This secret 1960s study left its stamp on US nuclear forces for the next 40 years.

STRAT-X

USAF photo

Left: A time-lapse photo of Peacekeeper ICBM re-entry vehicles passing through clouds during a flight test. Above: USS* Alabama, *an* Ohio*-class nuclear-armed submarine, cuts through open waters.

By Peter Grier

In the mid-1960s, senior Pentagon officials became concerned about the state of the US nuclear deterrent force.

The Soviet Union for years had been churning out more and more heavy intercontinental ballistic missiles—long-range, fast-flying, silo-based nuclear weapons. At the same time, the Soviet Union had begun building anti-ballistic missile (ABM) defense systems around important homeland targets.

The two developments, either singly or in combination, had the potential to alter the strategic superpower balance.

The problems were fundamental ones. First, increasingly numerous ICBMs posed a threat to America's own weapons. How could the US maximize the portion of the nuclear arsenal to survive a Soviet first strike?

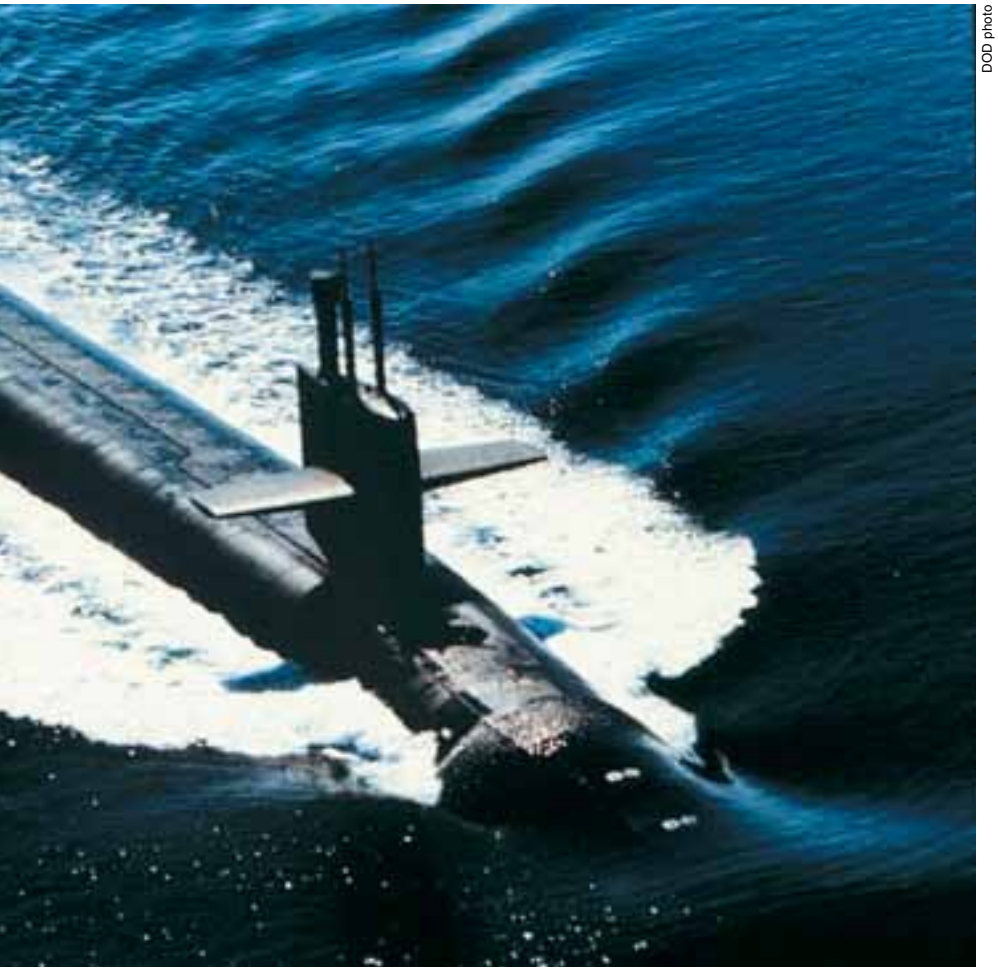
Second, ABM systems around Moscow, especially, generated doubts about US ability to hit key targets. How could Washington ensure that enough US weapons would get through in a devasting second strike, and therefore deter Soviet leaders from ever attempting a first strike?

To analyze this situation, Secretary of Defense Robert S. McNamara in late 1966 launched a study aimed at developing some answers. That study was called Strategic eXperimental, or STRAT-X, for short.

STRAT-X turned out to be an intense, nine-month-long national effort. Participants intended it to be a game-changing look at the question of what nuclear systems the US should deploy in coming years. Viewed with the benefit of hindsight, STRAT-X clearly succeeded.

