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BUILDING A SAFER WORLD

Building a Safe, Secure, and Credible NATO Nuclear Posture

Steve Andreasen, Isabelle Williams, Brian Rose, Hans M. Kristensen, and Simon Lunn

Foreword by Ernest J. Moniz and Sam Nunn

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Cover: A Dutch F-16 takes off from Leeuwarden Airbase in the Netherlands in 2011.
PHOTO BY ROBIN UTRECHT/AFP/GETTY IMAGES

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ABBREVIATIONS

CMX	Crisis Management Exercises
DCA	dual-capable aircraft
DDPR	Deterrence and Defense Posture Review
DOD	U.S. Department of Defense
ERI	European Reassurance Initiative
GAO	U.S. Government Accountability Office
GPS	global positioning system
HLG	High Level Group
INF	Intermediate-Range Nuclear Forces (Treaty)
MUNSS	Munitions Support Squadrons
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organization
NNSA	National Nuclear Security Administration
NPG	Nuclear Planning Group
NPR	Nuclear Posture Review
NSNWs	non-strategic nuclear weapons
RAP	Readiness Action Plan
SACEUR	Supreme Allied Commander Europe
SIOP	Single Integrated Operational Plan
SNOWCAT	Support of Nuclear Operations with Conventional Air Tactics
STMS	Security Transportable Maintenance System
STRATCOM	U.S. Strategic Command
TNWs	tactical nuclear weapons
WS3	Weapons Storage and Security System

DEFINITIONS

The terms "tactical nuclear weapons" and "non-strategic nuclear weapons" typically describe either short-range nuclear weapons or those weapons that are not covered by bilateral U.S.-Russian arms control agreements. The terms are equally problematic in describing the U.S. B61 gravity bombs deployed in Europe as these weapons are also fit for deployment on dual-capable strategic bombers. Moreover, the yield of several U.S. B61 variants is not distinct from those weapons described as having a "strategic" purpose.

SOURCE: See Hans M. Kristensen and Robert S. Norris, "Nonstrategic nuclear weapons, 2012," *Bulletin of the Atomic Scientists* 68, no. 5 (2012): 96–104, http://www.tandfonline.com/doi/pdf/10.1177/0096340212459040.

Foreword

TOWARD A NEW NATO NUCLEAR POSTURE

Ernest J. Moniz and Sam Nunn

The negative political dynamic between the North Atlantic Treaty Organization (NATO) and the Russian Federation today is the frame for any discussion of NATO defense policy and posture, including NATO's nuclear posture. Within this frame, unity within the alliance takes on a special meaning. NATO is averse to taking steps that might create controversy or suggest a lack of cohesion in the face of a newly aggressive Russia, and the United States must be resolute in its commitment to the defense of NATO. This stance especially has bearing today given the uncertainty that has engulfed the Trump administration's relationships with NATO and with Russia.

The principle of collective defense enshrined in Article 5 of the Washington Treaty is essential, and any changes to NATO's defense policy and posture must be seen through that lens; however, the current security environment should not preclude Washington and NATO from reviewing NATO's nuclear posture. In fact, NATO's security requires a hard look at and new approaches to NATO deterrence and defense through the prism of reducing the risk of nuclear use. Forward-deployed U.S. nuclear weapons in Europe increase the risk of accidents, blunders, or catastrophic terrorism and invite pre-emption. Given these added risks, it is past time to revisit whether these forward-based weapons are essential for military deterrence and political reassurance. The Trump administration's National Security Strategy of December 2017 commits to this continued deployment without presenting the considered analysis that would emerge from a hard look.

The chapters in this report, written by experts and practitioners in European security and nuclear weapons, provide a foundation for that hard look. The report underscores the strong arguments for NATO to move to a safer, more secure, and more credible nuclear posture without forward-deployed U.S. nuclear weapons in Europe. The challenge is how to advance current thinking about the military and political dimensions of alternative nuclear postures.

Regarding the military side of the ledger, it seems clear that consolidating U.S. nuclear weapons now stored in Europe back to the United States would not diminish U.S. and NATO nuclear capabilities. A number of former senior U.S. officials and military leaders have made the point that U.S. nuclear weapons based in Europe have virtually no military utility, primarily because of the extremely demanding scenario for conducting a nuclear strike mission using NATO dual-capable aircraft (DCA). In addition to the complicated procedures for decision making related to nuclear use, any attempt to employ those weapons will be further complicated by the visibility of the many actions required to prepare the aircraft, weapons, and crews for such an attack—all of which undercut their survivability and plausible use. Moreover, those factors make forward-deployed nuclear weapons potential targets in the early phases of a conflict, perhaps triggering a chain of events that the United States and NATO would want to avoid: early nuclear use.

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Forward-deployed nuclear weapons in Europe have military liabilities, and they may, in fact, increase the risk of nuclear use in a crisis.
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In short, forward-deployed nuclear weapons in Europe have military liabilities, and they may, in fact, increase the risk of nuclear use in a crisis. These dangers also apply to Russia’s forward-deployed nuclear weapons. Taken together, these shorter-range weapons in western Russia and in Europe are a clear and present danger to both Russia and NATO, particularly in an era of tensions, but also in an era of possible nuclear terrorism.

What remains true and credible is that the United States has a robust strategic nuclear deterrent that is capable of being employed deliberately anywhere on the globe in defense of U.S. interests and U.S. allies—and it is, and should be, understood by any potential (and rational) adversary to NATO, including Russia, in exactly this way. In any crisis involving NATO, U.S. nuclear capabilities would also be on stage with the nuclear forces of the United Kingdom and France. Indeed, as NATO has repeatedly stated, “The supreme guarantee of the security of the Allies is provided by the strategic forces of the Alliance.” This position has been, and remains, the credible foundation for any plausible scenario for employing U.S. nuclear weapons.

On the security side of the ledger, although returning forward-deployed nuclear weapons to the United States would not diminish NATO nuclear capabilities, it

would unquestionably reduce the risks from a potential terrorist incident or political instability—both of which are inherent in a posture that stores nuclear weapons at multiple sites across multiple countries. It is a reality that terrorists with global reach seek nuclear capability and have operated at NATO's border and within some NATO countries as well as Russia.

Finally, the financial side of the ledger is harder to calculate, complicated by a number of assumptions related to absolute and marginal costs for Washington and its NATO allies. Any savings that might be accrued by removing forward-deployed B61s from Europe and reducing the overall purchase of B61s present only modest marginal costs for the United States. For NATO allies of the United States, however, the marginal costs of procuring and maintaining DCA—and supporting U.S. nuclear weapons stored in Europe—may be relatively larger. That said, any reduction in costs associated with the nuclear mission could free up resources for NATO to focus on other urgent tasks, including conventional reassurance and cyber defense, depending on decisions made by NATO member countries about their national defense budgets.

One thing is certain: although leadership cannot come from Washington alone, U.S. leadership is the essential prerequisite to a reexamination of NATO nuclear policy, beginning with a compelling reaffirmation by the president of the principle of collective defense enshrined in Article 5 of the Washington Treaty. Washington must also take steps to work with allies to sustain, adapt, and perhaps enhance NATO's current procedures for nuclear sharing and consultations, consistent with a safer, more secure, and more credible nuclear deterrent. Such steps will not preclude the B61-12 life extension program (which also has a role in U.S.-based strategic forces) or plans by some NATO allies to purchase F-35 aircraft. Maintaining some dual-capable aircraft and trained pilots in Europe, along with a residual support infrastructure for nuclear weapons, should also be part of the overall NATO nuclear deterrence review.

The implications of sustaining or removing U.S. forward-deployed nuclear weapons in Europe are serious. Now is the time and the opportunity to ask whether those weapons are more of a security risk than an asset to NATO and whether they increase or reduce the risk of nuclear use. We hope that this report will help stimulate and inform such a review.

Key Findings

CHAPTER 1
What Is NATO's Nuclear Posture?

Approximately **150 U.S. nuclear weapons are reportedly stored in Europe.** They are deliverable by U.S. and North Atlantic Treaty Organization (NATO) dual-capable aircraft (DCA). Both the aircraft and warheads are undergoing modernization and replacement as part of a comprehensive plan to recapitalize the U.S. nuclear arsenal.

NATO's status as a nuclear alliance does not depend on the presence of U.S. nuclear weapons in Europe. The strategic forces of the alliance, particularly those of the United States, are the supreme guarantee of the security of the member states.

Governments of some NATO member states, including those that participate in the nuclear mission, have expressed **concern over the security risks, credibility, and financial and political costs of the current posture.**

Internal divisions and continuing public sensitivity to nuclear weapons, coupled more recently with Russian regional coercion and improved conventional and nuclear capabilities, have **dulled incentives to revise NATO's nuclear posture** or to debate alternatives.

CHAPTER 2
Challenges for Maintaining NATO's Nuclear Posture: Risks, Credibility, and Cost

Assumptions about the safety and security of U.S. nuclear weapons stored in Europe have been called into question by recent terrorist attacks and political instability. It should be assumed that they are targets for terrorism and theft.

The credibility of NATO's current nuclear posture has significant operational flaws. The threat of a limited U.S. response with strategic forces would be at least as credible, if not more so, than a response with DCA from European territory.

The political complexities of the NATO decision-making process also raise **doubts that member states could reach consensus on nuclear signaling or use in a crisis.**

The United States and NATO member states will incur several upfront costs to retain a forward-deployed nuclear capability in Europe. Those costs include more than $10 billion to upgrade the B61 gravity bomb.

The cost of procuring and maintaining DCA—and any savings that could be incurred in the absence of U.S. nuclear weapons based in Europe—are more difficult to calculate. They will by definition be viewed asymmetrically by NATO DCA members with substantially smaller defense budgets than the United States has.

CHAPTER 3
B61-12 Guided Nuclear Bomb

The B61-12 bomb is planned to replace the current U.S. gravity bombs that are forward deployed in Europe.

Production of the B61-12 has already been delayed, and costs have more than doubled to nearly $10 billion. Further delays and increased costs are likely.

The B61-12 will combine enhanced accuracy with low-yield options. This capability has led some to question whether the weapon lowers the threshold for nuclear use.

CHAPTER 4
Supporting the DCA Mission

The Netherlands, Italy, and Turkey have decided to replace their existing aircraft with the F-35A, Germany has so far been replacing its aircraft with the Eurofighter, and Belgium is currently undecided.

The latest batch of F-35As cost $94.6 million each, and the total cost to make the F-35As nuclear capable is estimated at $350 million.

The extensive work for DCA capability planning, design, testing, and certification means that **it likely will be the mid-2020s before the F-35A becomes nuclear certified.**

Significant support costs are associated with making the aircraft nuclear capable and with forward deploying the nuclear weapons in Europe. Information about support costs, however, is hard to find and often inconsistent.

CHAPTER 5
B61-12 Integration on Allied Aircraft

Each NATO host country is expected to upgrade its current DCA in the early- to mid-2020s. **Only the F-35A is currently planned to be nuclear capable.**

If this upgrade is agreed on, **it is unclear whether the United States or host countries will be responsible for the costs** to enable replacement DCA to carry nuclear weapons.

The nuclear-sharing mission is not popular among certain parliamentarians and members of the public, and basing countries try to avoid public debate on this issue. To date, **no hosting country has publicly confirmed its plans for enabling replacement aircraft to carry nuclear weapons.**

CHAPTER 6
NATO Nuclear Sharing: Consultation

For years, **nuclear issues have received little high-level attention within NATO.**

NATO mechanisms for nuclear sharing stem from the Cold War and are in need of review. Questions continue as to whether such mechanisms remain adequate today.

CHAPTER 7
NATO Nuclear Sharing: Operational Factors and Procedures

The operational dimension of forward-deployed U.S. nuclear weapons in NATO countries has become increasingly secondary to political factors.

NATO's engagement in conventional "out of area" operations during the past two decades reduces operational attention to the nuclear mission. That situation also raises nuclear readiness challenges.

Despite concerns about Russian nuclear policy and programs, the reticence of many NATO members to draw public attention to nuclear policy will remain strong.

CHAPTER 1

WHAT IS NATO'S NUCLEAR POSTURE?

