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Accidental Nuclear War

Modifications to superpower arsenals and to procedures for handling them could substantially reduce the risk of unintended Armageddon

by Bruce G. Blair and Henry W. Kendall

If nuclear war breaks out in the coming decade or two, it will probably be by accident. The threat of a cold-blooded, calculated first strike is vanishing, but beneath the calm surface of constructive diplomacy among the traditional nuclear rivals lurks the danger of unpremeditated use of nuclear weapons. The accidental, unauthorized or inadvertent use of these weapons has become the most plausible path to nuclear war.

Both superpowers, as well as France, Great Britain and China—long-standing members of the nuclear club—are potential sources of accidental missile launch. The emergence of fledgling nuclear powers such as India, Pakistan and Israel—some armed with ballistic missiles—pushes nuclear safeguards even closer to the top of the international security agenda.

The political stability of some nuclear newcomers is questionable, and so any physical and procedural safeguards they place on their weapons might readily be overriden. It is unlikely, however, that a nuclear attack by one of these nations—either on one of the superpowers or a client state—could trigger a massive nuclear response. U.S. and Soviet arsenals still pose the greatest controllable threat of unintended war, and so changes to those arsenals offer the greatest hope of alleviating that risk.

The chances of unwanted nuclear war would be reduced significantly if tamperproof, coded locks were installed on all nuclear weapons and if methods were put in place to disarm nuclear forces even after launch. In addition, the U.S. and the Soviet Union should reduce their reliance on the dangerous policy of launch on warning and reduce the launch readiness of their nuclear forces.

The social and political upheavals in the Soviet Union underscore fears of unintended nuclear war. Civil turmoil raises the possibility that rebellious ethnic groups or splinter organizations could capture nuclear weapons. Other, deeper fault lines run through the whole of Soviet society and may be capable of cracking the foundations of its nuclear command system. Although the U.S. faces no such civil unrest, the country's system of nuclear command carries some risk that nuclear weapons might be used contrary to the intentions of legitimate authorities.

The organization of missile forces in the U.S. and the Soviet Union makes it just as likely that many missiles could be launched without authorization as easily as a single one. A breakdown of control at the apex of the command chain or at lower levels (perhaps resulting from a violent rupture of Soviet political institutions) could lead to an attack causing vast destruction—and possibly trigger a larger nuclear exchange.

Were an unauthorized attack to occur from the Soviet Union, the minimum launch could involve a battalion (six to 10 missiles) or even a regiment (18 to 30 missiles). Each missile carries up to 10 warheads; the salvo could result in as many as 300 nuclear explosions. In the U.S. a minimum launch could involve either a flight of 10 missiles or a squadron of 50, carrying as many as 500 warheads, each more than 25 times as powerful as the bomb that destroyed Hiroshima. Even if no retaliation ensued, the resulting destruction and loss of life would dwarf any previous calamity in human experience.

Both U.S. and Soviet nuclear commanders face an unavoidable dilemma: they must exert negative control over nuclear weapons to prevent unwanted use, but they must exert positive control to ensure that weapons are used when duly authorized. Measures that reduce the chance of unwanted launch may increase the chance that legitimate launch orders will not be carried out. Military commanders have thus resisted improved safeguards on the grounds that those safeguards would weaken nuclear deterrence. Deficiencies in negative control have been tolerated, and although some remedial measures have gradually been implemented, a completely satisfactory trade-off has yet to be found.

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An alarmist position is unwarranted; the dominant peacetime requirement of both the U.S. and the Soviet nuclear command systems is to prevent reliably the illicit or accidental release of even a single nuclear weapon. The nuclear hierarchy is well aware that it would probably not survive the political repercussions of any major failure to perform this function. Both sides have developed sophisticated weapon-design principles and operational procedures to preserve effective negative control over tens of thousands of widely dispersed warheads; their record has been perfect to date.