Indeed, that was the conclusion of a 2006 Defense Science Board report on the future of US strategic strike capabilities. STRAT-X, it said, introduced into the national strategic debate a number of important system concepts and ideas. The very large Trident nuclear missile-carrying submarines, aircraft-launched cruise missiles, small and mobile ICBMs, and similar concepts all "have a STRAT-X legacy," said the DSB.

The STRAT-X study's emphasis on estimating and maximizing the damage US weapon systems could inflict upon the Soviet Union also inspired the development of multiwarhead ICBMs and submarine-launched ballistic missiles. STRAT-X led to greater US emphasis on hardened missile



DOD photo

silos and a new generation of sea-based nuclear systems. In that sense, it was the inspiration for both the Peacekeeper ICBM and the Trident SLBMs, although neither system explicitly was part of STRAT-X.

The Best and the Brightest

The STRAT-X study was a wide-ranging look at the future of US weapons that shaped the nuclear triad for decades, and remains a model for such efforts today. It was "one of the most influential analyses ever conducted" for the Pentagon, noted a 2002 RAND report on capabilities-based planning.

Strategic eXperimental drew on the talents of many of the best and brightest weapons engineers, nuclear planners, and strategic thinkers of the time. Lead contractor on the study was the Institute for Defense Analyses, a government-affiliated think tank run at the time by retired Gen. Maxwell D. Taylor, who had served as Chairman of the Joint Chiefs of Staff under President John F. Kennedy.

Military advisory groups oversaw the project, but the overall study was run by IDA's Fred A. Payne. He ran herd on a wide-ranging group of civilian and academic subcontractors—25 principals in all, from Boeing and Booz Allen Hamilton to Thiokol and TRW. Among those who took part in the effort was Freeman Dyson, an eminent physicist and later an anti-nuclear activist.

McNamara signed the order for STRAT-X on Nov. 1, 1966, specifying the study was to be a technological investigation "to characterize US alternatives to counter the possible Soviet ABM deployment and the Soviet potential for reducing the US assured-destruction force effectiveness during the 1970s."

Furthermore, study participants were to consider US alternatives from a uniform cost-effectiveness base, as well as from the point of view of possible Soviet countermoves.

The latter requirement led to an aspect of STRAT-X that today seems amusing. One of the volumes predicted USSR responses, and was written as if it were a staff study for Soviet Minister of Defense Gen. Andrei A. Grechko. It came complete with fulminations about the perfidy of capitalism and the inevitable triumph of the socialist will.

What McNamara really wanted from STRAT-X were path-breaking ideas about new weapon systems, either offensive or defensive—and he did not want the existing defense bureaucracy to get in the way. That was made clear in a January 1967 memo to IDA from the office of the Pentagon's director of defense research and engineering (DDRE).

AP photo by John Rous

Secretary of Defense Robert McNamara launched the wide-ranging STRAT-X study in 1966.

The memo read: "The systems to be analyzed need not be limited to those recommended by the services, and the STRAT-X study group is encouraged to examine system concepts unrestrained by considerations of potential management problems or political influences."

Land-, water-, underwater-, and aircraft-based missile systems were all placed on the table for consideration, although the study's terms of reference specifically excluded the topics of manned bombers and orbital bombardment systems. Winning systems were to be those that provided an economic way to produce a surviving penetration payload for targeting against the urban and industrial base of the USSR.

"Cost per surviving kilo pound of payload ... as a function of Soviet costs to negate that payload should be the primary but not sole

USAF photo

A Minuteman III is launched during a test. STRAT-X encouraged the development of multiwarhead ICBMs.

economic evaluation criteria," concluded the DDRE memo.

That dry language launched a crash nine-month effort in which STRAT-X participants dreamed up and considered dozens and dozens of variations of ways to deliver the most powerful weapons man has ever known. These concepts were matched against the anticipated Soviet deployment of bigger and more-accurate ICBMs to see which produced the cheapest survivable options.

The name STRAT-X had been chosen because it was vague, and did not hint at any bias to land- or sea-based systems. In the end, the study looked at some 125 weapon basing ideas. Of these, nine were studied in some detail, according to a declassified and redacted copy of the first volume of STRAT-X's 20-volume final report.