Steve Andreasen, Isabelle Williams, Brian Rose

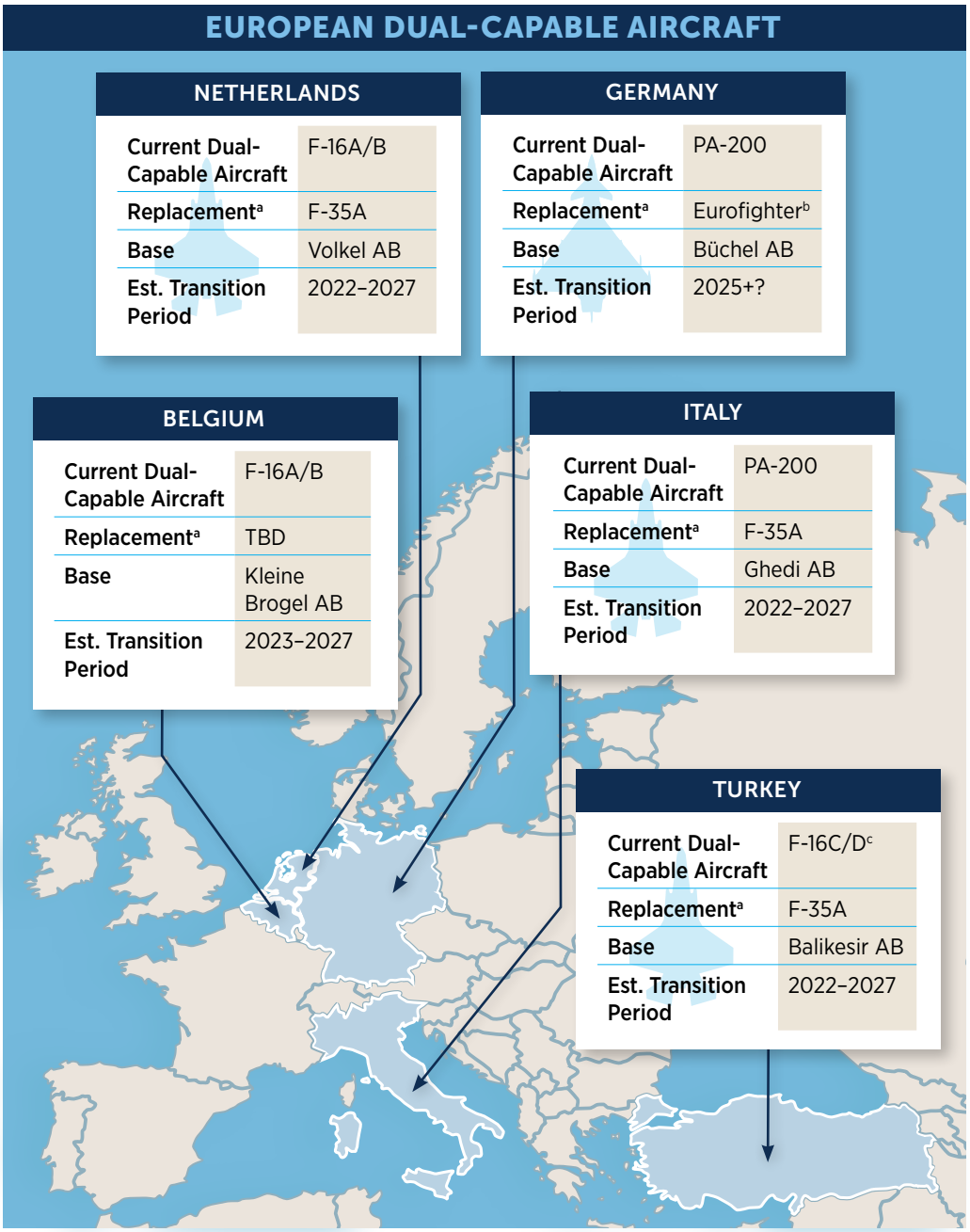
Nuclear weapons have played a key role in the collective defense policy of the North Atlantic Treaty Organization (NATO) since 1954 and are seen as the alliance's ultimate deterrent to aggression.

The arsenal committed to NATO includes forward-deployed U.S. nuclear weapons stored in Europe; U.S. strategic nuclear forces that compose the nuclear triad (i.e., land-, sea-, and air-based); and U.K. strategic nuclear weapons deployed at sea. Similar to most assets committed to NATO, the U.S. and U.K. nuclear forces are nationally owned and are under national command and control. In addition, France's independent strategic nuclear forces "have a deterrent role of their own" and "contribute to the overall deterrence and security of the Allies."[1]

There are approximately 150 forward-deployed U.S. nuclear weapons stored in Europe for use on U.S. and allied dual-capable aircraft (DCA).[2] The weapons assigned to U.S. aircraft in Europe are under U.S. control and may only be used following presidential authorization. The weapons assigned to allied aircraft may only be used following their release to NATO by the U.S. president.[3] These capabilities and the accompanying supportive force structures, infrastructure, and exercises come under a long-established NATO nuclear consultation, planning, and decision-making framework (outlined in chapters 6 and 7). Although the United States has a leading role, allied participation and burden sharing remain central to the concept of NATO collective defense and nuclear deterrence.

NATO's nuclear posture, therefore, consists of the following:

- U.S. and U.K. nuclear weapons committed or made available to NATO
- U.S. and allied DCA and supporting infrastructure
- NATO's nuclear doctrine and declaratory policy
- NATO's consultation and decision-making process



SOURCE: Dual-capable aircraft countries, sites, and estimates by Hans M. Kristensen and Robert S. Norris.

a. As of April 2017, though some countries have decided on the platform, no host country has publicly confirmed its plans for enabling the replacement aircraft to carry nuclear weapons.

b. Germany is replacing its PA-200 Tornados with the Eurofighter in most missions but has not announced whether it plans to make the Eurofighter nuclear capable or if it will purchase some number of nuclear certified F-35As for the NATO nuclear-sharing mission.

c. According to Hans Kristensen, the extent to which Turkey participates in the NATO nuclear mission is unclear, though it currently maintains nuclear-capable F-16s.

- Related procedures and exercises that ensure the readiness and capability of NATO to carry out the nuclear mission

U.S. NUCLEAR WEAPONS AND DELIVERY SYSTEMS IN EUROPE

The foundation for NATO's current nuclear posture was laid during the Cold War, when the United States deployed thousands of nuclear weapons in Europe. The purpose was to underscore the political solidarity between the United States and Europe and to provide a military capability to deter and, if necessary, defeat the numerically superior Soviet and Warsaw Pact armies.

Since the end of the Cold War, the alliance has reduced the number of nuclear weapons stored in European bases by more than 97 percent, from a peak of approximately 7,300 in 1971 to an estimated 150 that remain today. According to Hans Kristensen and Robert Norris, the weapons reportedly are stored at six U.S. and European air force bases in five countries: Belgium (Kleine Brogel), Germany (Büchel), Italy (Aviano U.S. Air Force, Ghedi-Torre), the Netherlands (Volkel), and Turkey (Incirlik U.S. Air Force).[4] Those remaining B61 gravity bombs can be delivered by U.S. and European DCA, which are designed for either conventional or nuclear missions. DCA currently deployed by the United States and NATO host countries include the F-15E Strike Eagle, F-16 Fighting Falcon, and Panavia PA-200 Tornado.

U.S. AIR NATIONAL GUARD

The F-16 Fighting Falcon, along with the F-15E Strike Eagle, and the Italian Panavia PA-200 Tornado constitute NATO's forward-deployed dual-capable aircraft.

DAVE BEZAIRE & SUSI HAVENS-BEZAIRE, WIKIMEDIA COMMONS

A B61 nuclear bomb on display at the Pima Air & Space Museum. The current variants of the B61 are being consolidated into a single weapon design, the B61-12, as part of an ongoing life-extension program.

As part of a comprehensive plan to upgrade its nuclear forces, the United States has begun the process of modifying the existing B61 nuclear gravity bomb by consolidating all five current variants into a single weapon, the B61-12. Today, some current B61 variants can be delivered only by tactical DCA, whereas others can be delivered only by long-range strategic bombers. The new B61-12 will be deliverable by both, thereby increasing the weapon's flexibility and interoperability but also potentially blurring the distinction between tactical and strategic missions. Production of the new B61-12 is planned to begin in 2020, with the first weapons ready to deploy to Europe in the early 2020s (see chapter 3).

Concurrently, the inventories of DCA owned by NATO countries hosting the U.S. B61 are reaching the end of their original service lives. These countries are therefore making (or have already made) decisions regarding replacement aircraft and the investments necessary to retain the DCA mission and nuclear weapons on their soil (see chapters 4 and 5).

NUCLEAR WEAPONS IN RUSSIA

Today, Russia's nuclear arsenal of approximately 4,300 warheads is estimated to include approximately 1,850 so-called non-strategic or tactical nuclear weapons.[5] These weapons, as well as ongoing improvements in Russia's conventional capabilities, are often cited as a core justification for retaining NATO's current nuclear posture.

Moscow increased reliance on its nuclear forces as a cost-effective counter to the technological breakthroughs achieved by the United States in advanced conventional arms in the 1990s—demonstrated repeatedly in the airpower-dominated

conflicts in Iraq, Bosnia, Kosovo, and Serbia—and to the corresponding reductions in Russian conventional capabilities after the collapse of the Soviet Union. Furthermore, the expansion of NATO to the Russian border caused concern about NATO political and military encroachment.[6]

Since then, Russia has refined its military doctrine a number of times. In early 2000, Russia adopted a new military doctrine, which some interpreted as providing for limited use of nuclear weapons for the purpose of "de-escalation" of a conventional conflict. Adjustments to Russian doctrine in 2010 and the current 2014 doctrine placed greater emphasis on the deterrent capabilities of its conventional forces and softened the language slightly on possible nuclear use.

Existing Russian doctrine states that Russia relies on nuclear forces to deter both nuclear and conventional conflicts and to deter threats to the existence of the state.[7] There remains considerable ambiguity, however, regarding the role of nuclear weapons in local or regional conflicts. Russia's nuclear rhetoric surrounding its activities since 2014 in Crimea and eastern Ukraine, interpreted by some as a more "aggressive" nuclear-use posture, as well as its modernization and deployments of dual-capable systems along NATO's eastern border and in Syria, contribute to this uncertainty. Furthermore, it is unclear how Russia defines existential threats.

Russia is currently modernizing all aspects of its nuclear arsenal. As in its strategic weapons modernization program, Russia appears to be phasing out older

REGULATING TACTICAL AND NON-STRATEGIC NUCLEAR WEAPONS

Although tactical and non-strategic nuclear weapons constitute large percentages of the arsenals in some nuclear weapon states, they are the least-regulated category of nuclear weapons. In the U.S.-Russian context, these weapons are subject only to an informal regime agreed to by the United States and Russia in 1991, consisting of unilateral, parallel declarations. The informal nature of the agreement has resulted in considerable uncertainty regarding implementation, as well as what is estimated to be a large disparity in numbers. Their small size, mobility, dispersed storage, and perceived (by some) usability at lower thresholds of conflict make the existence of these weapons in national arsenals a risk to global security. This security risk is especially problematic as more nuclear weapons states develop tactical systems.

SOURCE: Adapted from Nikolai Sokov, "Tactical Nuclear Weapons (TNW)," Nuclear Threat Initiative, May 1, 2002, www.nti.org/analysis/articles/tactical-nuclear-weapons/.

Soviet-era weapons in favor of a smaller force of new systems. According to one comprehensive assessment of Russian nuclear forces, recent advancements and increased reliance on Russia's conventional precision and stand-off capabilities appear likely to drive further reductions across all categories of Russian nuclear forces in the near-to-medium term, "with or without an arms control agreement."[8]

Some systems do raise concerns. The Russian Navy is fielding a new class of nuclear attack submarines, and a new dual-capable cruise missile has been demonstrated in ship- and submarine-launched strikes in Syria. The Russian Air Force is also fielding a new air-launched nuclear cruise missile. Another new system, the ground-launched SSC-8 cruise missile, may be tied to U.S. accusations that Russia is violating the Intermediate-Range Nuclear Forces Treaty by allegedly flight-testing a new ground-launched cruise missile in excess of the range limits on such capabilities.[9] The missile was reportedly deployed in early 2017.[10]

U.S. POLICY ON NUCLEAR WEAPONS IN EUROPE

For over 60 years, the United States has maintained a policy of extended nuclear deterrence, providing a nuclear umbrella over its allies via "the strategic forces of the U.S. triad, non-strategic nuclear weapons forward deployed in key regions, and U.S.-based nuclear weapons that could be deployed forward quickly to meet regional contingencies."[11]

The 2010 Nuclear Posture Review (NPR)—the most recent high-level U.S. government policy document regarding U.S. nuclear forces—concluded that the United States will retain the capability to forward deploy U.S. nuclear weapons on tactical fighter-bombers and strategic heavy bombers and will continue and expand consultations with NATO allies and partners to ensure the credibility and effectiveness of the U.S. extended deterrent. The NPR, therefore, made clear that the United States will consult with NATO regarding future basing of nuclear weapons in Europe and is committed to the consensus-based NATO process.[12] Additionally, the NPR states that the unique nuclear-sharing arrangements of the alliance are central to extended deterrence. These plans include participation by non-nuclear member states in the nuclear planning process and the operation of DCA by some host countries (outlined in chapters 6 and 7). The Trump administration's Nuclear Posture Review is anticipated to be released in February 2018.

NATO POLICY AND DOCTRINE

According to the 2016 NATO Warsaw Summit Communiqué, several fundamental principles of NATO's nuclear policy have remained largely unchanged:

- First, "as long as nuclear weapons exist, NATO will remain a nuclear alliance."