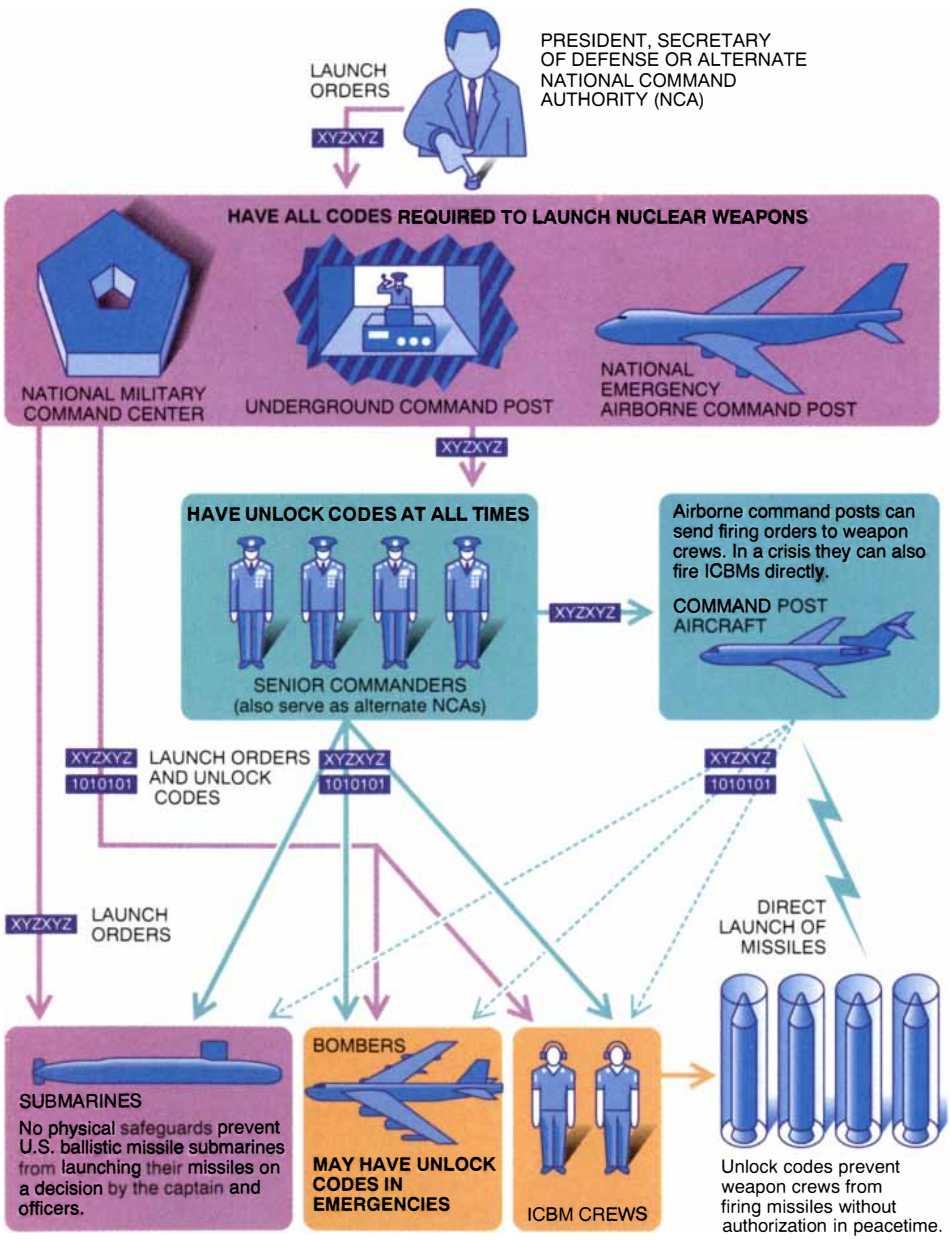
Complete confidence, however, is equally unwarranted. Even the most thorough study of ways that a disaster might occur cannot exhaust the perverse possibilities, as the explosion of the *Challenger* space shuttle and the nuclear accident at Three Mile Island attest. Furthermore, weaknesses in current safeguards are most likely to surface in a crisis—circumstances under which neither superpower has much experience in preserving negative control.

Crises shift the priority of nuclear command systems toward positive control at the expense of safeguards. When the Soviets invaded Czechoslovakia in 1968, they placed at least one army of their strategic rocket forces one notch below maximum alert. Nuclear warheads were removed from storage depots and affixed to missiles at the launch pads. These actions compromised a strong safeguard against unintended launch: separation of warheads from their means of delivery.

The U.S. engaged in comparable actions during the 1973 Arab-Israel war. Additional long-range bombers were placed on ground alert, ballistic missile submarines left port and nearly all land-based strategic missiles were readied for launch. Individual weapon commanders removed launch keys and presidential launch codes from their dual-lock safes—increasing the possibility of unauthorized release of weapons.

Current procedures since added to this alert level include the activation of special radio communications links that enable a military command aircraft to fire all 1,000 land-based American intercontinental ballistic missiles (ICBMs) by remote control. This decreases the power of ground crews to veto an illicit launch command.