The nine candidate basing systems were:

- Rock Silo, in which missiles would be based in hardened silos anchored in the granite bedrock of the nation's open western and northern ranges.
- Soft Silo, a similar system using silos more easily and cheaply constructed.
- Rock Tunnel, in which missiles would be shuttled by rail around a system of deeply dug granite tunnels, emerging at launch portals.
- Soft Tunnel, which would use a quicker and cheaper construction method than its rock counterpart.
- Canal-Based, which would entail sailing a missile about a network of canals in an attempt to confuse Soviet targeters.
- Land Mobile, a truck-based transporter system that would drive a missile at speed around a winding system of dedicated roads.
- Ship-Based, where surface ships with missile canisters would sail about the oceans, hiding amongst other maritime traffic.
- Submarine-Based, in which large, slow, and quiet submarines would cruise randomly beneath the seas, with missiles in canisters attached to the outside of their hulls.
- Air Launched ICBM, in which circling aircraft would be equipped with standoff ballistic weapons that could be fired at Soviet targets without having to approach USSR air defenses.

Capabilities-based Planning

The 2002 RAND report, prepared by Paul K. Davis, described STRAT-X as a foundational exercise in what has come to be called "capabilities-based planning." According to the RAND analyst, STRAT-X participants made a point of transcending the myriad details in which they could have become embroiled.

One of the study's enduring conclusions, according to Davis, was that US nuclear forces should be shaped with an emphasis on the number of arriving re-entry vehicles (RVs)—the number of warheads that would actually reach Soviet soil in a retaliatory attack. It was the bedrock manifestation of nuclear "capabilities."

To measure this, analysts had to take many factors into account, from the ability of a system to survive a Soviet first strike, to the reliability of all its components, and its ability to penetrate USSR defenses.

Interestingly, this measurement did not actually assess either the accuracy or the nuclear yield of the surviving American RVs. Analysts had figured out that the vast majority of targets in the USSR were vulnerable to pretty much any type of warhead the US was considering.

As Davis reported: "This, and concerns about air defenses and future intercontinental ballistic missile survivability, influenced the decision to move to multiple independently targeted re-entry vehicles and submarine-launched ballistic missiles ... with small weapons."

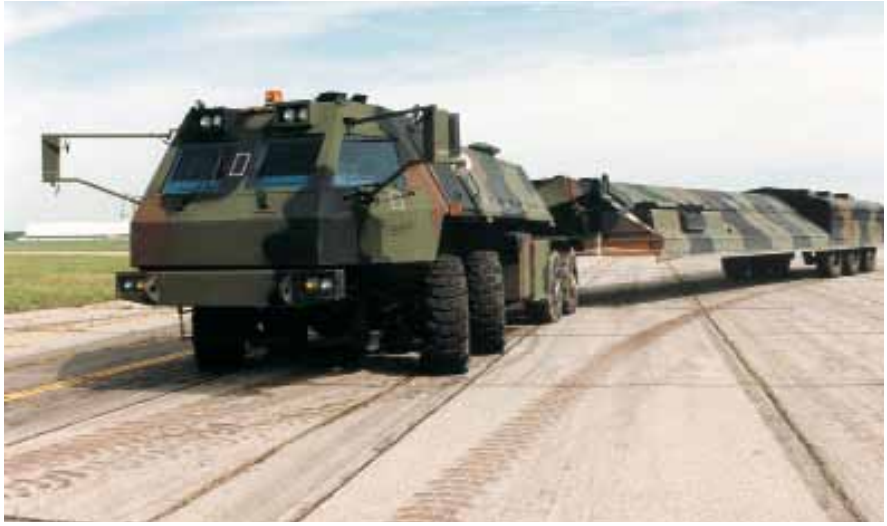
The final STRAT-X report was a massive document. Much of that work has never been declassified. The volumes that have been released, however, are testimony to the thoroughness and ingenuity of STRAT-X analysts.

The design of the land-mobile system, for instance, clearly presages that of the land-mobile Small Intercontinental Ballistic Missile, or "Midgetman," which the Air Force developed in the 1980s. The missile was canceled in 1992, following the collapse of the Berlin Wall and the end of the Cold War.

The STRAT-X land-mobile concept featured a rubber-tired transporter-launcher that carried one missile, capable of moving quickly around a system of dedicated roads in the western United States to complicate the job of Soviet attack planners.

STRAT-X analysts figured everything from the number of support personnel each wing of land-mobile missiles would need (5,606) to the percentage of each wing's transporters that would typically be down for maintenance at any one time (seven percent).

Transporters would need about a 20 mph average speed and a 35 mph "dash" speed to enable them to adequately perform their



STRAT-X considered a truck-based transporter system. It presaged the Midgetman system, whose mobile launcher is shown here.

USAF photo

A B-52 Stratofortress carries Air Launched Cruise Missiles. STRAT-X emphasized the importance of lots of warheads reaching their targets.

shell game-like task of moving quickly enough so that the USSR would not be certain of destroying enough of them in a surprise attack, according to STRAT-X.

