

**P**antex is a high-security Department of Energy facility named for its location in the Texas panhandle. It is protected by gun-toting guards wearing spit-shined combat boots. "Some of the guys say that if we just took down a couple of fences, it would look like a prison," says administrative program manager Jerry Hemphill, one of nearly 3,000 employees.

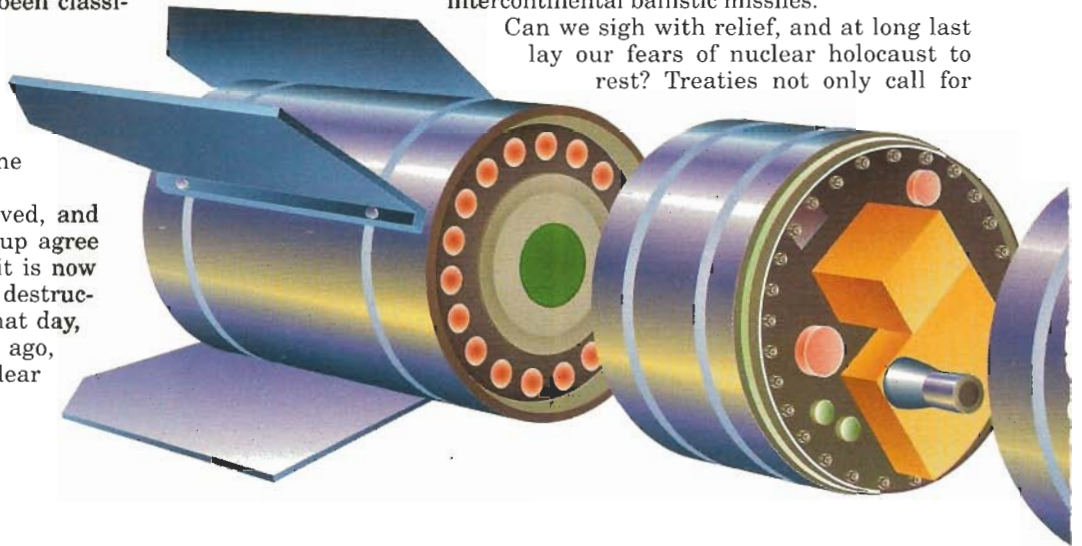
In January, Pantex officials allowed POPULAR SCIENCE inside the complex's razor-wire fences for an unprecedented tour. Building 104, a new \$30 million structure officially known as the Weapons Special Purpose Bay Replacement Complex, was still undergoing safety tests and had not yet been classified. Since our visit, it has gone "behind the fence," according to Tom W. Walton, public affairs officer at Pantex. It is here that the next chapter in the epilogue of the Cold War is being written.

The Soviet Union is dissolved, and the nations born of its breakup agree with the United States that it is now time to reduce the stockpile of destructive energy stored up since that day, a little more than 50 years ago, when the first controlled nuclear

chain reaction took place at Stagg Field on the University of Chicago campus.

Just a few years ago, the United States and the Soviet Union had a total of about 50,000 nuclear weapons in their stockpiles. Some of these weapons have already been dismantled. The Strategic Arms Reduction Treaty (START) calls for cutting the nuclear warhead count from around 9,000 per side to 6,000 per side. START II—designed to eliminate multiple-warhead, land-based missiles—would further reduce the strategic-weapons arsenals to 3,500 per side. The United States has already withdrawn all short-range and naval nuclear weapons formerly stored abroad, and the Russians say they no longer target the United States with intercontinental ballistic missiles.

Can we sigh with relief, and at long last lay our fears of nuclear holocaust to rest? Treaties not only call for



**Popular  
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# TAKING APART

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A B-61 nuclear bomb (rear) is broken down into four major subassemblies (center), which are dismantled separately. The bomb has about 6,000 parts, some of which are displayed on this table.