U.S. NUCLEAR WEAPON COMMAND



The actions taken in such alerts cannot be completely governed by political leaders. The vulnerability of nuclear forces and the command system itself to nuclear attack generates pressure to delegate authority for nuclear alerts and weapon release down the chain of command.

The U.S. and the Soviet Union, however, appear to differ substantially on the extent to which positive control is delegated in a crisis. The U.S. command system is decentralized and allows individual weapon commands to take virtually all alert steps short of firing weapons. Military commanders can send bombers to their holding stations near Soviet territory. They also launch the airborne command posts, which issue launch orders in case of an attack that destroys ground-based centers.

Orders affecting the disposition of nuclear forces flow through strictly military channels, with marginal civilian oversight. Furthermore, historical documents leave little doubt that past presidents have delegated to key military commanders the authority to execute nuclear war plans in the event of a communications failure and verification of a nuclear strike against the U.S. There is strong evidence that such arrangements are still in effect. Numerous military installations possess all the codes needed to authorize launch. The portion of the U.S. arsenal that is restrained by hardware locks can be readied for use by many sources within the military chain of command.

In contrast, no Soviet military commander has significant authority to alert or maneuver nuclear forces, much less order an attack. Changes in alert status require the explicit approval of

the highest political leaders. Furthermore, nuclear orders are apparently processed in parallel by several separate control channels to ensure strict conformity to political plans. Units of the KGB—the Soviet political secret police—have custody of tactical nuclear weapons and, it is believed, disseminate weapon unlock codes to tactical and most strategic forces, ensuring central political control. The scope for unauthorized release would expand, however, if codes were distributed as part of the preparation for war.

A further weakness in protection against unwanted war stems from launch-on-warning strategies, which call for commanders to fire retaliatory missiles after an attack is confirmed but before incoming warheads detonate. Both the U.S. and Soviet Union rely heavily on this strategy. It requires flawless performance from satellite and ground-based sensors and from human beings.

Launch on warning compels authorities to decide whether to fire—and against which targets—in a short time and without a clear picture of the attack supposedly under way. They must respond with no definitive warhead count, no clear idea of the intended targets, no prediction of expected damage and casualties, no knowledge of the objectives of the attack and possibly no way to tell whether the attack is deliberate, accidental or unauthorized. Even if this information were available, commanders could not easily comprehend it and react in measured ways in the time allowed by launch on warning.