- Second, "the strategic forces of the Alliance, particularly those of the United States, are the supreme guarantee of the security of the Allies."
- Third, NATO resolves to ensure a credible deterrent and defense through "an appropriate mix of nuclear, conventional, and missile defense capabilities," as a core element of its overall strategy, although what constitutes an appropriate mix is still an open question.[13]

However, the two most recent NATO summits, the 2014 Wales Summit and the 2016 Warsaw Summit, demonstrate how the post–Crimea/Ukraine security environment and strained NATO-Russia relations have shifted the narrative on NATO policy from crisis management to deterrence and defense. The Warsaw Communiqué states that although NATO remains open to partnership with Russia, there can be no "business as usual" until NATO observes a "constructive change in Russia's actions that demonstrates compliance with international law and its international obligations and responsibilities."[14]

Regarding peacetime basing of nuclear weapons, the communiqué explicitly underscores that nuclear deterrence "relies, in part" on U.S. nuclear weapons "forward deployed in Europe." This language had been dropped in the 2012 NATO Deterrence and Defence Posture Review (DDPR) and was left out of the 2014 Wales Summit Communiqué. The Warsaw Communiqué further states the importance of a responsive posture, noting, "NATO must continue to adapt its strategy in line with trends in the security environment . . . to ensure that NATO's overall deterrence and defense posture is capable of addressing potential adversaries' doctrine and capabilities, and that it remains credible, flexible, resilient, and adaptable."[15]

Perhaps because of basing country sensitivities, there is no explicit reference in the Warsaw Communiqué to NATO DCA, but rather to "capabilities and infrastructure provided by Allies concerned." Perhaps for the same reason, the language relating to nuclear burden sharing is also somewhat vague (and closer to the 2012 DDPR language): "The Alliance will ensure the broadest possible participation of Allies concerned in their agreed nuclear burden-sharing arrangements."[16]

This evolution in language, however, should not be read as either a decisive trend or the last word: there were allies that wanted to further emphasize NATO's nuclear deterrence in the document and allies that did not want to make any change to previous language, underscoring the ongoing challenge of establishing consensus among 29 member states.

THE POLICY DEBATE

Although there is broad consensus in NATO documents and U.S. policy regarding the continuity of NATO as a nuclear alliance, a debate over the risks, credibility, and

costs of maintaining NATO's current nuclear posture continues.[17] Some allies view forward-deployed nuclear weapons as a central component and visible symbol of the ongoing political commitment of the United States to defend NATO and deter Russia. Others have expressed concerns about the military utility of the current posture and the political, security, and economic costs of the weapons. Those internal differences, coupled with Russian regional coercion and harsh nuclear rhetoric directed at NATO member states, have dulled incentives to revise NATO's nuclear posture.

Although much of this report addresses the technical and operational aspects of nuclear policy and posture, it is important to stress the political context in which NATO's nuclear policy is set and which frequently represents a barrier to change. This context derives from the traditional public opposition to nuclear weapons in most countries and the consequent preference by most governments to avoid public discussion of nuclear weapons policy. Within NATO, this reticence means that nuclear weapons policy is pushed into the shadows, and more pressing matters offer a convenient distraction. The preference for a low profile on nuclear weapons policy has been reinforced by the tendency of alliance members to rely on U.S. leadership (although perspectives on U.S. leadership are changing across European countries for several reasons). The consequence is a reluctance on the part of some European NATO members to consider alternative approaches regardless of whether the current nuclear posture still meets deterrence and defense requirements in the contemporary security environment.

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CHAPTER 2

CHALLENGES FOR MAINTAINING NATO'S NUCLEAR POSTURE: RISKS, CREDIBILITY, AND COST

Steve Andreasen, Isabelle Williams, Brian Rose

Maintaining NATO's current nuclear posture poses several challenges in terms of security risks, credibility, and costs. These challenges and trade-offs must be balanced against NATO's overall deterrence and defense requirements and the preservation of NATO cohesion.

SECURITY RISKS OF THE POSTURE

At each of the U.S. and NATO air bases that are thought to store U.S. nuclear weapons in Europe, a combined force of U.S. and European NATO personnel is assigned to retain custody and provide security of U.S. nuclear weapons. The weapons are stored in underground, hardened storage vaults inside protective aircraft shelters at each storage base. Custody, repair, and improvements to the weapons and the storage vaults are the responsibility of the U.S. Air Force. Perimeter security (fences, monitors, and motion detectors) and controlling access to the storage sites are the responsibility of the host nation.

These sites present targets and opportunities for both insiders and outside groups to disrupt or gain access to the facilities and, potentially, the weapons themselves. In 2009 and 2010, an incident occurred that underlines this point. A group of activists entered a suspected NATO storage site in Belgium and walked freely for more than an hour before being detained by base security.[18]

More recent events have led to increasing concerns regarding the security of NATO bases and European nuclear facilities. The aftermath of the Brussels terrorist attacks in March 2016 revealed what appears to have been a credible threat to Belgian nuclear power plants.[19]

At about the same time as the Brussels attacks, the Pentagon ordered military families out of southern Turkey, including the Incirlik Air Base, because of ISIS-related security concerns.[20] Then, in July 2016, following an attempted coup to

topple the Turkish government, the Turkish commanding officer at Incirlik was arrested for his alleged role in the plot. If reports are accurate—that Incirlik is a major NATO installation hosting U.S. forces that control one of the largest stockpiles of nuclear weapons in Europe (see Chapter 5)—this event shows just how quickly assumptions about the safety and security of U.S. nuclear weapons stored abroad can change.[21] Continued political instability over the past year, including

SECURITY RISKS IN TURKEY

Political instability exacerbates the risks of storing an estimated 50 U.S. nuclear weapons in Turkey.

1 SPRING 2016

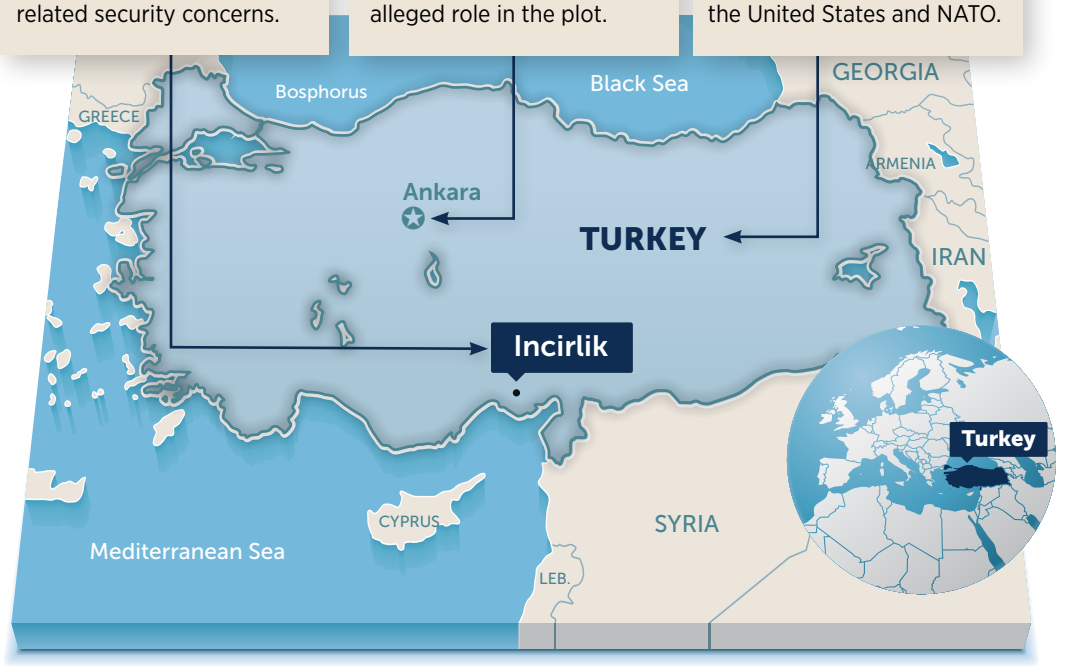
Pentagon orders military families out of southern Turkey, including the Incirlik Air Base, because of ISIS-related security concerns.

2 JULY 2016

Attempted coup to topple the Turkish government. Turkish commanding officer at Incirlik arrested for his alleged role in the plot.

3 ONGOING

Continued political instability, including mass arrests within Turkey and tensions between Turkey and the United States and NATO.



SOURCE: Julian Borger, "Turkey coup attempt raises fears over safety of US nuclear stockpile," *The Guardian,* July 16, 2016.

PHOTOS: (1) U.S. AIR FORCE, (2) GETTY IMAGES, (3) MAURICE FLESIER, CREATIVE COMMONS

mass arrests within Turkey and tensions between Turkey and the United States and NATO, are less than reassuring.

Even before these events, deficiencies in the security of U.S. nuclear weapons stored in Europe were cited in a 2008 study by the U.S. Air Force, which concluded that most sites in Europe "require additional resources to meet [U.S. Department of Defense] standards," and found "inconsistencies in personnel facilities and equipment provided to the security mission by the host nation."[22] A former senior NATO official, retired U.S. Air Force Major General Robertus Remkes, who commanded the 39th Wing at Incirlik Air Base and later J5 United States European Command, wrote in 2011 of the ongoing security risks associated with storing U.S. nuclear weapons in Europe and the severity of the political and security consequences for NATO of any infiltration of a site, whether or not the attackers gained access to the weapons themselves.[23]

Although the United States and NATO have undertaken considerable efforts to improve the physical security of nuclear weapons stored in Europe since the U.S. Air Force study, it should be assumed that those weapons remain potential targets for terrorist attacks. Storing nuclear weapons at locations throughout Europe to reassure some allies or as leverage in a future arms control deal with Russia, therefore, comes with the increasing risk of vulnerability to an evolving and deadlier terrorist threat (in contrast, nuclear weapons in the continental United States are secured in central storage facilities that are easier to protect than dispersed underground vaults inside aircraft shelters across multiple bases in Europe). Russia, too, may be vulnerable, with an estimated 1,850 non-strategic nuclear weapons reportedly kept in central storage facilities throughout the country.[24]

HOW CREDIBLE IS THE POSTURE?

Questions regarding the credibility—in military terms, the sum of capability and intent—of U.S. nuclear weapons in Europe should also be central to the debate on the future composition of NATO's nuclear posture. Deterrence and reassurance are two sides of the same coin, and as such, credibility matters to alliance members.[25] As former U.K. defense minister Denis Healey once remarked, "One only needed five per cent credibility of American retaliation to deter the Russians, but ninety-five per cent credibility to reassure the Europeans."[26]

Alliance Strategic and Conventional Forces vs. U.S. and European Dual-Capable Aircraft

The argument that forward-deployed U.S. nuclear weapons in Europe serve a military function not already addressed by alliance conventional forces or the strategic nuclear forces of the three nuclear NATO members—particularly, the large and

flexible capabilities of the United States—has been consistently refuted by current and former defense officials.[27]

Some U.S. strategic weapons today are highly flexible and accurate, and they possess low or variable yields, making the threat of a prompt, tailored strategic response to a limited nuclear strike highly credible. NATO itself has consistently underscored that the "strategic forces of the Alliance, particularly those of the United States, are the supreme guarantee of the security of the Allies."[28] Indeed, it is possible that the threat of a limited U.S. response with strategic forces would be at least as credible, if not more so, as a response with dual-capable aircraft (DCA) from European territory.

The application of strategic forces for extended deterrence is not without precedent. During the Cold War, NATO's requirements were coordinated with the U.S. Single Integrated Operational Plan (SIOP), and NATO targeting was the responsibility of the Supreme Allied Commander Europe (SACEUR). In a crisis, SACEUR was able to call on a number of U.S. strategic warheads carried on U.S. Poseidon submarines and already allocated under the SIOP to fulfill the NATO mission. Today, America's extended nuclear deterrent in Asia continues to rely solely on U.S. strategic forces. The "Asian model" includes less robust nuclear information sharing and consultation than NATO uses. In a European context, such mechanisms would necessarily be retained.[29]

In response to aggressive Russian actions in Ukraine, the United States and NATO countries have taken steps to improve and strengthen NATO conventional deterrence through the establishment of programs such as the European Reassurance Initiative (ERI) and the Readiness Action Plan (RAP), both discussed later in this chapter in more detail. Additionally, the United States has supplemented its already formidable conventional deterrence in Europe with the deployment and sale of new capabilities such as the conventional Joint Air-to-Surface Standoff Missile to European allies and partners.[30]

"It is hard to envision the circumstances under which a U.S. president would initiate nuclear use for the first time in more than 70 years with a NATO DCA flown by non-U.S. pilots delivering a U.S. B61 bomb."

