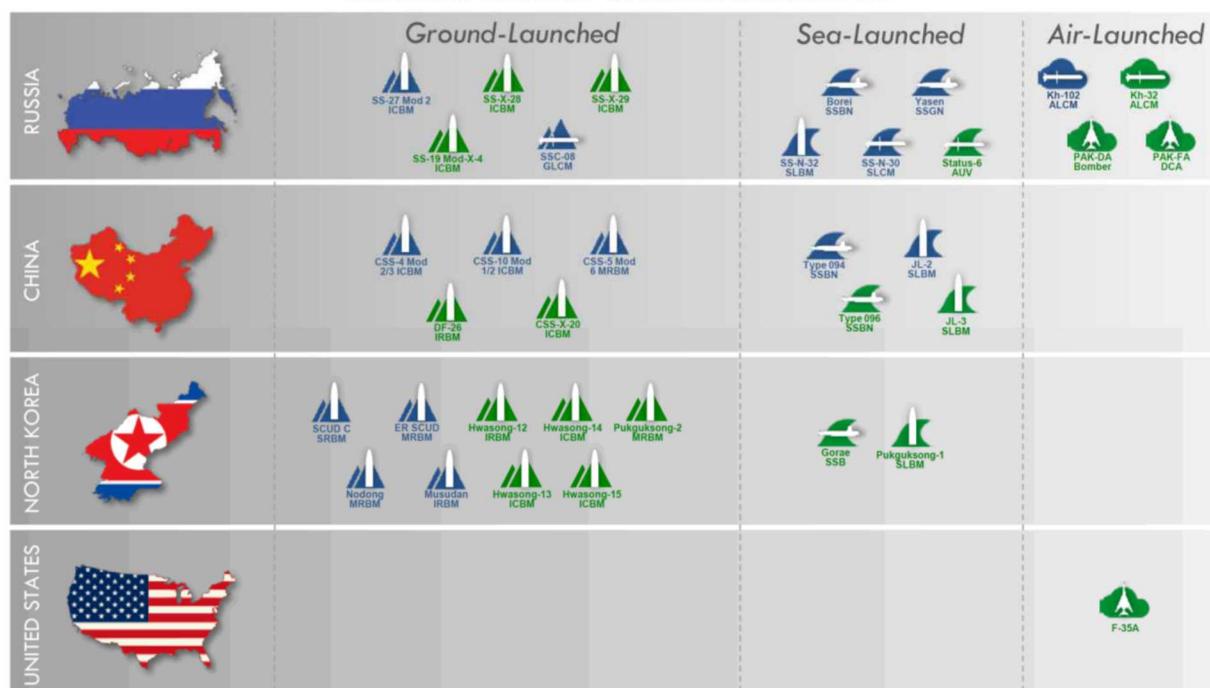
The 2018 Nuclear Posture Review

Global Nuclear Weapon Developments

“Despite concerted U.S. efforts to reduce the role of nuclear weapons in international affairs and to negotiate reductions in the number of nuclear weapons, since 2010 **no potential adversary has reduced either the role of nuclear weapons in its national security strategy or the number of nuclear weapons it fields.** Rather, **they have moved decidedly in the opposite direction.**”