SANDIA NATIONAL LABORATORIES

the dismantling of warheads, but also for the destruction of missiles and other delivery systems. And the production plants for fissionable materials—the plutonium and uranium that power nuclear weapons—stand idle. But despite all these changes, no government has any plans to destroy or make totally inaccessible its inventory of fissionable materials. Nuclear firepower is not going out of existence—merely into storage.

The atomic bomb was developed by the United States in the fear that Nazi Germany's scientists would be first to implement a concept known to all physicists since the 1930s—nuclear fission. That concept inflated physics, once a concern only of theoreticians and tabletop experimenters, into a huge industry and a major instrument of national power. Despite Germany's defeat in the spring of 1945, the bomb program hastened to its conclusion: Two atomic bombs were dropped on Japan in August of that same year.

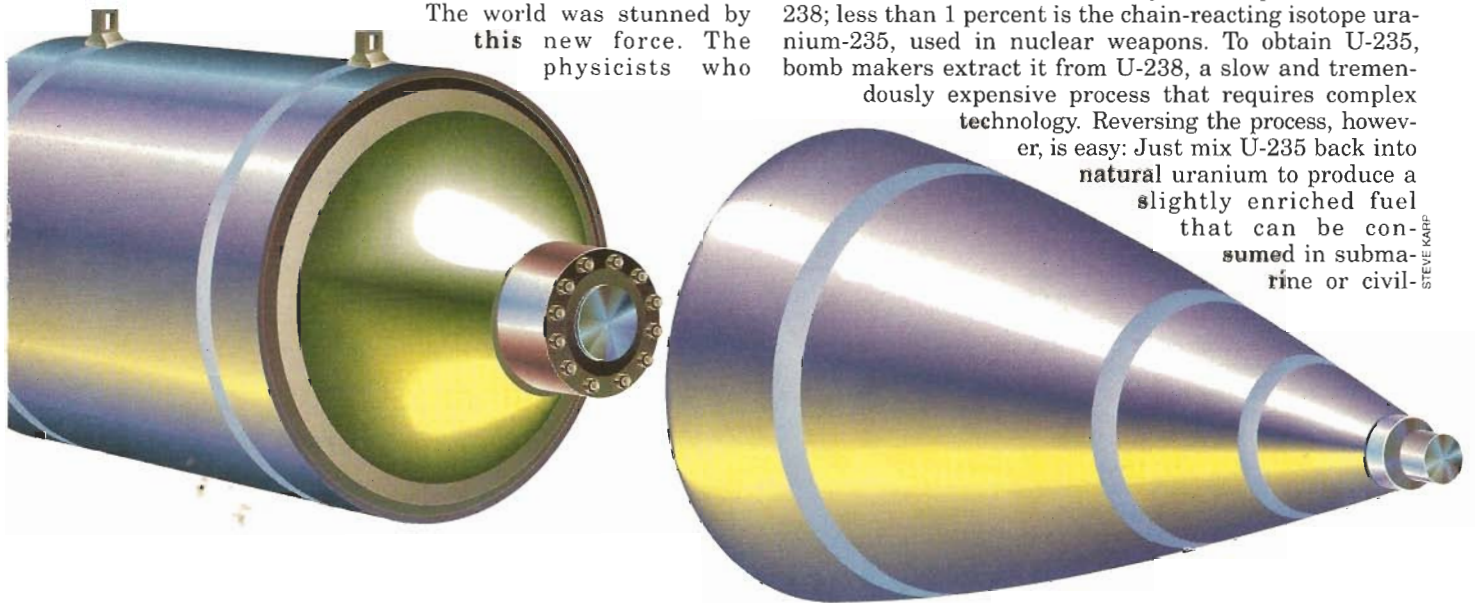
The world was stunned by this new force. The physicists who

had created it foresaw the future—that the Soviets would have the bomb soon (they did, by 1949) and that an arms race would follow. Now that race has finally ended, and the competitors—who together spent more than a trillion dollars to create their nuclear weapons complexes—are making plans for the dismantling of their arsenals. This is a positive step, but not one that will soon bring an end to the mess caused by nuclear weapons. In their race to produce weapons, the cold-warring nations contaminated land, air, and water with radioactive materials and toxic chemicals. As much as 15 percent of the former Soviet Union's territory is now estimated to be unfit for human habitation. In the United States, the cleanup is expected to take decades and will cost at least \$200 billion. Weapons dismantling in the next few years will add to this legacy an estimated 25 tons of highly enriched uranium and ten tons of plutonium.