"Seven Consecutive Miracles"

It is hard to envision the circumstances under which a U.S. president would initiate nuclear use for the first time in more than 70 years with a NATO DCA flown by non-U.S. pilots delivering a U.S. B61 bomb. Moreover, as Karl-Heinz Kamp and Robertus Remkes argued in 2011, even if ordered, the political and operational constraints involved in

U.S. ARMY

U.S. Army soldiers participate in a live-fire exercise in January 2016 with Polish allies in support of Operation Atlantic Resolve, a multinational demonstration of continued U.S. commitment to NATO collective security.

carrying out a nuclear strike with NATO DCA make the success of the mission far from certain.[31]

Kamp and Remkes describe the challenges of nuclear strike planning using NATO DCA. These challenges include (1) surviving a first strike; (2) receiving the orders and authorization from the U.S. president to conduct a nuclear strike; (3) successfully taking off and proceeding to the target; (4) achieving successful command, control, and refueling in flight; (5) surviving air defenses; (6) locating and correctly identifying the target; and (7) carrying out the strike itself with the weapon working as designed. Additionally, once the weapon is delivered, it is far from certain that the strike crews will make it home.[32] Despite significant advancements in U.S. and NATO reconnaissance and air strike capabilities, each of these challenges underscores the difficulties created by the visibility of the many actions required to prepare and deliver a nuclear weapon to its target that must take place to claim an effective and credible operational capability. Kamp and Remkes argue NATO cohesion and credibility through information sharing, consultation, common planning, and common execution (including of the nuclear mission) are much more important than the basing of U.S. nuclear weapons in Europe.[33]

Consensus for Nuclear Use at 29?

Advocates of maintaining NATO's existing nuclear posture argue that the DCA's most useful contribution is the highly visible example of alliance unity and resolve—

including allies having operational roles in planning and execution.[34] One former senior U.S. official and member of the U.S. High Level Group delegation noted, "the B61 and DCA fleet is the most strategic capability we have in this strategic environment that does the most potent signaling of our Allies to stand with us."[35]

However, NATO is a consensus-based organization of 29 members. It is also highly diverse, with a range of threat perceptions and views on nuclear use among its members. That diversity could potentially be a major source of vulnerability in a crisis, because differences in views could lead to stalled decision making or lack of consensus, thereby undercutting one of the fundamental purposes of the NATO deterrent—to promptly signal alliance unity and resolve in a crisis. A nuclear-use scenario with only partial backing of the member states could lead to visible divisions within the alliance—a condition on which a potential adversary would be certain to capitalize.[36] The current DCA posture, reliant in part on burden sharing through delivery by European aircraft, inevitably exacerbates those issues.

BALANCING PRIORITIES WITH COSTS

The financial costs to maintain forward-deployed U.S. nuclear weapons in Europe should also be factored into considerations about NATO's future nuclear posture, even though costs can be difficult to calculate and are likely to change.

The United States and NATO member states will incur several upfront costs to retain a forward-deployed nuclear capability in Europe. Current plans to upgrade the B61 nuclear gravity bomb (to the B61-12) are expected to cost the United States an estimated amount of more than $10 billion. Regardless of the future of NATO's nuclear posture, a portion of these weapons will likely be produced for delivery by U.S. strategic bombers—which are also tasked with supporting U.S. European Command requirements that support NATO deterrence and defense priorities. In this context, independent estimates suggest that approximately $2.5 billion could be saved by canceling only the procurement of B61-12s intended for delivery by DCA.[37] Overall, the U.S. Congressional Budget Office estimates that, over the 30-year period 2017 to 2046, tactical nuclear forces will cost the United States $25 billion, or an average of about $1 billion per year.[38]

Costs are already accumulating for integration work currently underway to make the B61-12 compatible with the existing F-15E, F-16, and Tornado aircraft. The new F-35A, which is expected to be the principal nuclear delivery platform for most NATO countries with a role in the nuclear mission, is now estimated to cost nearly $100 million per unit. Although projections for F-35A orders by DCA countries vary widely, those countries could incur anywhere from $8.5 billion to $23 billion to purchase new F-35A aircraft equipped to support the nuclear mission.[39] Less clear is whether F-35A orders would be reduced should the DCA mission be disbanded.

ESTIMATED COSTS OF NATO'S NUCLEAR POSTURE

WARHEADS		
ITEM	**COST[a]**	**WHO PAYS?**
Total estimated cost of a B61-12	$10 billion[b]	U.S.
DUAL-CAPABLE AIRCRAFT		
ITEM	**COST[a]**	**WHO PAYS?**
Estimated cost of an F-35A	$94.6 million[c]	All F-35 customers
Total estimated cost of F-35A B61-12 integration	$350 million	U.S.
Total estimated cost of B61-12 integration for other NATO DCA	Unknown	Unknown
Estimated cost to replace DCA with F-35A (current orders only)	$13–33 billion[d]	U.S. and NATO DCA countries
SECURITY AND INFRASTRUCTURE		
ITEM	**COST[a]**	**WHO PAYS?**
Annual cost to maintain nuclear weapons in Europe	$106.7 million/year[e]	U.S.
Annual cost for facilities in DCA countries	Unknown/year	DCA host countries
Site security and infrastructure improvements paid for by NATO	$300 million +	NATO common funding
Site security and infrastructure improvements paid for by the U.S.	~$100 million[f]	U.S.
Replace specialized weapons maintenance trucks	$26.7 million	U.S. and NATO common funding
Upgrade WS3 nuclear weapons vaults in Europe	$36.5 million	U.S.

a. Costs not cumulative.

b. Includes all costs for B61-12 modifications in support of both the NATO nuclear mission and the U.S. strategic mission.

c. The per unit cost of a Lot 10 order of F-35As in 2016/2017.

d. This calculation is adapted from aircraft estimates by the Federation of American Scientists (FAS) and NTI, and assumes a low of approximately 140 to a maximum of approximately 320 U.S. and NATO F-35A dual-capable aircraft. Dual-capable aircraft support both the nuclear mission and other conventional NATO missions. It includes the $350 million for B61-12 integration. It is unclear if and to what extent eliminating forward-deployed nuclear weapons would affect allied procurement of DCAs.

e. Based on 2011 estimate of approximately $100 million per year to support forward-based weapons in Europe, adjusted for inflation. Includes USAF provided Munitions Support Squadrons (MUNSS).

f. Estimate based on 2014 testimony by then Assistant Secretary of Defense Andrew Weber, who indicated that the $300 million NATO paid toward B61 storage security infrastructure and upgrades was approximately 75 percent of the total cost.

SOURCES: Cost estimates compiled from FAS, Arms Control Association, NNSA, GAO, CBO, and other sources.

Any cost savings could be marginal if DCA countries still purchase about the same number of aircraft.

The F-35A would require both hardware and software modifications to carry the B61-12. The total cost to design and develop these modifications across the entire fleet is estimated to be approximately $350 million.[40] Once the modification is made, a nuclear capability is presumed to be an option for all subsequent aircraft with a role in the nuclear mission.[41] Although it is unclear whether these upgrades will be incorporated into the final unit cost for NATO members, they would be minimal when spread across the entire fleet.

The ongoing costs for the United States to secure NATO's nuclear weapons in forward-deployed bases in Europe are estimated at approximately $100 million per year. DCA host countries also incur costs for NATO nuclear support missions, personnel, and equipment; however, information on annual costs to DCA countries to carry out that mission is not publicly available.

The cost of procuring and maintaining DCA—and any savings that could be incurred in the absence of U.S. nuclear weapons based in Europe—will by definition be viewed asymmetrically by NATO DCA members with substantially smaller defense budgets than the United States. Even with the uncertainties, savings of even a few billion dollars could be viewed as substantial, particularly for those countries that seek to improve their conventional contributions to NATO collective defense.

Finally, there are opportunity costs to consider, in particular concerning conventional forces. The United States has taken some steps to improve and strengthen NATO conventional forces through the establishment of the ERI in 2014, which seeks to assure NATO allies and partners of the U.S. commitment to the security and territorial integrity of NATO through the increased presence of American air, ground, and naval forces in Europe.[42] The 2017 U.S. defense budget included $3.4 billion for the program in support of the increased forward presence of U.S. forces in Europe and of more frequent bilateral and multilateral training exercises. NATO has responded similarly with the launch of the RAP at the Wales Summit in 2014. The RAP was initiated to ensure that the alliance was ready to respond swiftly and firmly to new security challenges from the east and the south.[43]

Resource requirements to sustain these and other initiatives will need to be considered in addition to programs to accommodate growing responsibilities in areas such as counterterrorism, cyber operations, and other regional security priorities. And all of those priorities will need to be balanced with the resources necessary to improve the nuclear forces and delivery systems in Europe.

CHAPTER 3

B61-12 GUIDED NUCLEAR BOMB

Hans M. Kristensen

The United States is in the early stages of a comprehensive effort to modernize its nuclear forces—both strategic and tactical. Modernization plans include a new land-based intercontinental ballistic missile, a new strategic nuclear submarine, a new strategic bomber, a replacement for its nuclear cruise missile, and upgrades to nuclear warheads and to supporting infrastructure. The cost of maintaining and modernizing U.S. nuclear forces is projected to cost $400 billion during the next 10 years and more than $1.2 trillion across 30 years.[44]

As part of this plan, the U.S. Air Force will replace all five variants of the B61 nuclear gravity bomb with one new type: the B61-12, the U.S. arsenal's first guided nuclear gravity bomb. That change means that the current B61 gravity bombs stored at six U.S. and European air force bases in Belgium, Germany, Italy, the Netherlands, and Turkey all will be upgraded in 5–10 years. The new weapons will presumably be brought in and the old ones moved out at the same time (there are enough weapons in storage in the United States with key components needed for production of the B61-12 so that the weapons in Europe do not have to be brought home for conversion first).

Plans for this upgrade to a more accurate weapon have been at least a decade in the making, and production could take close to a decade more. Design development began in 2008, and the 2010 Nuclear Posture Review decided to proceed with full-scope development. In 2016, the National Nuclear Security Administration (NNSA) authorized production engineering, the final developmental phase before actual weapons production, now set to begin in 2019. The first production unit is scheduled for March 2020, three years later than was initially planned, followed by full-scale production of an estimated 480 B61-12s by 2025.

Initially, the B61-12 was said to replace only the B61 versions that had yields ranging from 0.3 to 360.0 kilotons. But in 2013, the Department of Defense and Department of Energy informed Congress that the B61-12's unique combination

of increased accuracy and lower-yield options also would allow for the retirement of both the 400 kiloton B61-11 variant and the 1,200 kiloton B83-1.[45] In terms of numbers, the planned retirement of existing B61 types and the B83-1 will result in a reduction of the total inventory of nuclear gravity bombs by nearly 50 percent by the mid 2020s.[46]

It will not be a simple process. The B61-12 program actually consists of two components: the bomb assembly and the guided tail kit assembly. The NNSA is responsible for the bomb assembly, including the warhead, use-control, and assembly features, and the U.S. Air Force is responsible for the guided tail kit assembly (produced by Boeing) that enables the bomb to be employed with greater accuracy than current gravity bombs. According to Bruce Walker, vice president of Weapons Engineering and Product Realization at Sandia National Laboratories, the program is "the most complex program we've ever done…the largest nuclear weapon program in my 35 years at Sandia."[47]

Production of the B61-12 has already been delayed three years and has more than doubled in cost to nearly $10 billion. NNSA concluded in 2016 that the production plan could be met only by compressing schedules, which in turn would make it harder to address future difficulties.[48]

THE B61 FAMILY OF NUCLEAR BOMBS

U.S. NUCLEAR GRAVITY BOMBS, 2017				
GRAVITY BOMB	YIELDS (KILOTONS)	AIRCRAFT	USER	INVENTORY
B61-3	0.3, 1.5, 60, 170	F-15E, F-16, PA-200	U.S., NATO	130
B61-4	0.3, 1.5, 10, 50	F-15E, F-16, PA-200	U.S., NATO	130
B61-7	10–360	B-2A, (B-52H)	U.S.	350
B61-10	0.3, 5, 10, 80	F-15E, F-16, PA-200	U.S.	40
B61-11	400	B-2A	U.S.	30
B83-1	Low–1,200	B-2A, (B-52H)	U.S.	200
Total				~900
TOTAL INVENTORY FOLLOWING CONSOLIDATION, MID 2020s				
GRAVITY BOMB	YIELDS (KILOTONS)	AIRCRAFT	USER	INVENTORY
B61-12	0.3, 1.5, 10, 50	F-15E, F-16, F-35A, PA-200, B-2A, B-21	U.S., NATO	480

SOURCE: Warhead yields and inventory estimates by Hans M. Kristensen and Robert S. Norris.

The B61-12 will be assigned for use with both current and future strategic bombers (B-2 and B-21) and tactical fighter-bombers (F-15E, F-16, F-35A, PA-200). But unlike today, where different aircraft have to use different weapon types for different targets, the B61-12 will enable the U.S. Air Force to attack all gravity bomb targets with one weapon type that is usable by all nuclear-capable aircraft.

Eventually, the B61-12 will be replaced by the B61-13, another nuclear gravity bomb currently scheduled to begin development in the late-2030s.