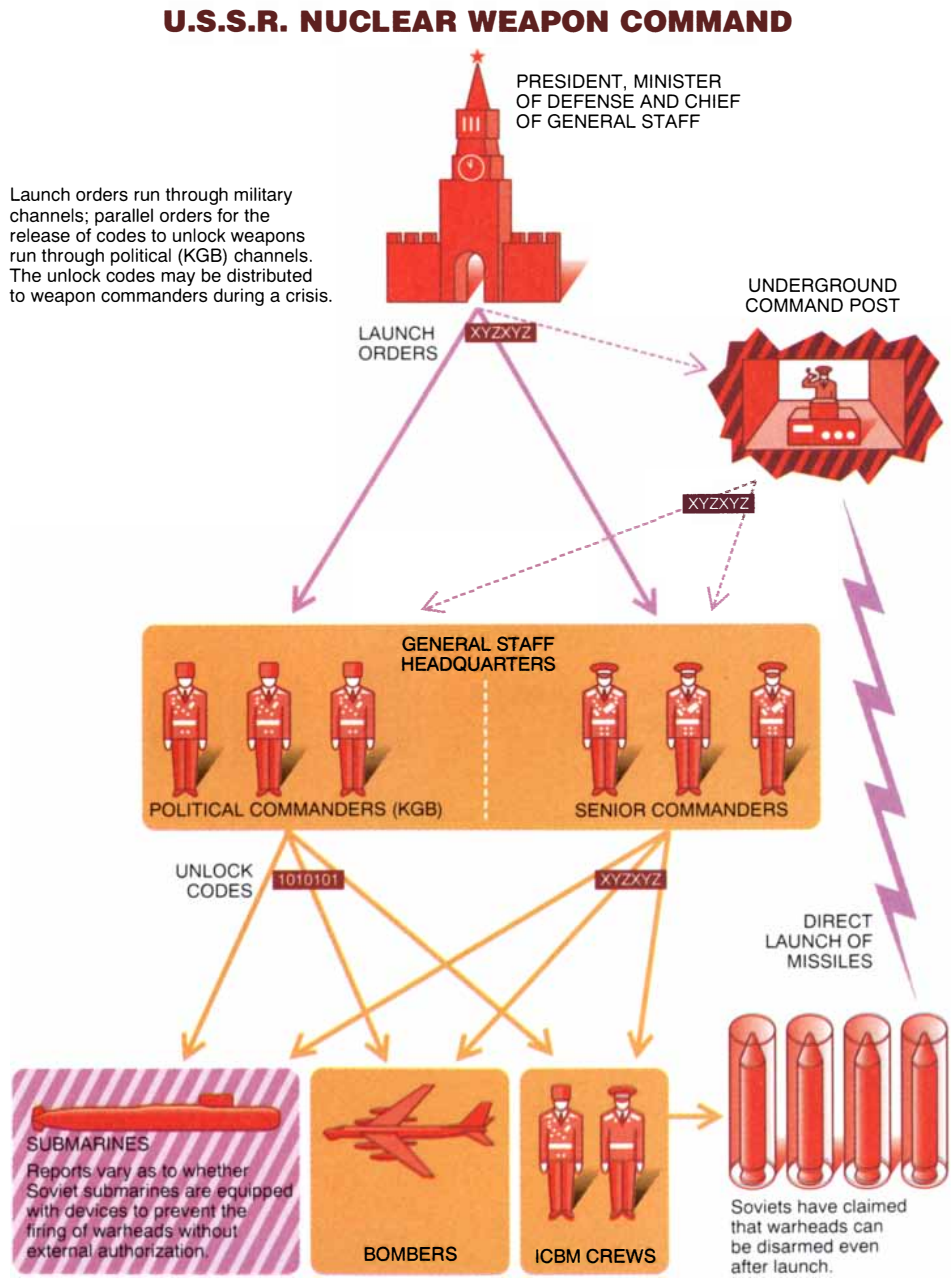
The commander of the North American Air Defense Command (NORAD), for example, would have only three minutes from the time of an initial attack indication to pass judgment on whether the continent is under fire or not. Clearly, this decision—and the subsequent ones that must be made during the 10-minute flight time of submarine-launched missiles or the 30-minute flight of ICBMs—entails major risks of premature release of weapons based on false alarms, miscalculations or confusion.

In the U.S. a so-called missile event—indication of a potential attack—typically occurs several times a day. When each event occurs, the command director at NORAD must establish a special conference with the Strategic Air Command and the Pentagon and declare his assessment of the threat to North America. In addition, thousands of anomalous sensor signals annually require urgent attention and evaluation. Each year between 1979 and 1984, the only period for which official information is available, NORAD assessed about 2,600 unusual warning indications. One in 20 required further evaluation because it appeared to pose a threat.

Most false alarms, whether generated by incorrect data, defective computer chips or other malfunctions, are quickly recognized, but perhaps once or twice a year an alarm persists long enough to trigger a nuclear alert. The last such incident to be publicly disclosed occurred in 1980, when a faulty computer chip generated indications of a massive Soviet attack.

In the ensuing confusion, a nuclear alert was declared, and the command director failed to issue a proper evaluation on time. (He was dismissed the next day.) The nuclear alert lasted longer and reached a higher level than the situation warranted. In the midst of a superpower crisis, such confusion could have been far more likely to lead commanders to act as if an attack were actually under way.

Similar Soviet procedures for evaluating indications of attack and initiating retaliation are apparently equally vulnerable to false alarms. A retired Soviet general recently told how he once witnessed signals from space-based sensors warning of the launch of U.S. Minuteman missiles against the U.S.S.R. A "competent operator," the general recalled, determined that the supposed missile exhaust plumes were