Natural uranium ore is mostly made up of uranium-238; less than 1 percent is the chain-reacting isotope uranium-235, used in nuclear weapons. To obtain U-235, bomb makers extract it from U-238, a slow and tremendously expensive process that requires complex technology. Reversing the process, however,

is easy: Just mix U-235 back into natural uranium to produce a slightly enriched fuel that can be consumed in submarine or civilian

STEVE KARP



# BOMB

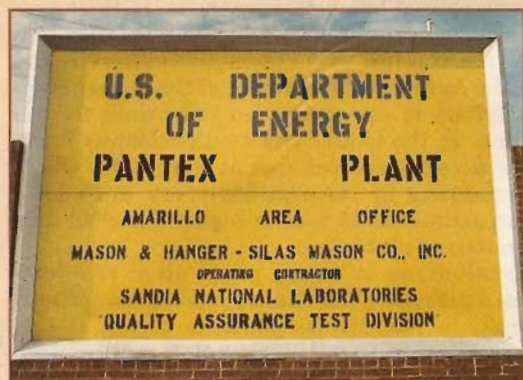
**Disassembling a nuclear weapon is easy. The hard part: Getting rid of its radioactive innards.**

BY KEVIN CAMERON

# THE INSIDE STORY OF PANTEX: THE UNITED STATES'

## SPECIAL DELIVERY

Weapons arrive at Pantex in armored, guarded trucks known as Safe Secure Tractor-trailers, or SSTs. Radio and satellite equipment enables government officials to track trucks' whereabouts at all times.



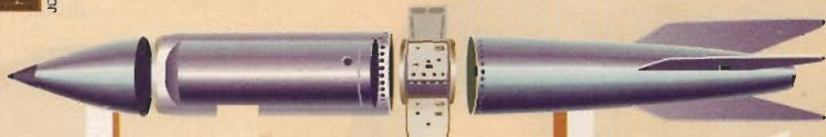
JOHN B. CARNIETT

**P**antex was once responsible for assembling weapons, but its more important mission now is disassembly. Employees work on about four nuclear weapons types in a year, out of about 30 in the U.S. arsenal. During the past 40-plus years, the Department of Energy has disassembled close to 50,000 weapons. Not all of the weapons, however, have been retired. Some were taken apart for testing, and were then reassembled. Others were retrofitted to create new weapons.

Weapons arrive at Pantex in armored, guarded trucks and are stored in bunkers (see illustrations at right). The weapons are inspected, separated into subassemblies, and finally broken down into individual parts for recycling or disposal. Workers separate the chemical explosives and radioactive materials, then store the weapons' plutonium pits.

Pantex has the capacity to disassemble about 2,000 weapons per year. But at that rate, the plant will soon run out of storage space for plutonium pits, which are no longer sent away to be made into new bomb cores. Proposals now on the table would allow Pantex to expand the storage space for pits, which would remain at the plant for an "interim" period of six to ten years. After that, the pits could be moved to another storage site.—*Dawn Stover*

