U.S. Nuclear Weapons in Europe

A Review of Post-Cold War Policy, Force Levels, and War Planning

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About the Author

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Further Information

A copy of this report (PDF color) and the individual color satellite images from Appendix C are available on the NRDC web site at
http://www.nrdc.org/nuclear/euro/contents.asp

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Front page photo: The tail section of a B61 nuclear bomb undergoing testing at Sandia National Laboratories. *Source: Sandia National Laboratories*.

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EXECUTIVE SUMMARY

Piecing together evidence from an array of sources, the Natural Resources Defense Council has determined that the United States is still deploying 480[1] nuclear weapons in Europe. That should come as a surprise. Until now, most observers believed that there were no more than half of those weapons still left on the continent. Declassified documents obtained under the U.S. Freedom of Information Act, military literature, the media, non-governmental organizations, and other sources show that the 480 bombs are stored at eight air bases in six NATO countries – a formidable arsenal larger than the entire Chinese nuclear stockpile.

The military and political justifications given by the United States and NATO for U.S. nuclear weapons in Europe are both obsolete and vague. Long-range weapons in the United States and Britain supplant the unique role the weapons once had in continental Europe, yet it seems NATO officials have been unwilling or unable to give them up. The deployment irritates efforts to improve relations with Russia and undercuts global efforts – and those of the United States and Europe – to persuade rogue nations from developing nuclear weapons. The Bush administration and the NATO alliance should address this issue as a matter of global nuclear security, and the United States should withdraw all of its nuclear weapons from Europe.

End of Cold War, nuclear war planning modernization, revoke traditional justification for weapons

Originally, the United States deployed nuclear weapons in Europe against the threat of a Soviet invasion during the Cold War. That threat ended more than a decade ago. In the 1990s, the United States modernized its nuclear war planning system, improving the ability to rapidly design and execute nuclear strike plans. Weapons based in the United States can cover all of the potential targets covered by the bombs in Europe, and NATO officials publicly say that they have reduced the number and role of nuclear weapons in Europe. Despite these facts, the United States still requires its military in Europe to maintain nuclear strike plans. Clinging to a Cold War nuclear posture impedes NATO's transition to a modern alliance and drains scarce resources that the alliance urgently needs to fulfill real-world non-nuclear missions.

Political and military landscape eliminate the need for nuclear weapons

European security conditions have changed significantly since NATO set the level of 480 bombs in 1993, eliminating a need for U.S. nuclear weapons in Europe. Nearly all of the countries that once were potential targets for the weapons are now members of NATO. Although NATO stated in 1996 that it had "no intention, no reason, no plan" to station nuclear weapons in new member states, the limited combat range of the nuclear strike aircraft deployed in Europe probably requires some form of staging through Eastern European air bases to effectively engage targets in Russia. Yet NATO itself has reduced the readiness level of the aircraft to such an extent that it would probably be more expedient to transfer the weapons from the United States in a crisis than to increase the readiness level.

NATO maintains that these bombs are not aimed at any particular country. A June 2004 NATO issue paper claims that the alliance has "terminated the practice of maintaining standing peacetime nuclear contingency plans and associated targets for its sub-strategic nuclear forces. As a result, NATO's nuclear forces no longer target any country." The statement is likely an exaggeration and slightly misleading. Although NATO no longer keeps aircraft on alert at the end of the runways as it did for most of the Cold War, it still maintains detailed nuclear strike plans for potential strikes against specific targets in specific countries. To justify further the presence of these weapons, NATO officials claim that the weapons are a deterrent to war, a theory disproved by the outbreak of armed conflict in Bosnia and Yugoslavia.

Absent any meaningful military role in Europe, nuclear planners have begun to search for political justifications for the nuclear weapons outside Europe. In the 1990s, U.S. and NATO officials heralded what they described as an unprecedented reduced role for nuclear weapons. At the same time, however, U.S. European Command (EUCOM) and U.S. Strategic Command arranged for the potential use of the NATO nuclear bombs outside of EUCOM's area of responsibility. European parliaments may not be aware of this change and some of them probably would not support it.

U.S. nuclear weapons in Europe undercut efforts to reduce global nuclear threat

Not only are U.S. and European rationales for forward-deploying U.S. nuclear weapons in Europe thin, but the presence of the weapons in Europe could affect the delicate relationship with other nuclear powers. Stationing U.S. nuclear weapons in Europe undercuts efforts to improve relations with Russia and gives the Russian military an excuse to maintain its own non-strategic nuclear weapons.

Equally troublesome is the fact that NATO has earmarked nearly a third of the forward-deployed weapons in Europe for use by the air forces of non-nuclear NATO countries, a violation of Non-Proliferation Treaty's (NPT) main objective. Some claim that there is no NPT violation because the weapons remain under U.S. custody until the U.S. president authorizes their use for war, at which time the treaty would no longer be in effect. But all preparation for the use of the weapons takes place now in peacetime. Equipping non-nuclear countries with the means to conduct preparations for nuclear warfare expresses a double standard that conflicts with U.S. and European nuclear nonproliferation objectives to persuade countries such as Iran and North Korea from developing nuclear weapons.

