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How We Spy on the Russians

We look down from space, listen underwater, track with radar and infrared, and put agents in the field to monitor Soviet compliance with SALT

BY NICHOLAS DANILOFF

The view from CIA headquarters in Langley, Va., is superficially serene. The director's private elevator whisks the visitor to the top floor, where a corridor runs along the north face to his quarters. The passageway is warmly carpeted; the tan walls are hung with abstract paintings in elegant gold-leafed frames. By the elevator door hangs a display of medals the CIA awards its officers for especially meritorious or valorous service.

To the left is the airy office of deputy director Frank Carlucci, who made a name for himself as U.S. ambassador in revolutionary Portugal. To the right is the office of the director of the Central Intelligence Agency, Retired Admiral Stansfield Turner, who occasionally invites journalists to "background" lunches but who▸

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declined to be interviewed for this article.

Turner has resisted strong White House pressure to speak out on behalf of the SALT treaty now before the U.S. Senate. He refuses because he says that would undermine "the objectivity" of the CIA.

The occasional visitor, lingering over the admiral's sherry and filet mignon, gazes out of the broad picture windows at sturdy Virginia oaks and tulip poplars that mask the giant espionage bureaucracy from the George Washington Parkway. Turner doesn't see the trees; he sees the forest.

What worries him, as well as others, is: Will the Russians play by the rules of the new SALT II treaty? And if they don't, will U.S. intelligence catch them cheating?

Reconnaissance satellites and other high-technology gadgetry are the CIA's tools for monitoring Soviet compliance. Thus, it was a routine event, several years ago, when a photoanalyst in the CIA's National Photographic Interpretation Center was scrutinizing a "close-look" satellite image of Soviet strategic missile fields. Suddenly, he noticed suspicious excavation.

The analyst paused, then consulted his superior. The first SALT pact froze strategic arsenals and clearly prohibited construction of new missile silos. The superior suggested waiting for further photographic evidence before raising the issue with higher authorities. That corroboration took time coming because in the next weeks clouds masked the missile sites. When new photos arrived, silo excavation was undeniable. Thousands of cubic yards of earth were being removed. In the end, the CIA would identify 110 sites where such work was underway.

Informed of this, Henry Kissinger, then President Nixon's assistant for national security, ordered a "hold" on the photographs. That meant the pictures could not leave the center or be published in the periodic "compliance reports" which the CIA puts together for senior officials. Kissinger then asked for an explanation from the Soviet ambassador.

A quiet internecine battle in the bureaucracy followed. Lower officials, unware of Kissinger's private talks with Ambassador Anatoly Dobrynin, became concerned about the administration's apparent coverup. They began suspecting the White House of incompetence. Eventually someone leaked to the media.

Meanwhile, Dobrynin told Kissinger that the "silos" were not for missiles. They were "command and control" sites, the Russian said. Kissinger protested that the sites were identical to missile silos.

"You'll see they are different," Dobrynin said. "Wait."

Eventually, the CIA reported the Russians were fitting capsules into the silos which contained electrical cables for transmitting launch commands to missiles surrounding the command post. The administration accepted the explanation, although some officials continued to worry that the command silos could be converted to launch silos within weeks.

The flap over the so-called "3X" silos, and other ambiguous activities, led to the painful refinement within the U.S. government of a new mechanism for monitoring SALT. The focal point of the "SALT verification" bureaucracy is a CIA committee called the DCI's (Director of Central Intelligence's) Steering Committee on SALT. Its job is to look for possible SALT violations.

Every day U.S. intelligence agencies take in a raft of material on activities within the Soviet Union and around the world. The Defense Intelligence Agency assembles reports on Soviet weapons production. The National Security Agency (created by secret presidential directive in 1952) at Fort Meade, Md., eavesdrops on Soviet military communications, missile tests and radar impulses. The supersecret National Reconnaissance Office (this Pentagon agency is so secret officials are not allowed to acknowledge it exists) runs the U.S. spy satellite program. And the CIA receives reports from agents in Eastern Europe, and even from inside the Soviet Union.