These transporters would be scooting about 65,000 square miles of public lands in the southwestern states, STRAT-X figured. The study assumed that land-mobile roads would traverse national forests and parks.

Analysts foresaw a day, however, when people and missile transporters might clash. Camping, fishing, rock-hunting, and other recreations increasingly were spreading into the hinterland of the West.

"It is surprising how much activity occurs on [open western land]. ... To what extent such activities may not be compatible with land mobile/random deployment is an open question at this time," noted the 1967 study. This was a prescient statement, one borne out in the 1970s and 1980s by the intense local opposition to suggestions of vast "racetrack" roadways and rail systems in the West to move missiles.

Meanwhile, the design of the proposed STRAT-X submarine was like nothing that had come before.

One of the reasons for the study was the Pentagon's perception that the existing Polaris submarine force had started to become vulnerable. Thus, planners were told to design an undersea concept that would allow a large increase in ocean operating area.

Their solution was a submarine designed to be as difficult as possible for the Soviets to find. It would be extremely quiet and harder to hear on sonar, as it cruised randomly about the open seas.

"The new submarine is one designed especially as a missile launcher and is, therefore, considerably different from the [existing] SSBN, which is a converted attack submarine," said the STRAT-X summary volume.

The new sub would carry its missiles outside of the pressure hull, in canisters. To launch, the crew would jettison a canister, which would drift away from the ship before firing its missile. This concept allowed the sub to carry larger and longer-range missiles, increasing the amount of ocean it could use as a range. Missile launch could take place at all speeds and depths, and firing could be delayed, so that Soviet forces could not backtrack along the missile trajectory to find and destroy the submarine.

The Mixed Legacy of STRAT-X

Speed was not of the essence. The new sub was designed with a small and relatively inexpensive nuclear power plant, because STRAT-X analysis concluded that when it came to undersea warfare, stealth was the most important characteristic a boat could have.

"A high burst speed is a minor trail-breaking consideration against attack vehicles in comparison with radiated noise characteristics and sonar countermeasures," said the study.

Today's *Ohio*-class Trident SSBN differs from the STRAT-X's original undersea concept, of course. At the time, Adm. Hyman G. Rickover, director of Naval Reactors Branch and the father of the nuclear Navy, argued strenuously to Congress that any new sub should indeed be able to produce a burst of getaway speed. This led to a requirement for a much bigger nuclear power plant, and inevitably a much grander sub design.

In addition, further Navy analysis indicated that the unknown problems associated with the entirely new approach of carrying missiles outside the pressure hull might be too great. In the end, Trident adopted the more conservative approach of sticking with missiles carried inside the sub.

For land systems, the STRAT-X discussion of mobility pioneered years of work on the land-mobile Midgetman, and on mobile basing systems for the MX, which included the "racetrack" plan to transport the large multiple-warhead missile around a road loop.

The volume laying out the assumptions about how the USSR would respond to next generation US systems makes for fascinating reading. "It has become increasingly obvious that the United States is making a number of serious mistakes by setting some seemingly impossible goals which are perhaps generated by the computer dream world in which it so delights," claimed the faux-Soviet author writing in the voice of an advisor reporting to the Minister of Defense.

The USSR would need to make "considerable effort" to improve the accuracy of its missiles if it decides it wants a first strike capability against US silo-based counterparts, said this volume, adding that such an effort will "doubtless be worthwhile."

The report indicates the STRAT-X analysts felt Soviet planners believed they could reasonably expect to have success in targeting the land-mobile missile system proposed as an option. Sub-based systems, however, appeared to be another matter.

"Detection, location, and identification of very quiet, slowly moving submersibles is indeed a difficult problem," warned this "Soviet" analyst.

The legacy of STRAT-X is mixed. In the end, the Soviet empire collapsed, leading to a far-reaching reduction in American strategic weapons and strategy.

Two postulated STRAT-X-inspired road-mobile ICBM systems—the single-warhead Midgetman and a force of 100 multiple-warhead Peacekeepers—were never fielded as intended. USAF did field 50 of the Peacekeepers in stationary silos in a compromise brokered in 1983 by a commission headed by retired Lt. Gen. Brent Scowcroft. Even so, the silo-based Peacekeeper has since been deactivated.

On the other hand, USAF—encouraged by STRAT-X—went ahead with its Minuteman III ICBMs, the first missile to fractionate its payload with multiple, independently targetable re-entry vehicles. The Navy, for its part, went ahead with the "new submarine," the Trident. Both remain in service, and are cornerstones of the US strategic deterrent. ■

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