What should be done about U.S. nuclear weapons in Europe?

To end Cold War nuclear planning in Europe, the United States should immediately withdraw the remaining nuclear weapons from Europe. Doing so would complete the withdrawal that began in 1991, free up resources in the U.S. Air Force and European air forces for real-world non-nuclear missions, and enable NATO to focus on the non-nuclear security priorities that matter.

In addition, NATO should end the practice of assigning nuclear strike missions to non-nuclear member countries. This should involve the removal of all mechanical and

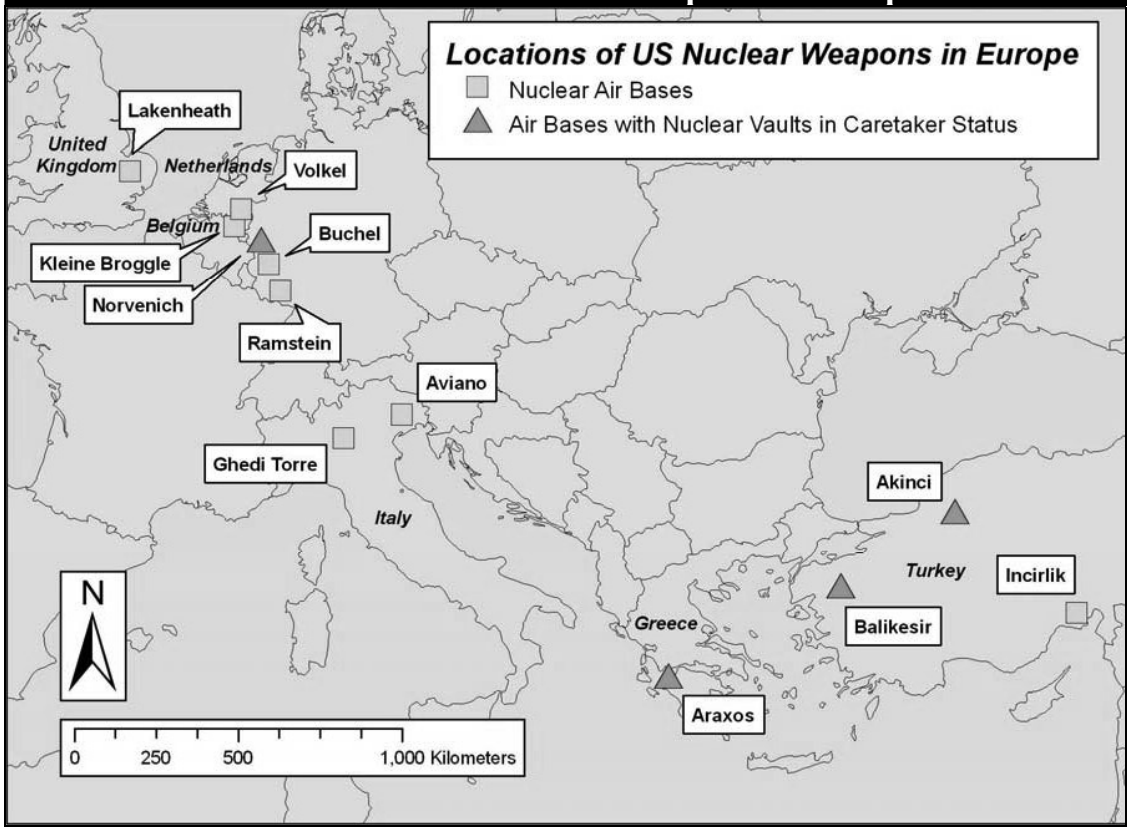
electronic equipment on host nation aircraft intended for the delivery of nuclear weapons, and the denuclearization of facilities on national air bases intended for storage and maintenance of nuclear weapons. Doing so would end NATO's nuclear double standard and strengthen the stand of the United States and Europe in persuading other countries from developing nuclear weapons.

Finally, the United States and Europe should use the political leverage that would come from these initiatives to engage Russia to drastically reduce their large inventory of non-strategic nuclear weapons. At the same time, NATO should use the removal of nuclear weapons from Greece, Italy, and Turkey to invigorate efforts toward a nuclear weapons free zone in the Middle East. Such initiatives would provide real benefits to NATO security.

LARGE U.S. NUCLEAR FORCE REMAINS IN EUROPE

The United States currently deploys approximately 480 nuclear weapons in Europe. The weapons are stored at eight bases in six countries, mainly located in northeastern Europe. At four other bases, mostly in the eastern Mediterranean region, the nuclear weapons have been removed but could be redeployed if necessary (see Figure 1).