B61-12 DEVELOPMENTAL TESTING

Since 2010, the U.S. nuclear weapons laboratories and the U.S. Air Force have conducted a host of B61-12 tests to develop and verify performance of its various components. Before 1992, developing the B61-12 would have required one or several live underground nuclear tests. Since then, however, the United States has developed a range of facilities that allow development and simulation of nuclear weapons without live nuclear test explosions. For the B61-12 program, this effort has included several non-nuclear tests, with more tests planned to verify changed non-nuclear components, performance, and safety.[49]

B61-12 COST ESTIMATES

The initial B61-12 cost estimate provided by NNSA in 2010 was approximately $4 billion.[50] By May 2012, the estimate had increased 50 percent to $6 billion,[51] and by July 2012, the Pentagon's Cost Assessment and Program Evaluation Office informed Congress that the cost would be about $10 billion.[52]

> Production of the B61-12 has already been delayed three years and has more than doubled in cost to nearly $10 billion.

The U.S. Government Accountability Office (GAO) reported in February 2016 that the total cost estimate by the NNSA and the U.S. Air Force (as of September 2015) was $8.9 billion, including $7.3 billion for NNSA work and $1.6 billion for the Air Force's development of the tail kit. However, the GAO noted that much of the B61-12 work "remains to be executed, with the largest share of program spending yet to come." The report found that as of September 2015, only $1.6 billion had been spent and that, in addition to the $8.9 billion, $800 million would be required for other program elements, including radar development costs.[53] The GAO overview, therefore, indicated a total development and production cost on the order of $9.7 billion.

Today, only about a quarter of the expected program cost has been spent. Extensive component development and production are still under way, and aircraft integration flight tests must be conducted with U.S. and NATO aircraft for the program to be able to deliver the first B61-12 bombs to the U.S. Air Force and bases in Europe by the early 2020s.[54]

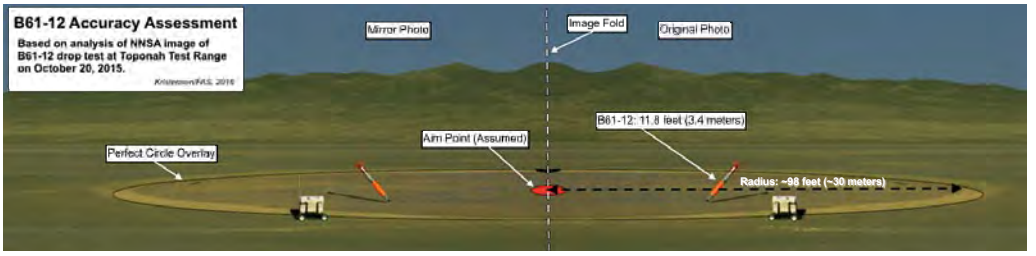
B61-12 MILITARY CAPABILITIES

The B61-12 will be the first guided nuclear gravity bomb in the modern U.S. arsenal. It will operate in one of two modes, depending on the delivery aircraft. Digital aircraft (F-15E, F-35A, B-2A, B-21) will be able to use the full guided capability with increased accuracy; older analog aircraft (F-16 and PA-200) will drop the B61-12 in an unguided ballistic mode with less accuracy. The F-16 and PA-200 will not be upgraded to use the increased accuracy because both aircraft will be replaced by the digital F-35A in the near future.

In 2013, U.S. Strategic Command (STRATCOM) Commander General Robert Kehler explained to Congress that the B61-12 was part of a deliberate strategy to give lower-yield weapons greater accuracy to increase military flexibility and provide attack options with less radioactive fallout: "[W]e are trying to pursue weapons that…would have less collateral effect if the President ever had to use them."[55]

The increased accuracy is provided by the guided tail kit, which steers the bomb toward its target. The system does not use the global positioning system (GPS) but an internal guidance unit that is hardened against radiation effects. The accuracy of the B61-12 is secret, but a video of a fully guided test drop in October 2015 shows the bomb hitting well within a circle with a radius of approximately 30 meters (100 feet). That test result indicates an accuracy roughly three times better than current B61 versions.[56] The increased accuracy will allow strike planners to select lower-yield options to destroy targets that today require higher-yield options.

The October 2015 video also shows that the B61-12 appears to have a limited earth-penetrating capability in soil. The combination of increased accuracy and



HANS KRISTENSEN, FAS

Author's reproduction of an NNSA image of a B61-12 accuracy test at Toponah Test Range in October 2015. The author assesses the accuracy of the B61-12 to be a significant improvement over current B61 variants.

U.S. AIR FORCE

A U.S. F-16 prepares to drop an inert B61-12 nuclear bomb during a flight test at Nellis Air Force Base, Nevada, in March 2017. The test is part of an ongoing life-extension and consolidation program for current B61 variants.

earth penetration would significantly enhance the targeting capability against underground targets.[57]

The unique effect of the B61-12's increased accuracy is that it will combine enhanced lower-yield options and the military capability currently provided by much higher-yield weapons into one bomb. And instead of those different capabilities necessitating use of different types of aircraft, the B61-12 will be available on all aircraft—whether tactical or strategic. The B61-12 will, in other words, be a much more flexible and versatile weapon.

IMPLICATIONS OF A MORE ADVANCED WEAPON

Former STRATCOM Commander and Vice Chairman of the Joint Chiefs of Staff General James Cartwright in 2016 acknowledged the implications: "What if I bring real precision to these weapons? Does it make them more usable? It could be."[58] Cartwright made a similar statement in 2015: "If I can drive down the yield, drive down, therefore, the likelihood of fallout, etc., does that make it more usable in the eyes of some—some president or national security decision-making process? And the answer is, it likely could be more usable."[59]

In 2014, former Air Force Chief of Staff General Norton Schwartz also said the increased accuracy would influence the way military planners think about how to

use the B61-12: "Without a doubt. Improved accuracy and lower yield is a desired military capability. Without a question."[60]

However, not everyone agrees with the desirability of a more "usable" nuclear weapon (see box below). In 2015, former Deputy Secretary of Defense Robert Work said, "Anyone who thinks they can control escalation through the use of nuclear weapons is literally playing with fire. Escalation is escalation, and nuclear use would be the ultimate escalation."[61]

The increased accuracy and lower-yield capabilities of the B61-12 will play an important role in the future adjustment of regional nuclear escalation scenarios in northeast Asia and Europe.

NATO allies hosting these U.S. weapons also will need to consider what, if any, political costs will be associated with hosting modernized weapons with new military capabilities. If the public is aware of the upgrade, it could result in significant backlash and could open debates about whether the new weapons affect any existing agreements or commitments. For example, the 2010 Strategic Concept, a statement of NATO's principles, declared that the alliance would "seek to create the conditions for further reductions in the future…of the number and reliance on nuclear weapons."[62] Increasing the capability of NATO's nuclear posture might appear to contradict that pledge.

MORE LOW-YIELD WEAPONS?

There are increasingly vocal demands in the United States and Russia for the creation of new, low-yield nuclear weapons. Such weapons would by definition be less destructive, which could make the decision to use them psychologically and operationally easier. If the two leading nuclear powers continue to consider tactical or non-strategic nuclear weapons essential and focus on making them more "usable," others could emulate this example, increasing the global risk of nuclear use.

SOURCE: Adapted from Nikolai Sokov, "Tactical Nuclear Weapons (TNW)," Nuclear Threat Initiative, May 1, 2002, www.nti.org/analysis/articles/tactical-nuclear-weapons/.

CHAPTER 4

SUPPORTING THE DCA MISSION

Hans M. Kristensen

The U.S. Air Force is planning to integrate the new B61-12 gravity bomb onto six different aircraft: two strategic (B-2 and B-21) and four tactical (F-15E, F-16, F-35A, and PA-200). European NATO host countries currently operate two types of nuclear-capable aircraft—the F-16 and PA-200—which are reaching the end of their service lives. The Netherlands, Italy, and Turkey have decided to replace their existing aircraft with the F-35A; Germany is replacing its aircraft with the Eurofighter; and Belgium is currently undecided.

Countries that host U.S. nuclear weapons and participate in the nuclear-sharing mission must, therefore, make or sustain decisions relating to costly replacement aircraft and the investments needed to retain the dual-capable aircraft (DCA) mission and nuclear weapons on their soil (see chapter 5). Those decisions will lock NATO into its current nuclear posture for the next several decades.

F-35A LIGHTNING II

In the United States, the F-35A Lightning II is scheduled to eventually take over the nuclear strike role from all other fighter-bombers. Several other countries, including the Netherlands, Italy, and Turkey, also have placed orders for the F-35A. The F-35 Joint Strike Fighter Operational Requirements Document calls for the F-35A to have the capabilities and provisions for DCA operations with up to two B61-12s carried internally.[63]

The extensive work for DCA capability planning, design, testing, and certification means it likely will be the mid 2020s before the F-35A becomes nuclear certified. However, exactly when the F-35A will be cleared to carry the B61-12 is uncertain because a U.S. Department of Defense (DOD) review in December 2016 concluded that the program as currently planned is "not executable." Proceeding with the

"current unrealistic plan… would be to completely ignore the costly lessons learned" from previous programs and the F-22 fighter program, the review said.[64]

AIRCRAFT FLIGHT TESTING

Flight testing involving the B61-12 on F-15E, F-16, and B-2 aircraft has been under way for several years. An F-15E bomb drop test in 2015 showed a significant accuracy and an apparent earth-penetrating capability.[65]

In 2016, flight testing expanded to the PA-200 bomber currently used by Germany and Italy. This testing included an eight flight-test series conducted over four weeks in the United States. The series was a key step toward ultimately certifying the PA-200 to be capable of carrying the B61-12 nuclear bomb in wartime.[66] The PA-200 is scheduled to continue B61-12 integration activities until 2020.

Flight testing on the F-35A is scheduled to begin in 2018 with the Block 4 upgrade, which is the follow-on modernization that includes nuclear capability. The GAO reported in April 2017 that the Block 4 program might be delayed and be more expensive.[67]

INCREASED MILITARY CAPABILITIES

When the F-35A was first declared combat ready in August 2016, the U.S. Air Force boasted that it "will be the most dominant aircraft in our inventory, because it can go where our legacy aircraft cannot."[68] According to Lockheed Martin, the F-35A will be eight times "more effective" in air-to-ground missions than the F-16.[69]

U.S. AIR FORCE

The F-35A Lightning II has been selected to eventually take over the nuclear strike role from other U.S. and NATO dual-capable aircraft.

In addition to the increased military capabilities provided by the new guided tail kit of the B61-12 itself, the F-35A is a stealth aircraft with significant new features. In particular, an F-35A with internal B61-12 carriage has significantly greater capacity to penetrate air defenses and get to its targets without being seen (or at least seen too late).

It is not clear what impact this capability will have on crisis stability in the Euro-Atlantic, but it could further escalate tension with Russia, leading to a new cycle of dangerous provocations and nuclear competition.[70]

NUCLEAR SUPPORT COSTS

In addition to the cost of procuring weapons and aircraft, there are significant support costs associated with making aircraft nuclear capable and with forward deploying nuclear weapons in Europe. Information about support costs, however, is hard to find and is often inconsistent. Adding to the confusion is that different costs are covered by different countries that do not have the same reporting or accountability requirements as the U.S. government.

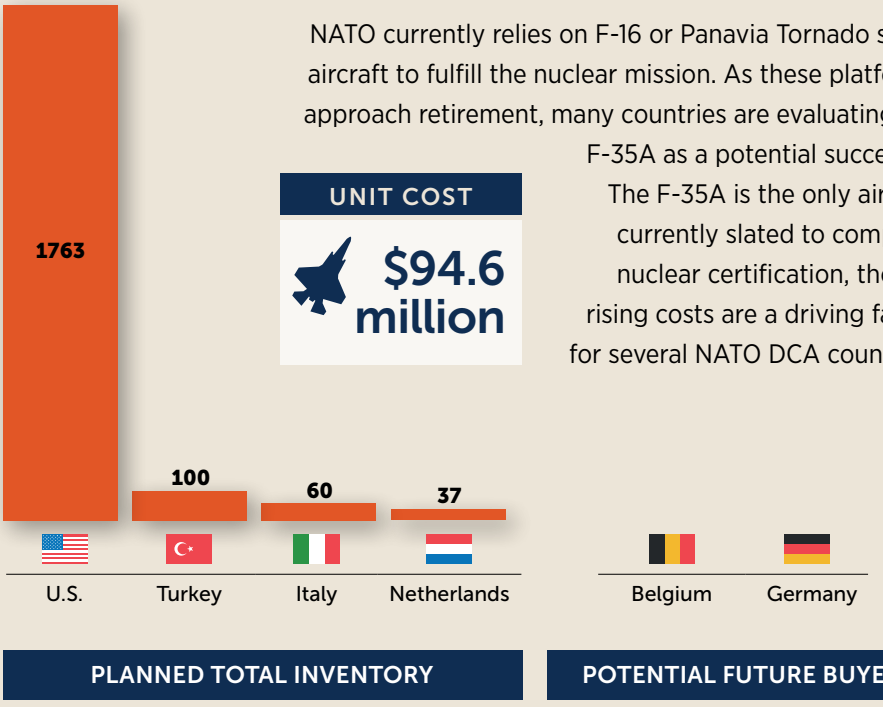
“In addition to the cost of procuring weapons and aircraft, there are significant support costs associated with making aircraft nuclear capable and with forward deploying nuclear weapons in Europe.”