IAN WOPFOL

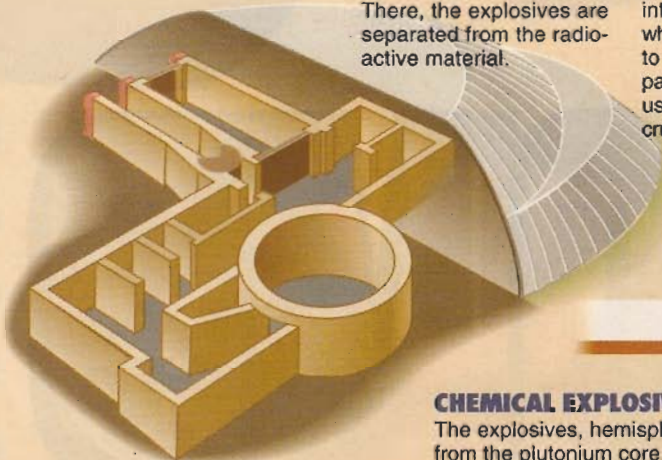


## DISASSEMBLY CELL

If it contains sensitive chemical explosives, the portion of the weapon containing radioactive material goes to a "cell" buried beneath more than 15 feet of gravel and sand. There, the explosives are separated from the radioactive material.

## SPARE PARTS

A weapon such as the B-61 bomb is broken down into its subassemblies, which are further reduced to thousands of individual parts. Parts that are not re-used or recycled are crushed beyond recognition.



## CHEMICAL EXPLOSIVES

The explosives, hemispherical shells cut away from the plutonium core, are burned outdoors.



ian power reactors. Without the extraction technology, the mixture is useless for bomb production.

Plutonium, however, is a problem. Nonexistent in nature, plutonium is created in nuclear reactors by irradiating natural uranium with neutrons. Unlike U-235, plutonium can be chemically extracted from any mixture with ease.

Arms control experts believe plutonium is relatively safe in fixed storage at military bases or dismantlement centers. The cost of such storage is estimated at \$1 to \$2 per gram, or between \$300 million and \$600 million per year worldwide—not too much to pay for protection against the unauthorized use of this dangerous, cancer-causing material.

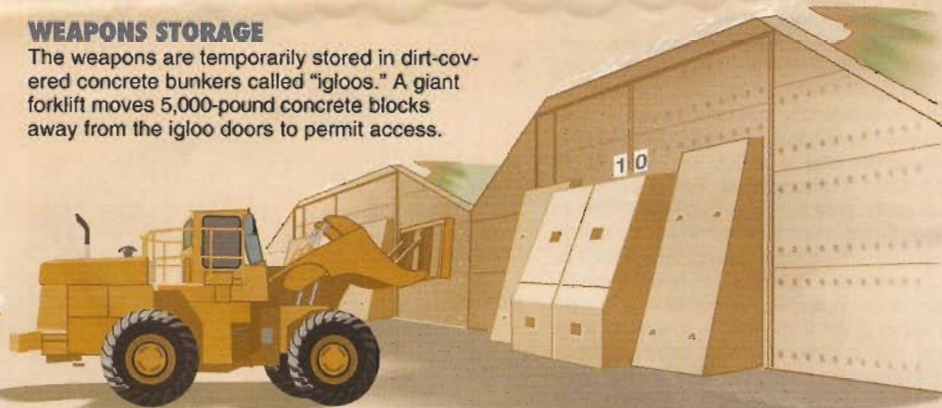
Greater risk occurs in transit. A special armored "white train" was once used to convey U.S. nuclear weapons to Pantex, the nation's only dismantlement center. Now a fleet of 70 special armored trucks, escorted by heavily armed guards, transports weapons to the 16,000-acre plant, located east of Amarillo, Texas.