Figure 1:
Locations of U.S. Nuclear Weapons in Europe



All the weapons are gravity bombs of the B61-3, -4, and -10 types.[2] Germany remains the most heavily nuclearized country with three nuclear bases (two of which are fully operational) and may store as many as 150 bombs (depending on the status of the weapons removed from the German Air Base at Memmingen and Araxos Air Base in Greece). Royal Air Force (RAF) Lakenheath stores 110 weapons, a considerable number in this region given the demise of the Soviet Union. Italy and Turkey each host 90 bombs, while 20 bombs are stored in Belgium and in the Netherlands (see Table 1).

The current force level is two-three times greater than the estimates made by nongovernmental analysts during the second half of the 1990s. Those estimates were based on private and public statements by a number of government sources and assumptions about the weapon storage capacity at each base. Although some of those

sources correctly identified 480 U.S. weapons in Europe by 1994, reductions rumored to have taken place in the second half of the 1990s in fact never happened.

Table 1:
U.S. Nuclear Weapons in Europe, 2005*

Country	Base	Weapons (B61)		
		US	Host	Total
Belgium	Kleine Brogel AB	0	20	20
Germany	Büchel AB	0	20	20
	Nörvenich AB	0	0	0
	Ramstein AB	90	40	130
Italy	Aviano AB	50	0	50
	Ghedi Torre AB	0	40	40
Netherlands	Volkel AB	0	20	20
Turkey	Akinci AB	0	0	0
	Balikesir AB	0	0	0
	Incirlik AB	50	40	90
United Kingdom	RAF Lakenheath	110	0	110
Total		**300**	**180**	**480**

* See Appendix A for more details and background.

The actual force level – greater in size than the entire Chinese nuclear stockpile – was continued from the force level set by the Clinton administration in 1994 and 2000. One of President Clinton's last acts as president was to sign Presidential Decision Directive/NSC-74 in November 2000, which authorized the U.S. Department of Defense to deploy 480 nuclear bombs in Europe. The new directive replaced a previous deployment directive from October 1997 that covered the years 1998 and 1999. The Bush administration is not thought to have changed the force level.

Table 2:
B61 Nuclear Bomb Characteristics[3]

Weapon	Yield	Years Build	Total U.S. Stockpile		
			Active	Reserve/ Inactive	Total
B61-3	.3, 1.5, 60, or 170 kilotons	1979-1989	200	196	396
B61-4	.3, 1.5, 10, or 45 kilotons	1979-1989	200	212	412
B61-10*	.3, 5, 10, or 80 kilotons	1990-1991	180	28	208
Total			**580**	**436**	**1,016**

* The B61-10 is a converted Pershing II missile W85 warhead.

The forward-deployed weapons probably include all three versions of the tactical B61 bomb (B61-3, B61-4, and B61-10). The B61-3 and -4 versions were built between 1979

and 1989, while the B61-10 is a converted Pershing II warhead. All three types have four selective yields down to 0.3 kilotons (300 tons), the lowest known yield of any U.S. nuclear weapon. Their maximum yields vary from 45 kilotons (B61-4) to as much as 170 kilotons (B61-3). (See Table 2)

Figure 2:
Close-Up of Protective Aircraft Shelters

Ten large Protective Aircraft Shelters (PAS) and F-15 aircraft are clearly visible in this satellite image of RAF Lakenheath in the United Kingdom. Also visible are various service vehicles in front of the shelters, three of which have open front doors. There are 60 PAS at the base (see Appendix C), 33 of which currently store a total of 110 U.S. B61 nuclear bombs. *Source: DigitalGlobe.*

The 480 bombs deployed in Europe represent more than 80 percent of all the active B61 tactical bombs in the U.S. stockpile. No other U.S. nuclear weapons are forward-deployed (other than warheads on ballistic missile submarines). An additional 436 bombs are in reserve or inactive status but could be returned to the active stockpile quickly if necessary.

Approximately 300 of the 480 bombs are assigned for delivery by U.S. F-15E and F-16C/D aircraft (capable of carrying up to five and two B61 bombs each, respectively) deployed in Europe or rotating through the U.S. bases. The remaining 180 bombs are earmarked for delivery by the air forces of five NATO countries, including Belgian, Dutch, and Turkish F-16s and German and Italian PA-200 Tornado aircraft (up to two weapons each).

Control of the nuclear weapons at national air bases is performed by the U.S. Munitions Support Squadron (MUNSS) at each base (see Table 3). Each MUNSS includes approximately 110 personnel that are responsible for the physical security of the weapons, maintenance and logistics of the weapons and the Weapons Storage and Security System (WS3), and handing over the nuclear bombs to the national air forces if ordered to do so by the U.S. National Command Authority. Prior to assignment to a MUNSS, officers undergo a two-day route orientation at Spangdahlem Air Base.[4] All MUNSS units fall under the command of the 38th Munitions Maintenance Group (MMG) at Spangdahlem Air Base. The group was stood up on May 27, 2004.[5]

Table 3:
Munitions Support Squadrons At National Air Bases

Base	Designation*	Status
Araxos AB, Greece		731 MUNSS withdrawn in 2001
Akinci AB, Turkey		739 MUNSS withdrawn in 1996
Balikesir AB, Turkey		39 MUNSS withdrawn in 1996
Büchel AB, Germany	702 MUNSS	Previously 852 MUNSS
Ghedi Torre AB, Italy	704 MUNSS	Previously 831 MUNSS
Kleine Brogel AB, Belgium	701 MUNSS	Previously 52 MUNSS
Nörvenich AB, Germany		604 MUNSS withdrawn in 1996
Volkel AB, the Netherlands	703 MUNSS	Previously 752 MUNSS

* New three-digit designations were assigned in 2004. All MUNSS units are organized under the 38th Munitions Maintenance Group (MMG) at Spangdahlem AB.