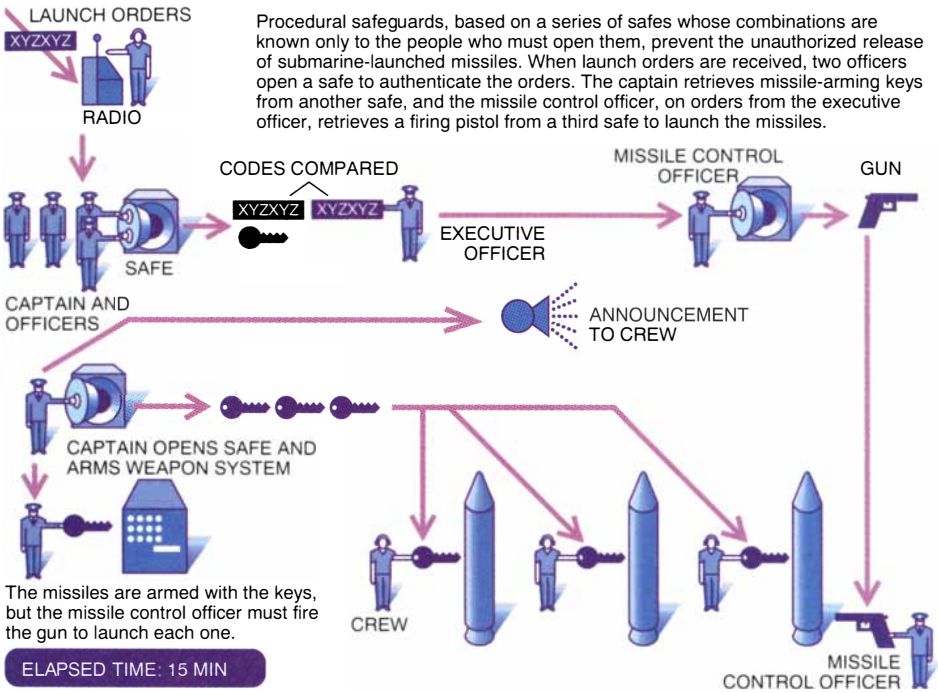


in fact merely "patches of sunlight."

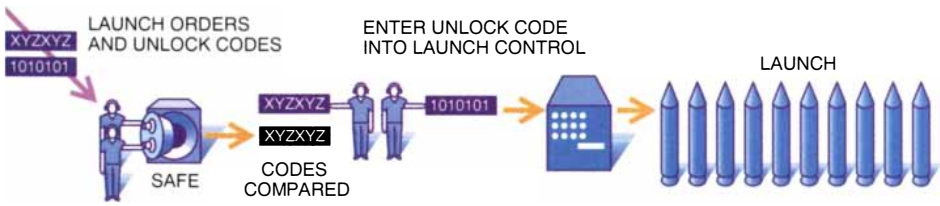
Thus far, humans have recognized hardware failures that produced false warnings of attack in time to avoid war. The corrective mechanisms have repeatedly passed muster—albeit during peacetime when alert and anxiety levels were low.

Still, in each case, certain safeguards against unwanted launch were discarded. In the U.S., Minuteman launch crews, for example, removed authorization codes and launch keys from safes. Bomber crews were scrambled, and command aircraft were launched without the knowledge of political authorities. Such actions run some indeterminate risk of provoking precautionary Soviet responses, which could in turn have reinforced the U.S. perception of an immediate threat. The question of whether such interactions based on a false alarm could trigger a nuclear attack is an open one.

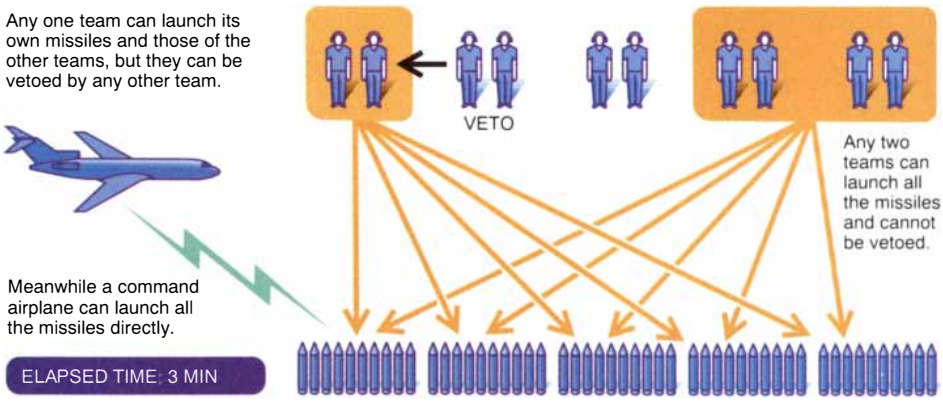
U.S. SUBMARINE LAUNCH



U.S. ICBM LAUNCH



Physical safeguards prevent unauthorized release of land-based ICBMs. Missile launch officers receive launch orders and missile-enabling codes. They match the orders against those in a dual-lock safe and must then enter the enabling codes into a control panel to launch the missiles.



A number of technical and procedural changes would reduce the chance of unintended war. Heading the list is the comprehensive use of so-called permissive action links (PALs). These electromechanical locks prevent warheads from detonating unless an essentially unbreakable code is inserted. Codes are disseminated to individual weapon commanders by higher authorities only when launch has been properly authorized. PALs prevent unauthorized release by a weapon's own crew or by enemy soldiers or terrorists who might seize a warhead. Similar devices, called coded switch systems, can be employed to prevent bomb bays from opening and missiles from firing.