The Congressional Budget Office projected in 2013 that it would cost about $350 million to make the F-35A nuclear capable.[71] So far, the Pentagon has budgeted $316.48 million for nuclear capability work on the F-35A through 2022,[72] with several more years of work planned after that. The costs to upgrade the other NATO allies' aircraft to carry the B61-12 is unknown.

In addition to those costs, the DOD informed Congress in 2011 that the Pentagon was spending about $100 million per year to support forward-based nuclear weapons in Europe.[73] Adjusted for inflation, that amount is approximately $109.1 million today. Part of the cost includes the 130-person-strong Munitions Support Squadrons (MUNSS) at each of the four national bases at an annual operating budget of approximately $232,000 each.[74] Host countries pay for the MUNSS facilities, but those costs are unknown.

NATO and the United States have also increased spending on security at the nuclear bases after an internal U.S. Air Force investigation concluded in 2008 that “most sites” used to store nuclear weapons in Europe did not meet U.S. security requirements.[75] At the time, U.S. and NATO officials publicly denied there were

F-35A: FUTURE NATO DUAL CAPABLE AIRCRAFT



NATO currently relies on F-16 or Panavia Tornado strike aircraft to fulfill the nuclear mission. As these platforms approach retirement, many countries are evaluating the F-35A as a potential successor. The F-35A is the only aircraft currently slated to complete nuclear certification, though rising costs are a driving factor for several NATO DCA countries.

UNIT COST

$94.6 million

SOURCES: For an assessment of NATO countries that play a role in the dual-capable mission, see Hans M. Kristensen, *Non-Strategic Nuclear Weapons* (Special Report No. 3), Federation of American Scientists. May 2012, p. 31. For country profiles and estimated F-35 inventories, see Lockheed Martin Corporation, "F-35 Fast Facts," 2018, https://www.f35.com/about/fast-facts.

problems, but DOD later informed Congress that NATO would spend $63.4 million on security upgrades in 2011–2012 and another $67 million in 2013–2014.[76]

Then, in March 2014, DOD reported that NATO had invested more than $80 million in infrastructure improvements since 2000 to store nuclear weapons in Belgium, Germany, Italy, the Netherlands, and Turkey. Another $154 million was planned for security improvements so that the sites would meet stringent new U.S. standards.[77] And in April 2014, Andrew Weber, then assistant secretary of defense for nuclear, chemical, and biological defense programs, told Congress that "NATO common funding has paid for over $300 million, approximately 75 percent of the B61 storage security infrastructure and upgrades" in Europe.[78]

Elaine Bunn, then deputy assistant secretary of defense for nuclear and missile defense policy, added that because host base facilities are funded through

individual national budgets, "it is not possible to provide an accurate assessment of exactly how much NATO basing nations have contributed in Fiscal Year 2014 toward NATO nuclear burden sharing, although it is substantial." Bunn provided additional information that showed funding of security enhancements and upgrades as well as funding of infrastructure upgrades (investment) at the specific European weapon storage sites. This funding, she explained, is provided through the NATO Security Investment Program, and there have been four NATO upgrades related to weapons storage (Capability Package upgrades) since the original NATO Capability Package was approved in 2000.[79]

Some of the security upgrades are clearly visible on commercial satellite photos. In 2015–2016, a new security perimeter was built at Incirlik Air Base around the so-called NATO area that contains the aircraft shelters with the underground nuclear weapons storage vaults known as Weapons Storage and Security Systems (WS3s). The upgrade followed a similar security perimeter upgrade at Aviano Air Base in northern Italy.[80]

Smaller security upgrades are also under way at some of the national nuclear bases, including a new WS3 vault support facility and a MUNSS Operations Center-Command Post at Kleine Brogel Air Base in Belgium, as well as a WS3 vault

U.S. AIR FORCE

U.S. Air Forces in Europe Commander General Roger Brady is shown B61 nuclear weapon disarming procedures on an inert training warhead in an underground Weapons Security and Storage System (WS3) vault in 2008.

U.S. AIR FORCE

A Dutch F-16 returns from a training mission at Volkel Air Base in the Netherlands. According to the author, U.S. nuclear weapons are stored in underground storage vaults inside hardened aircraft shelters similar to this one at several bases across Europe.

support facility at Ghedi Air Base in Italy. The cost for each of these upgrades is around $1 million.

In addition to these types of expenses, NATO is in the process of replacing the special weapons maintenance trucks with a fleet of new trucks known as the Secure Transportable Maintenance System (STMS). NATO provided $14.7 million for the program in 2011, and in July 2012, the U.S. Air Force awarded a $12 million contract to five companies in the United States to build 10 new STMS trailers for delivery by June 2014.[81]

Finally, the U.S. Air Force is planning a multiyear upgrade of the WS3 nuclear weapons vaults at the European bases. The upgrade will modernize the alarm data system and underground cables. The $36.5 million contract was awarded in September 2016, and the work will be completed in October 2020,[82] in time for the arrival of the first B61-12 bombs in Europe a few years later.

CHAPTER 5

B61-12 INTEGRATION ON ALLIED AIRCRAFT

Hans M. Kristensen

Belgium, Germany, Italy, and the Netherlands store U.S. B61 nuclear bombs on one national base each with a fully nuclear-certified fighter-bomber wing. There is some uncertainty about whether, or to what extent, Turkey is still part of the NATO nuclear-sharing arrangement. Turkey has a much lower aircraft readiness and no weapons deployed at Turkish bases. (There are up to 50 B61-3/B61-4 bombs stored in Turkey at Incirlik Air Base for use by U.S. Air Force fighter-bombers, but no nuclear-capable aircraft permanently stationed at the base.)

The nuclear-sharing mission is not popular among certain parliamentarians and members of the public, and basing countries try to avoid public debate on this issue. As a result, as of October 2017, no hosting country has publicly confirmed its plans for enabling replacement aircraft to carry nuclear weapons. Moreover, it is not clear who will pay the additional costs to make the aircraft dual capable (e.g., the host country, NATO, or the United States). Of the aircraft being considered by host countries to replace their currently deployed aircraft, at present only the F-35A could be modified to make it nuclear capable with the modernized B61-12, ensuring that countries maintain their nuclear commitment. This situation, therefore, raises questions about the future role for Germany and possibly Belgium—both of which have not decided to purchase the F-35A—in the nuclear mission.

BELGIUM

The Belgian Air Force uses the F-16A/B in the NATO nuclear strike mission. Its nuclear-capable F-16s are part of the 31st Squadron of the 10th Tactical Fighter Wing at Kleine Brogel Air Base. There are an estimated 10 to 20 B61-3/4 nuclear bombs at the base, stored in 11 underground vaults inside protective aircraft shelters.

The Belgian government has not yet decided which aircraft it will buy to replace the F-16s, which will be upgraded to carry the B61-12 until a new aircraft is acquired. Belgium is reportedly considering buying 34 new aircraft, the bulk of which would

be delivered in 2023 and enter service two years later. A request for proposals was issued in 2017.[83] A decision is expected in 2018 or 2019.

The F-35A is a strong contender, and Belgium might follow the decision of its Dutch neighbor. Other contenders include the European Eurofighter, the U.S. F/A-18F Super Hornet, the French Rafale, and the Swedish Gripen. Only two of those aircraft are nuclear capable, and an unnamed industry source told a journalist in 2015 that continuing the nuclear mission would favor the F-35A.[84] If so, Belgian F-35As would probably take over the nuclear mission from the F-16s in the mid- to late-2020s.

GERMANY

The German Air Force uses the PA-200 Tornado in the NATO nuclear strike mission. The nuclear-capable aircraft are operated by the 33rd Fighter Wing at Büchel Air Base, which like Belgium stores an estimated 10 to 20 B61-3/4 nuclear bombs in 11 underground vaults inside as many protective aircraft shelters.

Germany is replacing some of its PA-200 Tornados with the Eurofighter in some missions but has not announced a decision to make the Eurofighter nuclear capable. It is unclear how long the German Air Force will continue to operate the

U.S. AIR FORCE

A German Panavia PA-200 Tornado undergoes post-flight inspections after a training mission in the United States. The PA-200 is one of three aircraft certified for the NATO nuclear mission.

PA-200 Tornado in the nuclear role before the aircraft becomes obsolete. The German government told parliament in 2012, "It is planned to use the Tornado weapon system beyond 2025 in reduced numbers."[85] B61-12 integration flights on the Tornado began in 2016.

Equipping the Eurofighter with nuclear capability would require the aircraft to go through the lengthy integration program that the other nuclear aircraft have already started. That process would be expensive and likely face strong opposition in parliament. It would also mean that the Eurofighter would not become nuclear certified until well after other NATO aircraft had been upgraded. If it does not make the Eurofighter nuclear capable or buy a small number of F-35As, then Germany will likely leave the nuclear-sharing mission sometime in the late 2020s.[86]

It was therefore noteworthy when the chief of the German Air Force, Karl Mullner, recently stated that the Air Force is currently studying which aircraft should replace the Tornado: F-15, F-18, F-35, or the Eurofighter. Mullner made it clear that only the F-35A meets the Air Force's requirements for a next-generation aircraft.[87] The German Parliament and government would still have to agree and approve an F-35A program for the German Air Force, potentially by 2020.

ITALY

The Italian Air Force also uses the PA-200 Tornado in the NATO nuclear strike mission. The nuclear-certified PA-200s are part of the Sixth Wing (Stormo) based at Ghedi Air Base in northern Italy. This base also stores an estimated 10 to 20 B61-3/4 nuclear bombs in 11 underground vaults inside protective aircraft shelters.[88] B61-12 integration flights on the Tornado began in 2016.

Italy plans to replace the PA-200 with the F-35A in the nuclear mission by the mid-2020s. A total of 90 F-35s of all types are planned (down from 131), of which 60 will be the F-35A version. If approved, some 15 to 30 of them would probably be assigned to the nuclear mission.

The first two operational F-35As were delivered to the Italian Air Force in December 2016, making the Italian military the first non-U.S. military to receive operational F-35As. The two aircraft were delivered to the 32nd Wing (Stormo) at Amendola Air Force Base, where they will be part of the newly created 13 Squadron (Gruppo). The last of the 90 F-35As will be delivered in 2027. The two aircraft now in service are not nuclear capable. Italy has a unique position in the international F-35 program because it is the location of the final assembly and check-out) at Cameri in northeast Italy. This factory will also assemble Dutch F-35As.

The possible dual-capable role of the F-35A is rarely debated by the Italian public or government. The budget currently approved for the aircraft does not specify whether part of the funding will be dedicated to adapting the F-35A to a nuclear mission. It is likely that any parliamentary debate on the nuclear role of the mission and costs will raise opposition.

THE NETHERLANDS

The Dutch Air Force currently uses F-16A/Bs from the 312nd squadron of the 1st Fighter Wing at Volkel Air Base in the NATO nuclear strike mission. As at the other bases, there are 11 vaults with an estimated 10 to 20 B61-3/4 bombs at the Volkel base. B61-12 integration flights on the F-16 have been underway for several years.

The Netherlands plans to buy a minimum of 37 F-35As to replace its F-16s. Two training aircraft have been delivered, and another eight were ordered in March 2015 for delivery in 2019. Two aircraft were sent briefly to Leeuwarden Air Base in May 2016 before they were returned to the United States for more testing and evaluation. In addition to Leeuwarden Air Base, the Dutch F-35As will be based at Volkel Air Base, where, if approved, they will take over the nuclear mission from the F-16s beginning in the mid-2020s.

U.S. AIR FORCE

A pilot from the Royal Netherlands Air Force taxis to the runway for the first flight of a Dutch F-35 Lightning II in 2013. According to the author, the Netherlands is one of five European countries reported to have a role in the NATO nuclear sharing mission.

The Dutch F-35A program is in a unique situation because when it approved the purchase of the F-35A in November 2013, the Dutch parliament also approved a resolution stating that "the replacement for the F-16 should not have a nuclear mission."[89] The Dutch government did not explicitly reject the motion but instead responded that the mission was part of a broader NATO posture and that it would seek to create the conditions in Europe so that the aircraft no longer need to have a nuclear mission—essentially ignoring the resolution.[90]

TURKEY

The Turkish Air Force plans to purchase 100 F-35As to replace its fleet of F-16s. Unlike the other four countries in the NATO nuclear-sharing program, Turkey does not have an active nuclear wing with U.S. nuclear weapons present at the base. (There are nuclear weapons only at Incirlik Air Base, which is considered a U.S. base.) As a result, there is some uncertainty about whether, or to what extent, Turkey is still part of the NATO nuclear-sharing arrangement.