The breakdown of the weapons deployment reveals some interesting characteristics of the distribution of the weapons. The greatest number of weapons (300, or more than 62 percent) are stored on bases in northern Europe. More than 83 percent (110 of 132 spaces) of the vaults at RAF Lakenheath still store nuclear weapons. This "northern focus" is noteworthy given the considerable changes in the former Soviet Union. The 180 weapons on southern bases are fewer but much closer to the "new threat" of the proliferating countries in the Middle East region, a security problem that NATO is currently focused on.

Another interesting feature is that nuclear weapons that were withdrawn from two German bases, two Turkish bases, and one Italian base in the mid 1990s were not returned to the United States but transferred to the main U.S. base in those countries. In Germany, the weapons were moved from Memmingen Air Base and Nörvenich Air Base to Ramstein Air Base. In Turkey, they were moved from Akinci Air Base and Balikesir Air Base to Incirlik Air Base, and in Italy, the weapons were moved from Rimini Air Base to Ghedi Torre Air Base. These transfers appear to have been a consistent pattern: Nuclear weapons were not withdrawn from the European theater when a U.S. Munitions Support Squadron (MUNSS) was inactivated at national bases, but instead were moved to the main U.S. operating base in each country. In all of these cases, the weapons continue to be earmarked for "host nation use" and delivery by the national air forces.

In the case of Ghedi Torre Air Base, the situation is particularly noteworthy because the base's utilized weapons storage capacity is nearly double that of the other national bases. Out of a maximum capacity of 44 weapon spaces in 11 vaults at Ghedi Torre, roughly 40 (more than 90 percent) are filled. It is the only known case in Europe where a national air base stores more than 20 nuclear weapons. Half of the weapons at Ghedi Torre were previously stored at Rimini Air Base, which ended nuclear operations in 1993. It is unclear whether this means that the 6th Stormo Wing at Ghedi Torre has a particularly large nuclear strike mission, or that another Italian wing also has a nuclear role.

The deployment of U.S. nuclear weapons on the territories of European countries is arranged by a series of secret nuclear agreements between the United States and each host or user country. The nuclear agreements fall into four categories:[6]

> The Atomic Stockpile Agreement is a bilateral agreement between the United States government and a user nation. It guides introduction and storage within a country, custody, security, safety and release of weapons, as well as cost sharing.
>
> The Atomic Cooperation Agreement is a bilateral agreement between the United States and a user nation that provides for the "Exchange of Atomic information useful for mutual Defense Purposes."
>
> The Service-Level Agreement is a bilateral technical agreement between the military services of the United States and the user nation. It implements the government-to-government stockpile agreement and provides details for the nuclear deployment and use and defines joint and individual responsibilities.
>
> "Third party" stockpile agreements are government-level agreements between the United States, third nation and user nation. It guides stockpiling of nuclear weapons within the territory of a third-nation for the use by NATO committed forces of a signatory user nation.

Between 1952 and 1968, a total of 68 individual nuclear agreements were signed between the United States and nine NATO countries. By 1978, 53 of those agreements remained

in effect, including nine service-to-service technical agreements governing the deployment of U.S. Air Force nuclear bombs in as many countries (Belgium, Canada, Germany, Greece, Italy, Netherlands, Turkey and the United Kingdom).[7] Canada left NATO's surrogate nuclear club in 1984, apparently followed by Greece in 2001. As a result, nuclear agreements today are in effect with six NATO countries: Belgium, Germany, Italy, Netherlands, Turkey, and United Kingdom. The code words for some of the technical agreements (Service-Level Agreements) for the NATO countries that currently store U.S. nuclear weapons are known: Pine Cone for Belgium; Toolchest for Germany; Stone Ax for Italy; and Toy Chest for the Netherlands.[8]

Underground Nuclear Weapons Storage Logistics

The B61 nuclear bombs in Europe are stored in what is known as the Weapon Storage and Security System (WS3), a nuclear weapons storage capability unique to the European theater. This system enables the weapons to be stored underground in Weapons Storage Vaults (WSV) inside the individual Protective Aircraft Shelters (PAS)[9] on each base rather than in igloos in a centralized Weapons Storage Area (WSA). There are currently 204 WSVs in Europe, with a total capacity of 816 weapons (see Table 4).