Such devices were first installed by the U.S. in the early 1960s on tactical warheads assigned to allied forces stationed overseas; today all land-based U.S. tactical weapons are protected by PALs. By the end of the 1970s all Strategic Air Command nuclear warheads were equipped either with PALs or coded switch systems. We believe that Soviet land-based missiles and bombers are similarly equipped.

Naval nuclear forces on both sides, however, are generally not equipped with PALs. The resulting danger of accidental launch is particularly significant in the case of sea-launched cruise missiles. These weapons have a long range, and they are carried by surface vessels and attack submarines that would be in combat during the earliest phases of a conflict. Some British and French warheads are in similarly exposed forward positions.

Another way to reduce the risk of unintended nuclear war is to lower the levels of nuclear readiness. We estimate that 50 to 80 percent of the Soviet ICBM force is routinely maintained in a launch-ready configuration. In peacetime 15 percent of their submarine-launched ballistic missile force is deployed at sea, and none of the long-range bombers are on alert or even loaded with nuclear weapons.

The U.S., meanwhile, maintains about 90 percent of its ICBMs in launch-ready status, capable of firing within three minutes. Half of the ballistic missile submarine force is at sea at any time, and half of those vessels can fire their missiles within 15 minutes. A quarter of the strategic bomber force is on a five-minute ground alert.

This high state of launch readiness is an anachronism in the new era of U.S.-Soviet relations and poses an unnecessary danger. The percentage of both ar-

senals that is on alert should be cut down to a fraction of current levels. A threefold reduction could be carried out unilaterally without eroding deterrence, and deeper cuts could be made in stages under a verifiable agreement.

Furthermore, the warheads for units no longer on ready alert should be placed in the custody of civilian agencies, as they were during the 1950s when the Atomic Energy Commission held custody of nuclear weapons during peacetime. The civilian role in managing warhead stockpiles should be strengthened to maintain tight political control over the arming of nuclear-capable units in a crisis. Although some analysts argue that the risk of misperception in a crisis is lower if nuclear forces maintain high readiness at all times, such a posture runs contrary to current trends in superpower relations.

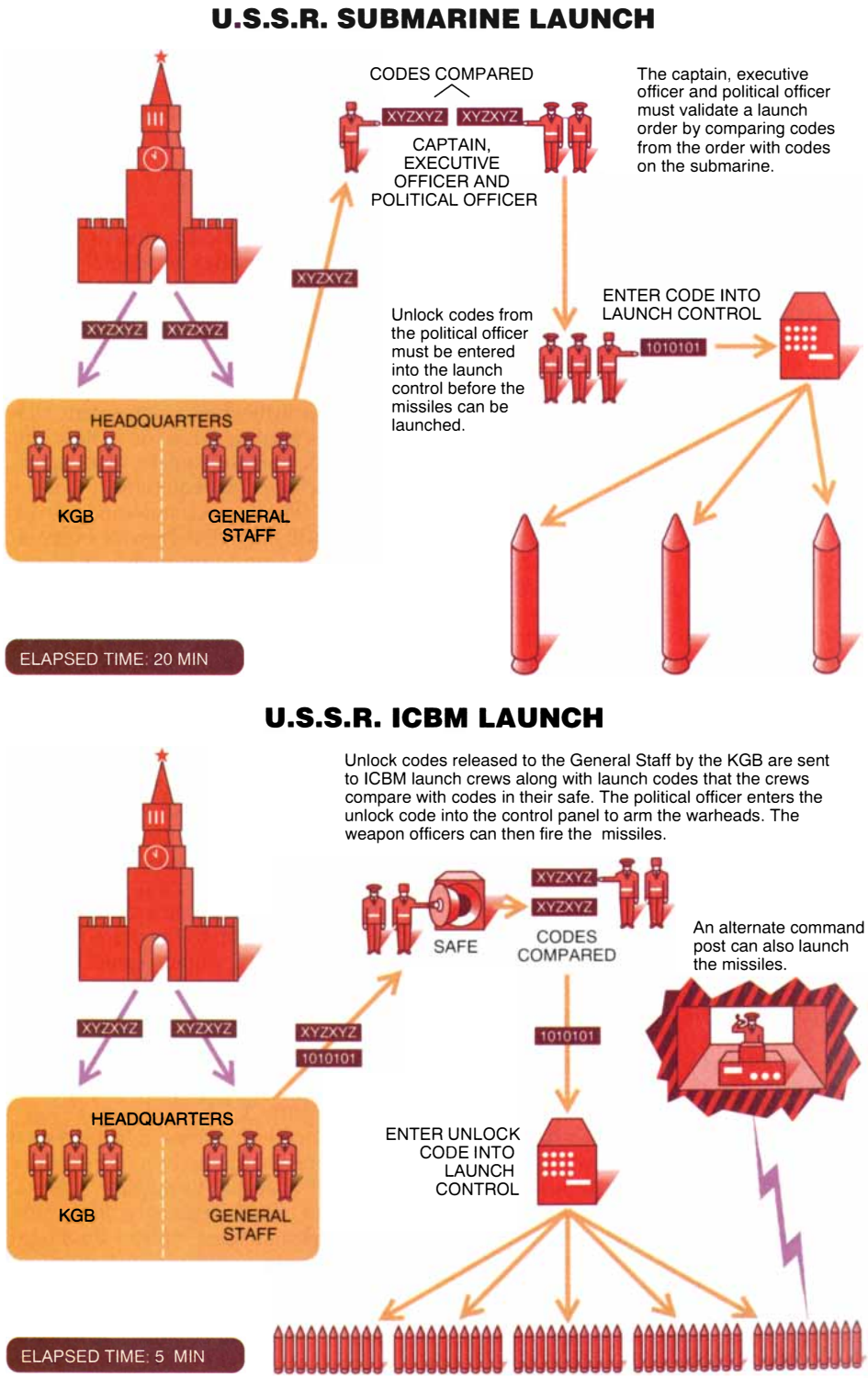
The adoption of lower alert levels would permit removing warheads or some other necessary component from some portion of the strategic arsenal, thus absolutely preventing an unwanted launch from causing a nuclear detonation. This danger is quite real. The Soviets recently disclosed that a nuclear-tipped ballistic missile had been launched by accident during routine maintenance. Fortunately, it fell a short distance from the launch pad.