The bombs, warheads, and artillery shells that the trucks transport to Pantex are delivered to an area called Zone 4 and temporarily stored in "igloos," bunkers made of reinforced concrete covered with at least three feet of soil. From the igloos, weapons are moved to buildings that are designed for inspection, assembly, and disassembly tasks. Building 104, one such facility, contains eight

# NUCLEAR WEAPONS DISMANTLEMENT CENTER

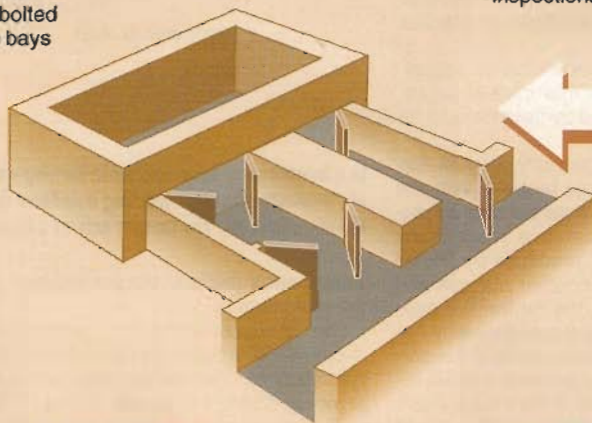
## WEAPONS STORAGE

The weapons are temporarily stored in dirt-covered concrete bunkers called "igloos." A giant forklift moves 5,000-pound concrete blocks away from the igloo doors to permit access.



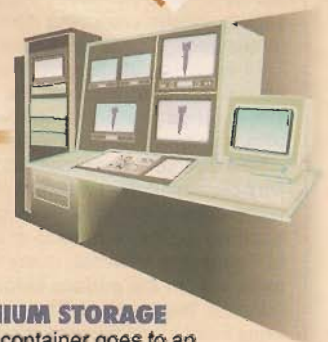
## DISASSEMBLY BAY

Technicians take apart weapons in "bays," which have thick, heavy walls and doors. The inner doors cannot be opened until the outer doors are closed. Weapons, bolted to carriers, are rolled into the bays through the larger doors.



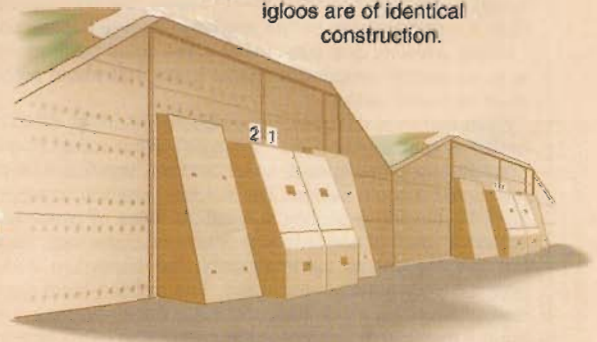
## X-RAY INSPECTION

Before they are disassembled, many weapons go to a radiography bay for high-power X-ray inspections.



## PLUTONIUM STORAGE

The steel container goes to an igloo for "interim" storage. Plutonium and weapons are stored in separate igloos, but the igloos are of identical construction.



## PLUTONIUM PIT

The bomb's core—a plutonium pit covered with a protective jacket of metal—is placed in a metal holder, which is stored inside an insulated steel container.



"bays"—large, heavily shielded rooms. The walls consist of 15 feet of earth sandwiched between a pair of two-foot-thick layers of concrete, and the entrances are protected by 1,100-pound doors. The floors are made from paint chips that are mixed with polyurethane to form a spongy material deemed unlikely to set off explosives. While there is little danger of a nuclear detonation, it's possible that the chemical explosive of a weapon could blow up during the disassembly process. If that were to happen, the room's shielding would help contain the blast.

In one of the bays, technicians operate a powerful X-ray machine that can penetrate 15 inches of steel. "You want to know what the weapon system's condition is before you

dismantle it," explains Randall L. Hodges, production supervisor for nondestructive evaluation.

Technicians place a weapon on a large turntable. Film is attached to a screen behind the turntable; pointed at the weapon is a linear accelerator suspended from a gantry—a jumbo version of the X-ray machine your dentist points at your cheek. A computer automatically controls the movement of the turntable and linear accelerator, and the technicians can watch the X-ray image as it's being made. Then they can add false-color enhancement to detect flaws.

After the X-ray inspection, the weapon goes to an assembly/disassembly bay. "You use essentially the same