Table 4:
Weapon Storage and Security System (WS3)

Country	Base	WSV	Max. Capacity
Belgium	Kleine Brogel AB	11	44
Germany[a]	Büchel AB	11	44
	Nörvenich AB[b]	11	44
	Ramstein AB	55[c]	220
Greece	Araxos AB[b]	6	24
Italy	Aviano AB	18	72
	Ghedi Torre AB	11	44
Netherlands	Volkel AB	11	44
Turkey	Akinci AB[b]	6	24
	Balikesir AB[b]	6	24
	Incirlik AB	25	100
United Kingdom	RAF Lakenheath	33	132
Total		**204**	**816**

[a] The German air base at Memmingen was closed in 2003.
[b] The vaults at these bases are in caretaker status with no weapons.
[c] One of these is thought to be a training vault.

Until now most independent analysts have assumed that each vault could store up to two weapons. But declassified documents disclose, as do careful analysis of photographs of the vaults published by the U.S. Air Force and Sandia National Laboratories (SNL) (reproduced below), that each vault can store up to four weapons. In reality, however, most bases utilize only part of their maximum capacity. The one exception is Ghedi

Torre Air Base in Italy, which stores 40 weapons in 11 vaults with only four spares (see Appendix A).

The WS3 program started in 1976 when SNL began a "forward look" study to determine how to better safeguard nuclear weapons deployed in overseas locations. At that time, nuclear weapons were stored in igloos in a double-fenced WSA at the base. In 1979, the effort produced a capability study on how to disperse the weapons for storage in the hangars themselves. Full-scale development of the four-weapon vault system began in September 1983, and Research, Development, Test, and Evaluation (RDT&E) was carried out at Ramstein Air Base in November and December 1987. The program entered production and deployment phase in August 1988 with a contract awarded to Bechtel International Inc. The first location to achieve Initial Operational Capability (IOC) was Büchel Air Base in September 1990. Incirlik Air Base was the last, in April 1998. Originally, 249 vaults were built at 15 sites in seven countries (see Appendix B).[10] The WS3 system is made up of five functional areas:

- Weapon Storage Vault (WSV)
- Communications, Command, and Control (C3)
- Assessment
- Code Transfer and Storage
- Voice Communication

The WSV, the mechanical portion of the WS3, is a reinforced concrete foundation and a steel structure recessed into the floor of Protective Aircraft Shelters (PAS). The vault barrier, barrier support, midlevel deck, and platform assembly are designed to be elevated out of the concrete foundation by means of an elevator drive system to provide access to the weapons in two stages or levels, or to be lowered into the floor to provide protection and security for the weapons. The floor slab is approximately 16 inches thick. Sensors to detect intrusion attempts are imbedded in the concrete vault body. A fully configured WSV will store up to four nuclear weapons (see Figures 3 and Figure 4).[11]

The WS3 was originally envisioned to be a global system deployed at U.S. Air Force bases where the U.S. deployed nuclear weapons overseas. A total of 437 vaults with a maximum capacity of more than 1,700 weapons were initially planned for 28 locations worldwide (36 vaults were planned for Kunsan Air Base in South Korea). Of these, 401 were in Europe with a combined capacity of 1,604 weapons. The scope of the program was scaled back considerably, as were the number of WSVs at each base. In 1997, there were 249 sites with a capacity of 996 weapons (even though only approximately 520 U.S. and U.K. weapons were present) in Europe. Today, there are 204 vaults with a maximum capacity of 816 weapons – nearly double the number of weapons actually deployed (see Appendix A and Appendix B).

Table 6:
Recent Modifications to U.S. Nuclear Weapons in Europe

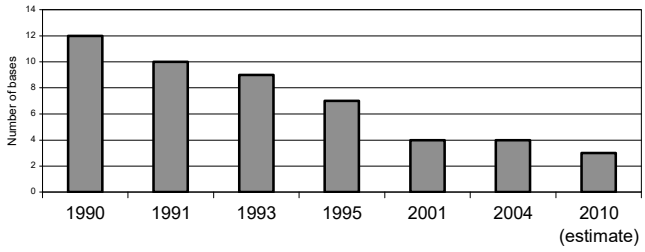
ALT 335	Carried out between October 1998 and September 2003. Installed a Trajectory Sensing Signal Generator (TSSG), a safety improvement that increases the nuclear safety of the bomb in certain normal and abnormal environments. Büchel AB received initial training in May 1996.
ALT 339	Carried out between October 1998 and September 2003. Installed the MC4519 MCCS Encryption Translator Assembly (MET) in B61-3, -4, and -10 to provide weapons with cryptographic capability to implement end-to-end encryption in the PAL Code Management System (CMS). MC4519 MET coupled with the CMS enables recoding of nuclear weapons in a fully encrypted manner. MET capability improves the positive controls over use of the warhead. Regular monthly shipments started in June 1997. The first CMS became operational on B61s in Europe on November 30, 2001.
ALT 354	Carried out between March 2001 and March 2002. Adjustment of fin cant angle for B61-3, -4, and -10 to improve weapon spin rates when used in conjunction with existing spin motor.