2018 NPR, pp. 7-8



KEY
DEVELOPMENT FIELDED LAND SEA AIR

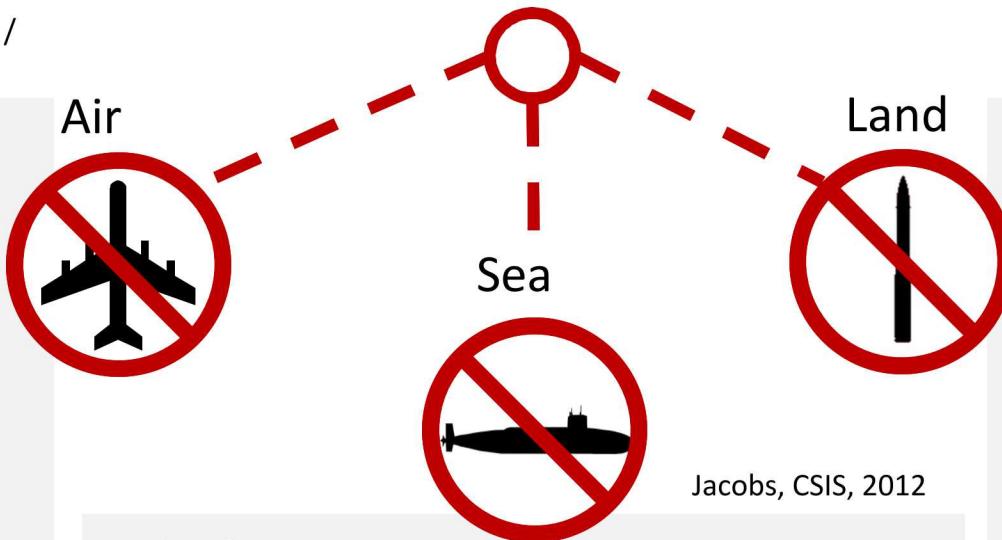
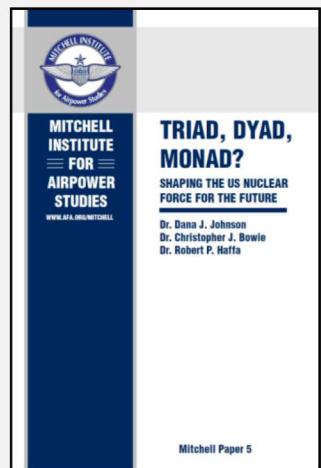
Discussion and Q&A



Recent Cases for Triad Leg Elimination



Johnson et. al., Mitchell Inst. /
Northrop Grumman, 2009



Jacobs, CSIS, 2012

Rationale

- Of any other dyad, ICBM/SLBM is most similar in deterrent value and stability to the triad
- The U.S. is already on a path toward such a de facto ICBM/SLBM dyad

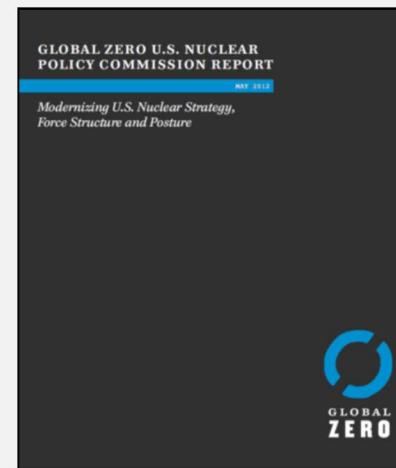
Rationale

- SSBN-X expected to cost nearly \$350 billion over 50 years
- Survivability is maintained by the aggregate of the air and land legs
- In likely nuclear use scenarios, capable nuclear offense is more important than a survivable defense



Source: <http://csis.org/blog/should-we-eliminate-nuclear-subs>

Cartwright et. al., Global Zero, 2012



Source: <http://www.globalzero.org/en/u-s-nuclear-policy-commission-report>

Rationale

- Russia overflight precludes non-Russia ICBM use
- ICBMs invite high risks of nuclear use based on rushed decision-making



The Nuclear Triad Debate



Is a triad still relevant today, or is another force structure more appropriate?

Do We Need ICBMs?

BY JEFFREY | 19 JULY 2012 | 50 COMMENTS

The Commander of the US Strategic Command, C. Robert "Bob" Kehler recently offered support for the Triad — the trinity of bombers, land-based missiles and ballistic missiles — that some people have chose to characterize as [irrelevant and unnecessary](#).

Now, admittedly by "some people" I mean two interns at the who now writes for [Air Force Magazine](#).

Nukes of Hazard has posted Kehler's remarks on the triad essentially the same as the ones he made in October 2011. Kehler has continuously expressed support for the triad, is to note that his support for the triad is contingent and imminent light of changes to the strategic environment. (Some people very seriously. It's a good thing Kehler doesn't command because he's got a thing or two to learn about sugar-coating.

Rather than heresy, Kehler's defense of the triad, has been, in fact, quite orthodox. He actually made the canonical case for the triad:

“

And I think that the range of precision weapons is increasing. The statement of the idea that

This has always been keeping some bases on land.

Source: <http://nuclear-icbms.com>

Should We Eliminate Nuclear Subs?