The steering committee and its Monitoring Working Group sift through these materials. The steering committee does not label ambiguous activities as violations. Declaring a violation is a political judgment made only at the White House.

Zbigniew Brzezinski, President Carter's national security affairs adviser, receives the DCI's reports and refers them to the Cabinet-level Special Coordination Committee of the National Security Council. This committee, in turn, refers them to the SALT Working Group, and its subgroup, the SALT Backstopping Committee. Somewhere between the working groups and the Oval Office a decision is made as to whether a violation has been detected, and what to do about it. It is a mark of the end of Cold War that the two superpowers created a mechanism to deal with compliance problems that might arise under the first SALT agreement—the Standing Consultative Commission, also known as the Geneva SCC, which meets twice a year in Switzerland to sort out challenges. Both sides have lodged complaints. The

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Russians, for example, charged that the United States was hiding something by covering certain Minuteman missile sites with "environmental" covers. They also asked why squatters were living in Atlas missile silos which were deactivated in 1965. Both sides feel the SCC has functioned satisfactorily.

"I would say it has worked well," says U.S. chief negotiator Ralph Earle, who defended the SALT II treaty daily before the Senate Foreign Relations Committee. "The discussions there have been frank and open, and every dispute has been resolved."

Because spy satellite photography has played such a crucial role in watching the Soviets, the Carter administration toyed with the idea of releasing some of the high-resolution photographs in its effort to persuade the Senate of U.S. ability to monitor the agreement. But cautious intelligence veterans prevailed, and the best work of the satellites were kept under lock and key.

"What it came down to," says Leslie Gelb, who until recently was a key SALT advocate and ran the State Department's Bureau of Politico-Military Affairs, "was the *slippery slope*. If you released some photographs, you would be under pressure to release more, and there was no telling where it would end."

Some of the lower resolution photographs taken by U.S. earth resources satellites have become available, and they offer a unique opportunity to lift the secrecy surrounding a number of Soviet installations, most notably the missile test center and space headquarters at Tyuratam. This center is one of the Soviet strategic missile test sites (the other is at Plesetsk, 62°8' North latitude, 40°1' East longitude). It has also been the starting point for all the early Sputniks, all manned flights, all planetary and lunar probes, some communications satellites and assorted military vehicles.

The Russians keep it secret, deceptively naming it the "Baikonur Cosmodrome" after the town of Baikonur, which is 370 kilometers to the northeast. Few foreigners have ever been allowed to visit the false "Baikonur," which contains 18 launchers for testing ICBMs. When visitors did come they were flown in at night.

To keep up the deception, Soviet officials passed out false geographical coordinates for the center and instructed Soviet journalists to dateline their stories on Soviet manned missions "Baikonur."

In the SALT II documents, the Russians finally acknowledged that Tyuratam is a testing site.

Any astute person, however, could have obtained a satellite photograph of the center by asking the U.S. Geological Survey to supply coverage of the geographical coordinates, 45°6' North latitude, 63°4' East longitude, the true position of the "Baikonur Cosmodrome." That Landsat satellite photograph of the center, if compared to a Soviet map, shows clearly that "Baikonur's" geography corresponds convincingly with the Tyuratam area which lies along the Syr Dar'ya River and the railway the czars built to connect Orenburg in the Urals with Tashkent. It does not correspond at all with the little sheep town of Baikonur at the end of the railway line running west from Karaganda and built between the two World Wars.

What the Tyuratam picture cannot convey is the sharpness of detail of the best reconnaissance photographs. Gloria Duffey, a former research assistant to Brzezinski at Columbia University, recalls a briefing on aerial and satellite photography she attended in March 1976 at the Strategic Air Command, Omaha, Neb. the screen a picture of the Earth, then one of North America, then one of the East Coast," she recalls. "Next they showed a picture of Manhattan. They clicked it down and you could see Columbia University. They clicked it down again and you could see the lettering on the library, names like Archimedes. Then they clicked it down again, and you could actually see a student on the steps of Butler Library reading a copy of the Columbia Spectator, and you could make out the headlines."

The Air Force, asked to supply these photographs for publication, telephoned SAC headquarters but could find no one who remembered that briefing.