Most missiles (including virtually all active strategic missiles belonging to the major nuclear powers) now have warheads attached to them. Launch-on-warning strategies and current alert levels preclude any other configuration. A verifiable agreement to move toward separable warheads and missiles—a common Soviet practice during the 1960s—would reduce the scope for unintended launch. Furthermore, converting weapons to this configuration would be a less drastic, and therefore more palatable, form of arms control.

Restoring the missing parts in time of crisis could be construed as a preparation for attack, thus increasing the possibility of unintended war. On balance, however, the reduced chance of unwanted launch and the easing of tensions resulting from fewer missiles poised for immediate strikes outweigh the possible danger of misperception in a crisis. Furthermore, that risk could be mitigated by agreements that define the conditions for reassembling weapons and by nuclear alert procedures that ensure firm civilian control.

Whatever the alert level, human factors play a key role in the risk of unwanted launch. All those involved in the nuclear weapon chain, from top decision makers to launch officers, are subject to human frailties and instabilities. These frailties are aggravated by work conditions that are boring and isolated. (Duty on missile submarines adds the further stress of trying to adapt to an unnatural 18-hour "day" for the two months of a typical patrol.) Such conditions can sometimes lead to severe behavioral problems, including drug or alcohol use and psychological or emotional instability.

In 1989, for example, of the roughly 75,000 members of the U.S. military with access to nuclear weapons and related components, nearly 2,400 had to be removed from duty. Seven hundred and thirty abused alcohol or drugs, and the rest had psychological or emotional problems, were insubordinate or engaged in criminal behavior. Herbert Abrams of Stanford University has recommended that drug and alcohol use among soldiers with nuclear responsi-



bilities be monitored more closely and that physicians who examine the soldiers be aware of the peculiar nature of their duties. In addition, much more can be done to alleviate stressful working conditions. (All these problems and remedies apply in at least equal measure to the Soviet nuclear apparatus.)

World leaders, meanwhile, are no less subject to stress. They may come to a crisis dependent on alcohol or drugs—whether self-administered or prescribed. Such problems afflicted Winston Churchill and Anthony Eden. Richard M. Nixon was too distraught over Watergate to participate in crucial discussions that resulted in a global U.S. nuclear alert in 1973; senior government officials later took precautions against the possibility that he might act irrationally in his capacity as commander in chief. Even a leader as ruthless as Stalin experienced severe stress during periods of crisis. Such infirmities can lead to behavioral changes, impaired judgment and even irrational actions. Some psychologists have suggested leaders be monitored.