In early 2010, General Ergin Celasin, who was commander of the Turkish Air Force in 1999–2001, reportedly said that the remaining U.S. nuclear weapons at Incirlik Air Base were not linked to the Turkish military because the Turkish Air Force's role in NATO's nuclear contingency plans came to an end with the withdrawal of U.S. nuclear weapons from Turkish air bases in the 1990s.[91]

Until 1996, the United States deployed nuclear bombs at Akinci Air Base and Balikesir Air Base for use by Turkish F-16s. But that year, the two U.S. Air Force units that had maintained custody of the weapons were withdrawn, and the 40 bombs were moved to Incirlik Air Base. By late 2000, those 40 bombs were still earmarked for use by Turkish aircraft.[92] The 40 bombs were probably withdrawn around 2005, leaving up to 50 bombs at Incirlik for use by U.S. jets.

Yet in 2010, in a coordinated response from the U.S. Air Force, the U.S. Strategic Command, and the Office of the Secretary of Defense to the U.S. Congress, the U.S. Air Force stated, "Turkey uses Turkish F-16s to execute their nuclear mission." And some of the F-16s would be upgraded to be able to deliver the B61-12 until the F-35A could take over the nuclear strike mission in the 2020s.[93]

The reason for this disparity between General Celasin's statement and the U.S. Air Force's response to the U.S. Congress is unclear. There is no doubt that the Turkish role in the nuclear strike mission is much less active than that of the other four nuclear-sharing countries. The reason might be that the Turkish role is dormant and aircraft are no longer certified at the operational level, but that the F-16s are still equipped to deliver nuclear bombs if necessary and that the F-35As will be nuclear capable as well.

> Recent events in Turkey... have raised concerns about the security and the future of the B61 weapons stored at Incirlik.

Turkey bought its first two F-35As in 2014 and another four in 2015. Turkish pilots were scheduled to arrive at Luke Air Force Base in the United States in March 2017 to begin training with American pilots to prepare for delivery of the first operational aircraft in 2019. In January 2017, Turkey reportedly decided to order another batch comprising 24 aircraft, about a quarter of the 100 aircraft it plans to buy as part of a $16 billion program. The second batch will be delivered in 2021–2022.

Recent events in Turkey, including the uncertain relationship between Turkey and the United States and other NATO allies, the ongoing conflict in Syria, and proximity to ISIS territory, have raised concerns about the security and the future of the B61 weapons stored at Incirlik (see chapter 2).

CHAPTER 6

NATO NUCLEAR SHARING: CONSULTATION

Simon Lunn

For decades, the United States has had forward deployed U.S. nuclear weapons in some European countries, and NATO allies have participated in the preparation and execution of the nuclear mission. Engagement in the nuclear planning process takes place primarily through two formal mechanisms—the Nuclear Planning Group (NPG) and the High Level Group (HLG). However, there are serious questions about whether the Cold War–era structures are working today and whether NATO nuclear issues are receiving an adequate level of consideration given today's security and political environment.

THE NUCLEAR PLANNING GROUP

The NPG is the main body through which the United States informs and consults all allies, with the exception of France, on nuclear policy. Established in 1966, the NPG was designed to meet allied requests to increase NATO involvement

FRANCE AND NATO NUCLEAR POLICY

France does not participate in either the Nuclear Planning Group or High Level Group. Nevertheless, France has an input into NATO nuclear policy by virtue of its membership in the North Atlantic Council and has crucially participated in the drafting and approval of all Strategic Concepts since the end of the Cold War. According to one official, "France joins discussions on policy, not posture." Others suggest that the issue of meeting at 28 or 29 NATO members in specific nuclear planning meetings (i.e., with or without France) raises questions concerning the appropriate format for nuclear decision making, particularly in crisis situations.

SOURCE: Author's personal communications with NATO officials.

DEPARTMENT OF DEFENSE

Chairman of the Joint Chiefs of Staff General Joseph Dunford (right) meets with his Turkish counterpart at a NATO military conference in 2016.

in nuclear planning and decision making. The NPG covers "a broad range of nuclear policy matters, including the safety, security and survivability of nuclear weapons, communications and information systems, as well as deployment issues."[94] It also covers broader nuclear issues, including arms control and nuclear proliferation.

During the Cold War, the NPG met twice yearly at the defense minister level and more regularly at the ambassadorial level. However, in the post–Cold War period, the nuclear dimension assumed a lower profile in NATO affairs, and meetings became much less frequent. NATO ambassadors have apparently not met formally in NPG format for 15 years (although according to one official, nuclear-related issues can "pop up" in regular meetings).

The work of the NPG is prepared at NATO by the Nuclear Planning Directorate and the NPG staff group that constitutes the "in-house" group dealing exclusively with nuclear matters. The directorate coordinates the work of the NPG and is staffed by members of NATO's International Staff—normally personnel with backgrounds in national nuclear affairs either at the operational or policy level—recruited from national capitals.[95] The NPG staff group offers continuity and institutional memory in NATO nuclear policy. The director of the group is traditionally an American.

The NPG staff group meets weekly and is attended by representatives from the national delegations based at NATO who have nuclear affairs among their responsibilities. The degree of familiarity and expertise of these national representatives in nuclear matters varies from country to country, frequently depending on the number of other NATO issues and responsibilities in their individual portfolios.

It is important to note that the nuclear-sharing consultations developed in the NPG do not depend on the presence of U.S. nuclear weapons in Europe. If the weapons were withdrawn to the United States, consultations would continue, although there would be discussion about whether and how to adapt the relevant mechanisms accordingly.

THE HIGH LEVEL GROUP

The work of the NPG is supplemented—and some would say bypassed—by the HLG, which is chaired by the United States and attended by designated senior officials from national capitals. The HLG was created in 1977 after U.S. officials grew concerned that nuclear consultations through the normal NATO machinery gave insufficient attention to nuclear matters at senior levels in national capitals.[96] The United States was particularly concerned about the capacity of the North Atlantic Council (NAC), the principal political decision-making body for the alliance, to deal with the key nuclear decisions anticipated during the ongoing review of this period. In the words of one official, it was important to "involve the people who write the instructions, not those who read them."[97]

The HLG has remained a special body parallel to the NPG and is used by the United States to brief on nuclear developments of interest to the allies. Some examples are the development of the B61 nuclear bomb, as previously noted, or U.S. assessments of Russian nuclear developments. Although the HLG meets regularly, the frequency of meetings is largely at the discretion of the group's chair. Reports prepared by the HLG are typically distributed directly to defense ministers rather than through the NAC.

NATO NUCLEAR CONSULTATION AND DECISION-MAKING PROCESS

The willingness of the United States to keep allies informed about nuclear issues and the willingness of allies to contribute to a common deterrence effort underpin the nuclear consultation process within NATO.

At the same time, the decision to initiate the use of a nuclear weapon made available to NATO rests with the U.S. president or the British prime minister. If a decision were made to use a U.S. forward-deployed warhead and have it delivered by NATO dual-capable aircraft (DCA), the decision to release the warhead would lie with the U.S. president; the use of a DCA would require the assent of the relevant host country.

Although not required, it is widely assumed that such a decision would be made in close consultation with all allies, and it would be reasonable to expect that the NAC, in permanent session, would play a central role.[98] France also would be a likely participant, despite not being part of the NPG.

The history behind the political guidelines for use of nuclear weapons by NATO is complex and has always involved reconciling the very different perspectives among members. The 1962 Athens Guidelines required consultation "time and

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NATO nuclear issues still do not receive adequate high-level political attention within the alliance either because attention is frequently focused on more pressing problems or because nuclear posture-related issues get lost in the bureaucracy.
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circumstance permitting.”[99] However, given the diverse views among allies, it was soon clear that this rudimentary principle had to be fleshed out. Seven years later, in 1969, Provisional Political Guidelines for the tactical use of nuclear weapons were adopted, outlining the criteria that NATO ministers should take into account during consultations.[100] The guidelines were further amended in 1986 into General Political Guidelines for the use of nuclear weapons in the defense of NATO.[101] It is unclear when, or whether, those guidelines have been updated.

INFORMAL GROUPS

The formal structures of NATO—the NAC and the NPG and HLG—provide the basis for NATO’s regular formal nuclear consultation and political decision making. However, consultation is NATO’s lifeblood, and consultation on NATO nuclear matters—and efforts to reach consensus—extend beyond the formal groups and hierarchy to include informal groups. Those groups include the influential Quad (i.e., United States, United Kingdom, France, and Germany);[102] those members pushing for disarmament and arms control (including several of the basing countries); and certain groups with specific regional perspectives (most notably today, the allies in closest proximity to Russia). Whether exerting direct or indirect influence on alliance nuclear policy, this informal network provides an important backdrop to the formal decision-making process.

CRITIQUE OF THE EXISTING MECHANISMS

Despite those formal and informal structures for consultation and decision making, NATO nuclear issues still do not receive adequate high-level political attention within the alliance either because attention is frequently focused on more pressing problems or because nuclear posture-related issues get lost in the bureaucracy. As an example, most recently, there has been little discussion of the consequences of the introduction of the B61-12 and its advanced capability.

Underpinning allied participation is the acceptance of U.S. leadership in NATO’s nuclear affairs. However, in a partnership of shared risks, this dominance creates questions of its own about the appropriate level and degree of consultation, as well as the degree of assertiveness by allies.

This state of affairs raises a host of questions around (1) whether the HLG provides the right level and degree of political involvement, (2) what the role of U.S. leadership should be, (3) what the difference between information and consultation is, and (4) the degree to which allies are willing to challenge U.S. policy prescriptions.[103] There also are questions regarding whether the body merely reflects what it believes the United States wants to hear—or simply avoids the challenging issues.[104]

More broadly, the current components for nuclear-sharing consultation all stem from the Cold War and have yet to be adapted for today's security and political environment. The enlargement of NATO does not appear to have changed this dynamic. Some of the more recent members have insisted that NATO's nuclear policy and posture need greater credibility. However, officials also note that the more recent members lack the experience and knowledge of older members regarding NATO nuclear policy. As a result, as one official noted, they "tend to participate in consultations as concerned spectators interested in information and reassurance rather than the process of consultation itself."[105] For the most part, the participation of allies continues to be passive rather than active.

DEPARTMENT OF DEFENSE

Defense Secretary Jim Mattis hosts a joint news conference with NATO Secretary General Jens Stoltenberg at NATO headquarters in Brussels in 2017.

With regard to nuclear decision making more broadly, the procedures and considerations agreed to in the Provisional Political Guidelines were followed regularly during the Cold War. However, as one NATO official noted, "they have been largely forgotten in the post–Cold War period."[106] The 2012 Deterrence and Defence Posture Review referred to the need for planning guidance "aligned with 21st-century requirements," but it is not clear what the requirements would entail and where planning guidance stands.[107]

CHAPTER 7

NATO NUCLEAR SHARING: OPERATIONAL FACTORS AND PROCEDURES

Simon Lunn

Since the end of the Cold War, the operational dimension of forward-deployed NATO nuclear forces has become increasingly secondary to political factors.[108] This trend began with dramatic changes in the 1990s, in particular the withdrawal of Russian forces from Central and Eastern Europe and the collapse of the Soviet Union, which led to the substantial reduction by NATO of its U.S. non-strategic forces. Although reductions began with ground-launched systems, NATO later announced a reduction in air-delivered weapons, leaving only several hundred gravity bombs in Europe.[109]

Those weapons are the basis for the dual-capable aircraft (DCA) mission. Unlike Cold War nuclear planning that matched NATO capabilities against anticipated Soviet and Warsaw Pact conventional and nuclear targets, the size and disposition of this legacy NATO force is not driven by operational factors.[110] DCA were retained in part for their ability to strike targets in Russia, but the size of the force today is largely the result of political factors—namely an emphasis on allied nuclear sharing and a visible symbol of the U.S. commitment to NATO.

With the changing post–Cold War security environment and the onset of "out of area" missions in Bosnia, Kosovo, Yugoslavia, Afghanistan, and Libya, NATO's nuclear posture inevitably assumed a lower profile. Indeed, aircraft that were assigned to the DCA mission increasingly were used for conventional strike operations in diverse theaters, including Afghanistan and Libya. Key NATO documents continued to emphasize nuclear weapons, but they were given minimum attention.[111] Reductions and (in some cases) complete withdrawals of air-delivered weapons continued in NATO basing countries, albeit at a slower rate than in the early 1990s. However, in the absence of a U.S. initiative to withdraw the remaining weapons to the United States, the official preference in many basing countries remained the status quo—with the less attention, the better, because the European public was not enthusiastic about the nuclear mission.

U.S. AIR FORCE

Two Polish F-16s fly in formation during a NATO exercise in 2017.