The CMS greatly simplifies use and logistics for personnel and greater flexibility and speed in maintenance and arming of the weapons. The products were delivered on November 7, 2001, but MUNSS units began training for them in 1996 (the 817th MUNSS at Büchel Air Base in March 1996). The CMS first became operational on nuclear bombs in Europe on November 30, 2001. One part of the system, a cryptographic processor, was deployed in Europe in 1997 "to address some Y2K problems." CMS replaced the code management equipment on all U.S. military and National Nuclear Security Administration (NNSA) users by early 2004, and is envisioned to be the common foundation for all future upgrades of U.S. PAL system hardware and software.[31]

Table 7:
Type 3 Trainer Requirements by Location and Type[32]

Base	Type 3A	Type 3E	Total
Aviano B61-4	2	3	5
Büchel B61-4	1	6	7
Ghedi Torre B61-4	1	6	7
Incirlik B61-4	2	1	3
Kleine Brogel B61-4	1	6	7
Lakenheath B61-4	2	7	9
Ramstein B61-0		1	1
Ramstein B61-4	2	4	6
Spangdahlem B61-4	1	1	2
Volkel B61-4	1	6	7
Total	**13**	**41**	**54**

Table 10:
Host Country Air Bases With Nuclear Weapons



Greece's decision is also important because it represents the first case where nuclear weapons have been completely removed from a burden-sharing NATO country. The removal of nuclear weapons from the Turkish bases Erhac and Eskisehir in 1991 and the Italian Rimini base in 1993 was part of the 1991 decision by NATO to reduce air bombs by 50 percent. In those cases, the weapons were returned to the United States, but allied wings maintained a nuclear strike role. The removal of nuclear weapons from the German bases at Nörvenich and Memmingen[180] and the Turkish bases at Akinci and Balikesir was different because the weapons were not returned to the United States but have remained in storage at Ramstein and Incirlik earmarked for host-nation use.

Figure 19:
PA-200 Tornado at Büchel Air Base

German Tornado fighter-bomber of Jabo G-33 at Büchel Air Base in front of a Protective Aircraft Shelter. There are 20 nuclear bombs are the base in underground Weapons Storage Vaults inside 11 shelters.
Source: German Air Force.

Germany's contribution to NATO's nuclear strike mission also seems to be at stake. Nuclear weapons have already been removed from two of three bases that until 1996 stored nuclear weapons (Nörvenich Air Base and Memmingen Air Base).[181]

The 34 fighter-bomber wing (Jagdbombergeschwader or Jabo G-34) at Memmingen Air Base ceased operations in 2002 and the base was closed in 2003.[182] The Tornado fighter-bombers of the 31st Wing (Jabo G-31) at Nörvenich Air Base (the weapons have already been transferred to Ramstein Air Base) will be replaced with non-nuclear capable Eurofighter (EFA 2000) aircraft in 2007–2010. The 33rd Wing (Jabo G-33) at Büchel Air Base still stores nuclear weapons but will transition to the Eurofighter in 2012–2015.[183]

Figure 20:
Büchel Air Base

The southwestern end of Büchel Air Base showing the northern "loop" with aircraft shelters and storage buildings. Protective Aircraft Shelters (PAS) are visible along this loop and the loop on the other side of the runway. Twenty nuclear bombs are stored in 11 PAS on the base.

Source: http://de.indymedia.org/

Descriptions of nuclear weapons certification inspections of non-nuclear NATO countries are rare, but one such instance involves the German Jabo G-33 at Büchel Air Base. In April 1996, the same year nuclear weapons were removed from Memmingen Air Base and Nörvenich Air Base, NATO conducted a Tactical Evaluation (TAV EVAL) at the base only three months after USAFE carried out a full force Site Assistance Visit of the 817th MUNSS. The JABOG-33 "did a superb job during the [TAC EVAL] inspection" and the 817th MUNSS received an "Excellent" rating from the TAC EVAL. According to the 817 MUNSS, the "Jabo G-33 and the 817 MUNSS showed others why our motto is 'Partners in Peace'":[184]

> "The GAF [German Air Force] performed superbly during the JSSI [Joint Safety and Security Inspection] portion of the inspection. There [sic] overall 'Excellence' rating is testimony to the hard effort that the Jabo G-33 personnel have contributed since the last inspection. The Maintenance Personnel and