JUL 18, 2012

By Eli Jacobs

A recent [Washington Post](#) op-ed advocating de-alert asserted that "the chance of nuclear war or surprise attack is nearly zero." While people of good will can disagree on the probability of nuclear war (and the wisdom of de-alerting), it takes quite a bit of digging to find someone who can envision an intentional, massive surprise attack with nuclear weapons. Indeed, a disarming nuclear first-strike — carried out against the United States or any other established nuclear power — is widely viewed as unthinkable.

Practically, US nuclear forces are shaped with a heavy emphasis on surviving an all-out nuclear first strike. Indeed, survivability is arguably the only comparative advantage of strategic nuclear submarines—the one delivery vehicle that seems (most) sacrosanct in debates about whether we should pursue cost-saving cuts to the nuclear triad of subs, bombers, and land-based ballistic missiles.

This is an irresolvable tension: our least useful nuclear capability is the one we're the least open to reconsidering. This post will argue that survivability should no longer be the primary objective in sculpting our nuclear force and that, as a result, should the United States pursue cost-saving cuts to our nuclear weapons arsenal, ballistic missile submarines may prove the best candidate.

Survivability is Overrated

A nuclear bolt-from-the-blue — a surprise attack a la Pearl Harbor with the goal of destroying US nuclear weapons — will not be thinkable for the indefinite future. Between Russia's diminishing nuclear capability and China's de-alerted posture geared towards second strike, a bolt-from-the-blue is likely impossible given current circumstances. The far greater concern is the long-term. However, two structural features of international politics mean that this reality is likely to persist indefinitely.

First is the relatively multipolar distribution of international power. Although the United States and Russia possess the bulk of the world's nuclear weapons, a number of other countries have sophisticated nuclear arsenals. This reality is likely to persist for quite some time, despite the Obama administration's ambitions of achieving worldwide nuclear zero.

These nuclear powers share complicated political and military relations, ranging from friendly to lukewarm to adversarial — a fact that is likely to prevent a nuclear first strike even if it were hypothetically achievable. Even if it

Source: <http://csis.org/blog/should-we-eliminate-nuclear-subs>

ICBM Coalition Of Rural Senators Fights Nuclear Weapons Cuts

Posted: 04/17/2012 12:01 am Updated: 04/17/2012 8:54 am

 218 people like this.

Afford, Don't Need

ACA Resources

Nuclear Weapons

(Weapons: Less Is More (2012))

By the Editor: The 'Bloated' U.S. Weapons Budget (just 2012)

to deter nuclear attack against the U.S.

108
comment

Outrageous
Elections 2012, Faster, New State 2014, Navy, Prolife

WASE
rockets, Iran, prolife

Schwartz stands behind nuclear deterrent

By Marcus Weisgerber - Staff writer
Posted: Wednesday May 16, 2012 17:18:16 E

The Air Force's top officer on Wednesday day an influential retired general that recommends nuclear stockpile.

The study was led by retired Marine Gen.

U.S. Nuclear Triad Essential for National Security

Bryan DeWinter | July 18, 2012 at 3:30 pm | 1 Comment |  4  

General Robert Kehler, during a current commander of the Strategic Command, offered only tepid support for the existing U.S. nuclear triad during a July 12 speech on Capitol Hill.

General Kehler said that the traditional U.S. nuclear triad—comprised of intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and strategic bomber aircraft—remains "the best arrangement that we have today." Strategic Command, according to General Kehler, consider eliminating this structure if the President's requirements change.

While it is entirely appropriate for a senior military commander to follow the policies of the President, this approach is wrongheaded for policymakers. The triad continues to serve vital security interests, and its maintenance should be derived from a sound evaluation of the strategic environment.

Kehler's speech also serves as another reminder of the dangers inherent in the "nuclear zero" policy, which envisions a world without nuclear weapons. It is a guiding philosophy of the Obama Administration, and it should be changed.

The "nuclear zero" concept undermines world stability and security for at least one very fundamental reason: It assumes that U.S. nuclear weapons reductions will generate goodwill on behalf of our adversaries. Nothing could be further from the truth. Countries pursue nuclear weapons programs because of their own perceptions of security, and that is not directly related to the number of U.S. nuclear weapons. In addition, nuclear weapons have defered conflict between major world powers since they were created.

The nuclear triad remains essential for preserving U.S. national security and that of its allies. Each of the three components has complementary strengths that offer the most credible strategic deterrent force. In 2030, when the U.S. plans to start replacing its systems, it will have 60-year-old ICBMs, 40-year-old SLBMs, and 35- to 70-year-old bombers. The current Administration has thus far only demonstrated its willingness to pledge to pursue those efforts—with numerous strings attached.