If all these measures fail to prevent an unwanted launch, steps can still be taken to mitigate the consequences. One obvious step is to reduce the number of warheads each missile carries; another is to develop methods for destroying missiles after launch. A third step is to implement launch-detection systems to provide warnings of unintended launches to both sides. Some combination of acoustic and optical sensors would serve for ICBMs; sea-launched ballistic missiles and cruise missiles would require small transmitters that would send signals to relay satellites. Such a detection system might contain provisions for disabling it at the onset of a crisis.

Improvements in the "hot line" (first put in place in 1963) would reduce risks of misperception related to unintended launches, reassembly of missiles and warheads, and other apparently hostile acts. Currently the link between the U.S. and the Soviet Union runs through a Soviet and an American satellite primarily used for civilian communications, with alternate routes provided by cable and radio links. This configuration, however, cannot ensure reliable communication under the adverse conditions in which it is most needed. All parts of the system are vulnerable to nuclear attack. Moreover, the cable routes have been cut inadvertently a handful of times already. Dedicated, radiation-resistant satellites operating in the extremely high frequency band would prevent nuclear static from interrupting signals and would make it possible to continue hot-line conversations through mobile terminals that could accompany relocated command centers.

The critical action, however, is to implement mechanisms for disarming missiles once they have been launched. Costly attempts to develop antiballistic missile systems have led to a dead end. Continuing compliance with the Antiballistic Missile Treaty would limit deployment to 100 interceptors based at Grand Forks, N.D. Such a system (at a cost of about $10 billion) could destroy only about 50 reentry vehicles and would be ineffective against cruise missiles or submarine-launched ballistic missiles. A more capable system, exceeding treaty restrictions, would cost far more. Furthermore, there is currently no realistic prospect of pursuing such a project.

The only practical method for stopping a missile after accidental launch is for the country of origin to destroy it or to allow the target country to destroy the warheads prior to impact—a "command destruct system." Indeed, in 1971, the Soviet Union and the U.S. signed a little-known agreement that specifies what each is to do in the event of an unwanted launch. That agreement includes the requirement that the nation "whose nuclear weapon is involved will immediately make every effort to take *necessary* measures to *render harmless or destroy* such weapon without its causing damage."

A typical U.S. system might be based on a coded key automatically generated at launch time to prevent its theft. After the unwanted launch had been verified, the key would be transmitted to the warheads by dedicated relay satellites from a special command and control system located in the National Military Command Center. It would also be sent by hot line to the target country, along with data on warhead trajectories, so that destruct attempts could be made up to the point of reentry. A destruct system could be disabled—by special command units not involved in the launch process—just prior to an authorized launch, to preclude the remote possibility that an adversary would be able to disarm an intentional attack.

Destruct devices should be placed on the warheads themselves to maximize the time available to decision makers. The best place for destruction would be in the midcourse part of the flight, where it would do the least damage.

It would be particularly important, especially during a crisis, that destruction or disarming be verifiable by both sides. ICBMs might emit a coded radio signal or emit a burst of chaff visible to radar. Alternatively, warheads could be fired with minimum yield by draining their tritium before detonation. Cruise missiles might disarm their warheads, then climb to high altitude, transmit a coded signal and then fly into the ocean or the Arctic ice cap, where they could crash or be destroyed by an explosive charge.

Although such a system would add weight and complexity to nuclear reentry vehicles, this penalty is more than balanced by the reduction in the danger of unwanted launch. Nevertheless, the U.S. military and the Defense Department have shown no interest in implementing command destruct systems. This is particularly puzzling in view of attitudes in the Soviet Union: Deputy Foreign Minister Viktor Karpov has told us that Soviet ICBMs already carry command destruct systems.

The risk of accidental nuclear explosions and the worse risk of nuclear war, however low they may be, should be lowered further. The U.S. and the Soviet Union should move promptly to bring about acceptable compromises. There is ample latitude for each country to act independently in this area—most improvements in safeguards can be accomplished unilaterally. The Soviets, for example, have recently moved nuclear weapons from areas of ethnic unrest to storage depots in the Russian Republic. They plan to dismantle ICBM forces in Kazakhstan, the only ethnic region that "hosts" Soviet strategic forces.

It would also be worthwhile for the two governments to exchange views on particular risks of unwanted launch and measures to reduce those risks. Those discussions should be broadened to include other nuclear states. Relations have never been more conducive to fruitful talks on the issue.

FURTHER READING

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