Appendix A:
U.S. Nuclear Weapons in Europe, 2005

Country	Base	Custodian[a]	Delivery Aircraft	WS3 Capacity[231]			Weapons (B61)		
				Vaults	Capacity	Completed	U.S.	Host	Total
Belgium	Kleine Brogel AB	701 MUNSS	Belgian F-16	11	44	Apr 1992	0	20	20
Germany[b]	Büchel AB	702 MUNSS	German PA-200 Tornados	11	44	Aug 1990	0	20	20
	Nörvenich AB*		German PA-200 Tornados	11	44	Jun 1991	0	0	0
	Ramstein AB	52 FW	US F-16C/D	55[c]	220[c]	Jan 1992	90[d]	40[e]	130
Greece	Araxos AB*			6	24	Sep 1997	0	0	0
Italy	Aviano AB	31 FW	US F-16 C/D	18	72	Jan 1996	50	0	50
	Ghedi Torre AB	704 MUNSS	Italian PA-200 Tornados	11	44	Jan 1997	0	40	40
Netherlands	Volkel AB	703 MUNSS	Dutch F-16	11	44	Sep 1991	0	20	20
Turkey	Akinci AB*		Turkish F-16	6	24	Oct 1997	0	0	0
	Balikesir AB*		Turkish F-16	6	24	Sep 1997	0	0	0
	Incirlik AB	39 FW	US F-16C/D	25	100	Apr 1998	50	40	90
United Kingdom	RAF Lakenheath	48 FW	US F-15E	33	132	Nov 1994	110	0	110
Total				**204**	**816**		**300**	**180**	**480**

* Site is in caretaker status.

[a] Each Munitions Support Squadron (MUNSS) includes approximately 125-150 assigned personnel.

[b] Operational and support responsibilities of USAF and the Bundeswehr for munitions support bases in Germany are described in the 1960 Tool Chest Agreement.[232]

[c] One vault is a training vault.

[d] Assumes 20 weapons removed from Araxos Air Base in 2001 were transferred to Ramstein Air Base rather than to Aviano Air Base to avoid filling the Italian vaults to capacity. Alternatively, the weapons could have been returned to the United States.

[e] Half of these weapons may have been returned to the U.S. after Memmingen Air Base closed in 2003.

Appendix B:
Planned and Current WS3 Capacity[233]

Country	Base	1986		1997		2004	
		Vaults	Max Cap.	Vaults	Max Cap.	Vaults	Max Cap.
Belgium	Florennes AB	2	8*	0	0	0	0
	Kleine Brogel AB	11	44	11	44	11	44
Germany	RAF Brüggen	0	0	10	40	0	0
	Büchel AB	11	44	11	44	11	44
	Hahn AB	53	212	0	0	0	0
	Memmingen AB	11	44	11**	44	0***	0
	Nörvenich AB	11	44	11**	44	11**	44
	Ramstein AB	58	232	55	220	55	220
	Wueschheim AB	2	8*	0	0	0	0
Greece	Araxos AB	11	44	6	24	6**	24
Italy	Aviano AB	18	72	18	72	18	72
	Comiso AS	2	8*	0	0	0	0
	Ghedi Torre AB	6	24	11	44	11	44
	Rimini AB	6	24	0	0	0	0
Netherlands	Volkel AB	11	44	11	44	11	44
	Woensdrecht AB	2	8*	0	0	0	0
South Korea	Kunsan AB	36	144	0	0	0	0
Turkey	Balikesir AB	6	24	6**	24	6**	24
	Erhac AB	6	24	0	0	0	0
	Eskishir AB	6	24	0	0	0	0
	Incirlik AB	30	120	25	100	25	100
	Murted (Akinci) AB	6	24	6**	24	6**	24
United Kingdom	RAF Bentwaters	25	100	0	0	0	0
	RAF Greenham Common	2	8*	0	0	0	0
	RAF Lakenheath	48	192	33	132	33	132
	RAF Marham	0	0	24	96	0	0
	RAF Molesworth	2	8*	0	0	0	0
	RAF Upper Heyford	55	220	0	0	0	0
Total	**28 sites**	**437**	**1748**	**249**	**996**	**204**	**816**

* For support of W80 warheads for the Ground-Launched Cruise Missile (GLCMs). It is not known how many W80s could be stored in each vault, but the W80 is much smaller than the B61 bomb, of which up to four can be stored in each WSV, so more than four W80s conceivably could have been stored in each WSV. The 1987 INF Treaty removed this requirement.
** WS3 site in caretaker status. MUNSS inactivated and no weapons present.
*** Memmingen Air Base closed in 2003.

Appendix C:
Portraits of NATO Nuclear Bases in Europe

This appendix contains satellite images and maps of air bases in Europe where NATO currently stores nuclear weapons or maintains Weapons Storage Vaults capable of storing nuclear weapons if necessary. Details of the deployments and weapons storage facilities are described below each image and in Appendix A and Appendix B.

Satellite images were obtained for most of the bases, but in four cases (Akinci Air Base, Büchel Air Base, Nörvenich Air Base, and Volkel Air Base) satellite images were not available. Base maps were found for Büchel Air Base and Volkel Air Base, while an aerial photograph was obtained of Nörvenich Air Base. Only Akinci Air Base could not be illustrated.