The current fiscal environment means that only dedicated political leadership from the White House will result in the funding necessary to accomplish the needed modernization, despite nuclear weapons presenting only a

GLOBAL ZERO U.S. NUCLEAR POLICY COMMISSION REPORT

May 2012

Dear Strategy,
Structure

Participized a report conducted by
the U.S. reduce its

James Carlwright who
is holding his
position of the
U.S. to 90
intercon-
cerns.
study." G
is Institu
d and s
erent.
ce? It's
Global
the elim
invento
ed" and
news/2
r-deter

The logo for the Mitchell Institute for Airpower Studies. It features a circular design with a five-pointed star in the center, surrounded by a ring of smaller stars. Below the star is a stylized eagle with its wings spread wide. The text "MITCHELL INSTITUTE" is at the top of the circle, and "for Airpower Studies" is at the bottom.

**MITCHELL
INSTITUTE
≡ FOR ≡
AIRPOWER
STUDIES**

www.AFA.org/Mitchell

**TRIAD, DYAD,
MONAD?**

**SHAPING THE US NUCLEAR
FORCE FOR THE FUTURE**

Dr. Dana J. Johnson
Dr. Christopher J. Bowie
Dr. Robert P. Haffa

Mitchell Paper 5

Source: <http://www.northropgrumman.com/analysis-center/other-publications/assets/triad-monograph.pdf>

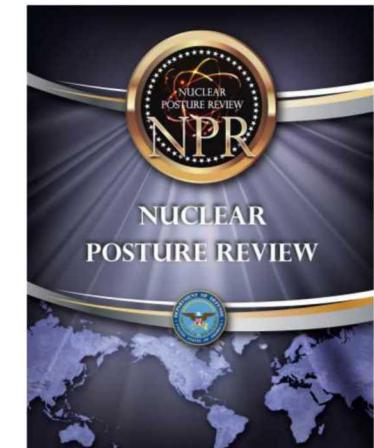
Source: <http://www.globalzero.org/en/us-nuclear-policy-commission-report>

The 2018 Nuclear Posture Review



Deterioration of the Global Strategic Environment

“The United States remains committed to its efforts in support of the ultimate global elimination of nuclear, biological, and chemical weapons. It has reduced the nuclear stockpile by over 85 percent since the height of the Cold War and deployed no new nuclear capabilities for over two decades. Nevertheless, **global threat conditions have worsened markedly since the most recent 2010 NPR**, including increasingly explicit nuclear threats from potential adversaries. **The United States now faces a more diverse and advanced nuclear-threat environment than ever before**, with considerable dynamism in potential adversaries’ development and deployment programs for nuclear weapons and delivery systems.”



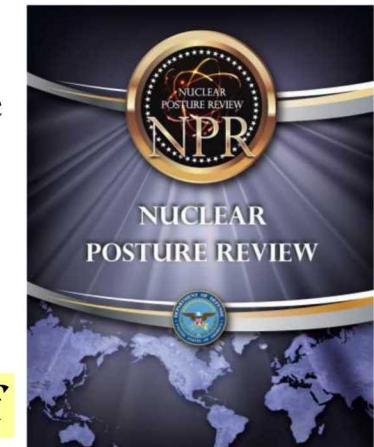
2018 NPR, pp. V

The 2018 Nuclear Posture Review



Flexibility and New Capabilities

“The United States has understood the value of flexibility for nuclear deterrence for six decades, but its importance is now magnified by the emerging diversity of nuclear and non-nuclear strategic threats and the dynamism and uncertainties of the security environment. **This need for flexibility to tailor U.S. capabilities and strategies to meet future requirements and unanticipated developments runs contrary to a rigid, continuing policy of ‘no new nuclear capabilities.’** Potential adversaries do not stand still. On the contrary, they seek to identify and exploit weaknesses in U.S. capabilities and strategy. Thus, U.S. future force requirements for deterrence cannot prudently be considered fixed. **The United States must be capable of developing and deploying new capabilities, if necessary, to deter, assure, achieve U.S. objectives if deterrence fails, and hedge against uncertainty.**“



2018 NPR, pp. 27