By 1999, the weapons took on an even more limited role. The 1999 NATO Strategic Concept formally announced that NATO's nuclear forces no longer targeted any specific country, consistent with the view that "NATO and nuclear allies can emphasize that they are responsible nuclear players that envisage nuclear weapons as weapons of last resort under extreme circumstances."[112] Furthermore, officials noted that Supreme Allied Commander Europe (SACEUR)[113] no longer planned targets and that NATO no longer exercised against Russia. DCA missions assumed a generic regional nature—referred to as "scenario independent options"—and ceased to be target specific as they were during the Cold War.[114]

However, although it remains the policy of NATO not to target its nuclear forces at any specific country, the policy does not preclude the possibility (or even likelihood) that contingency plans exist. Recent NATO documents suggest that NATO must "signal to Russia, or any other potential nuclear adversary, that the use or threat of use of nuclear weapons involving the Alliance would immediately transform the nature of [a] crisis."[115] More recently, General Paul Selva, U.S. Air Force, chief of staff, testified before Congress that "[t]he stated purpose of those weapons in Europe is to deter the Russians from escalating to nuclear warfare, in order to prevent a conventional attack from going nuclear."[116]

NATO policy today is to retain the current force posture, including the retention and modernization of NATO DCA and the B61 nuclear bomb.[117] A renewed interest in the credibility of the DCA mission has reportedly led to proposals from NATO's military to simulate the capability of the DCA to penetrate Russian air defenses.

That said, NATO's increasing involvement in out-of-area operations presents additional readiness challenges. An increased and sustained NATO operational tempo that includes the use of DCA in conventional strike missions has had an effect on the DCA's nuclear readiness status, which is now said to be a minimum of 30 days.[118] The Baltic air policing mission, ongoing since 2004 to guard airspace over Estonia, Latvia, and Lithuania, places an additional strain on DCA availability. Operations to practice the various support activities needed to enable the DCA mission, such as air refueling or electronic warfare, are held periodically and allow the participation in the mission of other members that are not basing countries.[119]

EXERCISES

NATO nuclear exercises have also declined in regularity, causing some allies to argue for reversing the inevitable reduction in readiness.[120] During the Cold War, the procedures for nuclear decision making were practiced regularly in exercises designed to familiarize key participants at all levels with the considerations that would underpin the use of a nuclear weapon. The initiation of nuclear use was normally the last stage of an exercise using conventional forces.

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NATO nuclear exercises have also declined in regularity, causing some allies to argue for reversing the inevitable reduction in readiness.
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Since the end of the Cold War, NATO exercises have mainly involved interventions and crisis management.[121] Since the accession of new member states in 1999, NATO at the headquarters level has exercised a conventional defense scenario only three times.[122] These procedural exercises held at the level of the North Atlantic Council are known as Crisis Management Exercises (CMX). They have not, as during the Cold War, taken NATO to the point of exercising a nuclear release from U.S. to NATO command and custody.[123] NATO members also conduct annual Steadfast Noon exercises for DCA to practice the employment of the U.S. B61s deployed in Europe.

Following the 2016 Warsaw Summit, NATO officials expect that collective defense CMX, involving Article 5 scenarios (the premise that an armed attack against one member constitutes an attack against all allies) involving Russia, will once again

become the norm rather than the exception. According to NATO officials, practices during post–Cold War exercises have not included procedures involving nuclear release as it would scare the public.[124]

It remains to be seen whether traditional reticence to draw attention to nuclear policy and deployments will endure or whether a more visible demonstration of NATO's nuclear capabilities will gain support in light of NATO's newfound emphasis on collective defense and deterrence. Some members' concerns about Russian nuclear activities may lead to increased pressure for a return to more serious nuclear planning and exercises, including a transition from conventional to nuclear conflict.

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94. NATO, "The Nuclear Planning Group: One of NATO's Key Defence Decision-Making Bodies," October 27, 2010, http://www.nato.int/cps/ic/natohq/topics_50069.htm?selectedLocale=uk.

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96. This suspicion was confirmed by the crisis over the enhanced radiation/reduced blast warhead (ERBW) in 1977–1978; production was cancelled by President Carter in 1978 when European leaders could not guarantee deployment of the warhead in Europe. Despite a series of briefings to the North Atlantic Council on the development and planned deployment of the ERBW, there had been insufficient recognition among European leaders of the ramifications and potential for public concern. The ERBW was known colloquially in the media at the time as the bomb that "kills people and leaves buildings intact." As a result of last-minute "wobblings" by European leadership, President Jimmy Carter decided to cancel the planned deployment.

97. Personal communication with a senior U.S. official closely involved with the creation of the HLG.

98. It should be remembered that the military input to the NAC is provided by the chairman of the Military Committee with the Supreme Allied Commander Europe also in attendance as required.

99. At the 1962 NATO ministerial session of the NAC, sections of various bilateral agreements between the United States and European allies on sharing of nuclear weapons were codified in what became known as the Athens Guidelines.

100. These criteria would include the sorts of targets, collateral damage considerations, geographic areas, political objectives, and so on. The emphasis was on controlling use and examining options.

101. Beatrice Heuser, "Alliance of Democracies and Nuclear Deterrence," in *War Plans and Alliances in the Cold War: Threat Perceptions in the East and West*, edited by Vojtech Mastny, Sven S. Holtsmark, and Andreas Wenger (London: Routledge, 2006), 195.

102. The Quad consists of the nuclear three plus Germany. They meet informally before most meetings of significance. Their prior agreement on key issues of NATO policy frequently provides an essential basis for eventual consensus but is often resented by other members.

103. Discussions about NATO's tactical nuclear weapons during the post–Cold War period were often inconclusive. U.S. officials, confident in existing U.S. strategic assets, would ask their allies, "What do you want?" The reply was "Tell us what we need." This exchange is sometimes compared to the Alphonse and Gaston cartoon routine "After You." Within the context of the regular NATO nuclear forums, officials refer to an informal hierarchy consisting of the two NATO nuclear powers, the United State and the United Kingdom, the four DCA countries, and Greece and Turkey, followed by other members with various degrees of involvement in the SNOWCAT (Support of Nuclear Operations with Conventional Air Tactics) operations. France is not in the NATO nuclear hierarchy as its nuclear forces are totally independent. France's nuclear forces are not assigned to NATO and France is not, therefore, part of the NPG.

104. In their contributions to the development or reevaluation of NATO's nuclear strategy, the starting point of allies was always the 1999 Strategic Concept; See Simon Lunn, "NATO Nuclear Policy," in *Reducing Nuclear Risks in Europe: A Framework for Action*, edited by Steve Andreasen and Isabelle Williams (Washington, DC: Nuclear Threat Initiative, November 2011), 24–51.

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108. Camille Grand, "Nuclear Deterrence and the Alliance in the 21st Century," *NATO Review*, 2016, www.nato.int/docu/Review/2016/Also-in-2016/nuclear-deterrence-alliance-21st-century-nato/EN/.

109. The announcement was made at the NPG meeting at Taormina, Italy, in 1991.

110. There was no need for the operational flexibility that had underpinned Flexible Response.

111. The Strategic Concepts of 1991 and 1999 echoed the traditional need for European-based U.S. warheads. Such statements were dropped from the 2010 Strategic Concept only to return in the language of the Warsaw Summit 2016.

112. Grand, "Nuclear Deterrence and the Alliance in the 21st Century."

113. The SACEUR is responsible to NATO's highest military authority, the Military Committee, for the conduct of all NATO military operations. The SACEUR is traditionally a U.S. commander, dual-hatted as Commander of the U.S. European Command. See NATO's website at www.nato.int/cps/en/natohq/topics_50110.htm for more information.

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115. Grand, "Nuclear Deterrence and the Alliance in the 21st Century."

116. See the statement of General Paul Selva, Vice Chairman of the Joint Chiefs of Staff, before the House Armed Services Committee hearing on *Military Assessment of Nuclear Deterrence Requirements*, March 8, 2017.

117. Ibid.

118. Ibid.

119. These activities are known as SNOWCAT (Support of Nuclear Operations with Conventional Air Tactics) operations. They exercise NATO support for nuclear operations with conventional air tactics.

120. This information is based on the author's conversations with NATO officials.

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Ernest J. Moniz is co-chair and CEO of NTI. He served as United States Secretary of Energy (DOE) from 2013–2017. As Secretary, he advanced energy technology innovation, nuclear security and strategic stability, cutting-edge capabilities for the American scientific research community, and environmental stewardship. Previously, he served as DOE Under Secretary (1997–2001) and Associate Director for Science in the Office of Science and Technology Policy (1995–1997). As Under Secretary, he led a comprehensive review of nuclear weapons stockpile stewardship and served as the Secretary's special negotiator for disposition of Russian nuclear materials. He was a member of the President's Council of Advisors on Science and Technology and of the Defense Threat Reduction Advisory Committee (2009–2012). He also served on the Blue Ribbon Commission on America's Nuclear Future that provided advice to the president and the secretary of Energy, particularly on nuclear waste management. Before entering government, Moniz was a member of the Massachusetts Institute of Technology (MIT) faculty and is now the Cecil and Ida Green Professor of Physics and Engineering Systems emeritus and Special Advisor to the MIT President. He was the Founding Director of the MIT Energy Initiative (MITEI) and Director of the Laboratory for Energy and the Environment. From 1991–1995 and in 1997, he was head of the Department of Physics, and he was director of the Bates Linear Accelerator Center from 1983–1991. He is a non-resident Senior Fellow at the Harvard Belfer Center.

Sam Nunn is co-chair and former chief executive officer of the Nuclear Threat Initiative. He served as a United States Senator from Georgia for 24 years (1972–1996) and is retired from the law firm King & Spaulding. He is a distinguished professor in the Sam Nunn School of International Affairs at Georgia Tech and chairman emeritus of the board of the Center for Strategic and International Studies in Washington, DC. During his tenure in the U.S. Senate, Nunn served as chairman of the Senate Armed Services Committee and the Permanent Subcommittee on Investigations. He also served on the Intelligence and Small Business Committees. His legislative achievements include the landmark Department of Defense Reorganization Act, drafted with the late Senator Barry Goldwater, and the Nunn-Lugar Cooperative Threat Reduction Program, which provided assistance for more than 20 years to Russia and the former Soviet republics for securing and destroying their excess nuclear, biological, and chemical weapons.

Brian Rose joined NTI in 2016 as a program officer with NTI's Global Nuclear Policy Program, where he works on deterrence, strategic stability, Euro-Atlantic security, emerging technologies, and U.S. nuclear modernization. Before joining NTI, Rose served in analytical, program management, and outreach positions at the Lawrence Livermore National Laboratory, the United States Institute of Peace, the U.S. Department of State, and The George Washington University. From 2008–2009, he served on the staff of the Congressional Commission on the Strategic Posture of the United States, which informed the 2010 Nuclear Posture Review. Rose holds a bachelor's degree from St. Mary's College of Maryland and a master's degree from the Elliott School of International Affairs at The George Washington University.

Isabelle Williams joined NTI in 2007 and serves as senior advisor to the Global Nuclear Policy Program, where she helps coordinate the international strategy of the program and works on Euro-Atlantic security and multilateral disarmament efforts. She previously managed the next-generation non-proliferation program for the Partnership for Global Security, was a research associate at the Chemical and Biological Arms Control Institute, and held successive positions at the International Institute for Strategic Studies in London. She has a BA and an MA (Honors) in international studies from the University of Leeds, United Kingdom.

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Additional NTI Resources

NTI Co-Chair and CEO Ernest J. Moniz on Global Nuclear Risks

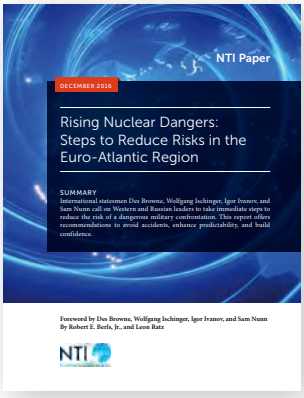
In a January 2018 speech at the Center for Strategic and International Studies, NTI Co-Chair and CEO Ernest J. Moniz warned of the growing risk that miscalculation, accident, mistake, or terrorism will lead to nuclear use. He urged leaders to reexamine strategic policies on the U.S. nuclear arsenal, force posture, and doctrine in light of these 21st century risks.

Speech text and C-Span video available at
www.nti.org/MonizNuclearPolicy

Pathways to Cooperation: A Menu of Potential U.S.-Russian Cooperative Projects in the Nuclear Sphere

By Andrew Bieniawski and Anton Khlopkov

Developed by NTI and the Russia-based Center for Energy and Security Studies (CENESS), this new report offers an alternative to the acrimony that has recently characterized U.S.-Russia relations. Building on the success of bilateral cooperation to destroy Syria's chemical weapons and cooperation on the Iran nuclear agreement, the report offers policymakers a menu of dozens of projects on nuclear security and safety issues that could be implemented in the near term and as political relations improve.



Rising Nuclear Dangers: Steps to Reduce Risks in the Euro-Atlantic

By Robert E. Berls, Jr., PhD and Leon Ratz

In the foreword, international statesmen Des Browne, Wolfgang Ischinger, Igor Ivanov, and Sam Nunn call on Western and Russian leaders to take immediate steps to reduce the risk of a dangerous military confrontation. The report offers specific recommendations to avoid accidents, enhance predictability, and build confidence between the West and Russia.

Copies of the papers available at
www.nti.org/NuclearSecurityResources

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