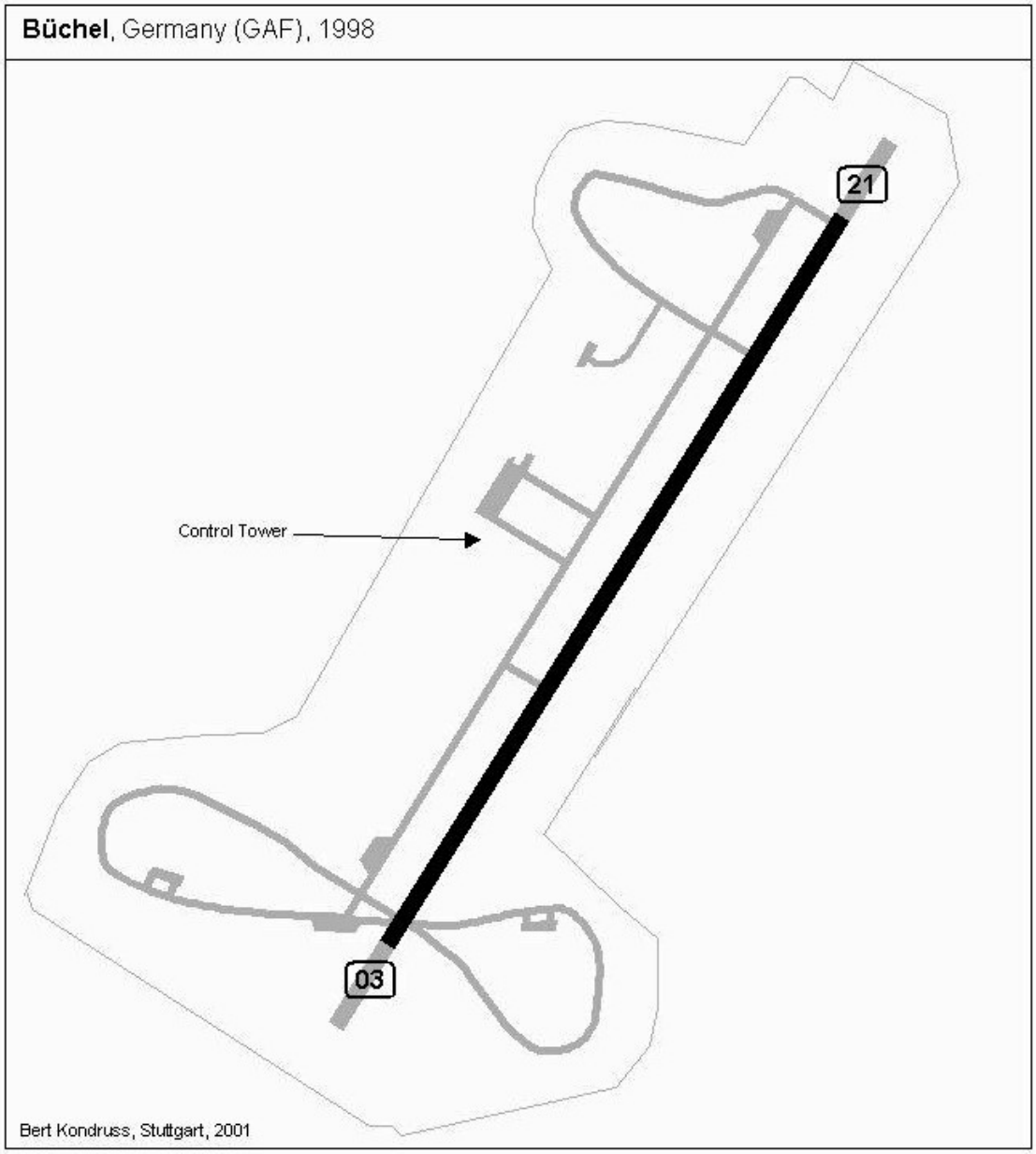
The quality of the satellite images made it possible to clearly identify both the location and the size of the individual Protective Aircraft Shelters on the bases. The approximate size of the shelters was measured from the satellite images. In some cases, it was also possible to identify the Weapons Storage Area where nuclear weapons were kept before the Weapon Storage and Security System became operational in the 1990s.

Each base contains more Protective Aircraft Shelters than are used for nuclear weapons storage. The satellite images and the information used in this report do not permit identification of which Protective Aircraft Shelters currently store the nuclear weapons.

Below follows the satellite images, photographs, or maps and descriptions of the following bases (note: the images are best viewed in color and all are available on the Internet at http://www.nrdc.org/xxxx):

Araxos Air Base, Greece
Aviano Air Base, Italy
Balikesir Air Base, Turkey
Büchel Air Base, Germany
Ghedi Torre Air Base, Italy
Incirlik Air Base, Turkey
Kleine Brogel Air Base, Belgium
Nörvenich Air Base, Germany
RAF Lakenheath, United Kingdom
Ramstein Air Base, Germany
Volkel Air Base, Germany

Büchel Air Base Map[234]



Büchel Air Base, Germany: The base is located in southwestern Germany (50°10'N, 07°04'E) near the border to Luxemburg. The base has 11 Protective Aircraft Shelters (PAS) equipped with WS3 Vaults for storage of nuclear weapons (maximum capacity is 44). There are 20 B61 nuclear bombs stored on the base for delivery by German PA-200 Tornado IDS bombers of the Jabo G-33 squadron. *Source: http://www.mil-airfields.de/.*