Rep. Les Aspin (D-Wis.), chairman of the House subcommittee on intelligence oversight, disclosed earlier this year the best U.S. satellites can clearly distinguish an object one foot long from an altitude of 100 miles. Paul Bennett, arms control specialist at the Union of Concerned Scientists, says U.S. satellites may do better than that, defining an object as small as three or four inches from 100 miles.

Satellite photography has made remarkable strides in the last 20 years. The U.S. Big Bird satellite passes over the ~~Soviet~~ Union every 90 minutes, scanning large swaths of territory. On command, it can zoom in for a closer look. It delivers its take by jettisoning up to six canisters of film by parachute. These are scooped up in mid-air by "Skyhook" C-130s (see photos page 30) or helicopters, or are retrieved from the ocean by Navy ships.

The newest satellite, the KH-11, is even more sophisticated. Some of its capabilities became known because of the espionage trial of Edward Kampiles, 23, a disgruntled CIA employe who sold a KH-11 manual to a Soviet agent in Athens.

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wide-look and close-look functions. It turns what it sees into electronic impulses which are then transmitted to earth. The KH-11 is believed to carry an on-board computer capable of comparing shots taken from similar positions in space and noting changes. Once the KH-11 images are transmitted to earth, they are reconstituted into viewable photos.

Scientists have found that "false color" images possess advantages over ordinary color or black-and-white. By taking pictures in different bands of the color spectrum, photoanalysts can spot distinctive features. For example, the human eye cannot distinguish between green paint on a missile silo and surrounding foliage of trees. But infrared photography will turn foliage bright red, and green paint blue.

"The satellite photographs are remarkably versatile," says William Colby, former director of the CIA. "We've used them occasionally to check up on the credibility of Soviet defectors. A defector might tell you something, and then you could go photograph it and see if it made sense. Or you could photograph his hometown, then quiz him about the layout of various buildings, and so forth, and see how good a memory he had, or how accurate his observations were."

Colby is an international lawyer for the Washington firm of Reid and Priest. A strong advocate of SALT II, he stresses openness.

"The more the United States and Soviet Union know about each other, the better off we'll be," he says icily. "That's what I told Brezhnev myself."

The Soviet Union, Colby says, is a closed society, despite its huge output in books, magazines and news reports. Furthermore, the Soviet Union is unlikely to become as open as the United States in the foreseeable future. Therefore, Colby says, the American espionage effort must go on.

Besides taking photographs, satellites do numerous other jobs in the spy business.

Military communication satellites link secret agents with headquarters. These "store/dump" satellites receive, store and retransmit messages which are fired off in rapid bursts by agents and, it is hoped, avoid detection by the adversary's counterintelligence.

"Ferret" satellites listen to the other side's electronic emissions which reveal details of air defense systems, disclose heightened states of military readiness, and provide data on military operations. The United States, for example, monitored the desperate communications between ground control at the Baikonur Cosmodrome and Cosmonaut Vladimir Komarov, whose Soyuz-1 spacecraft malfunctioned, killing him on re-entry.

Before Komarov was ordered down April 24, 1967, Soviet premier Aleksei Kosygin and Komarov's wife were patched through to the spaceman in distress for an extraordinary, and touching, leave-taking.

The NSA refused to release a transcript of the interchange, or even to confirm its existence, in response to a Freedom of Information petition, even though the London Daily Telegraph published an account of the incident in 1975 based on an interview with the monitor.

The monitor said the Soviet ground command directed Komarov to take certain manual actions.

"I am doing it, but it doesn't work," the cosmonaut replied in frustration.

When it became obvious both the space ship and Komarov were doomed, Komarov's wife was patched through to the craft.

"I love you, I love you," she cried in great distress.

"I love you too," he replied, "and the baby, and the baby. Go home now. Go home."

A little later, Kosygin came on the air.

"You and your kind made the greatest achievements in Russian history," Kosygin said solemnly. "We are proud of you. You will always be remembered."

The ship tumbled in orbit and neither ground control nor Komarov was able to stabilize it. The main parachute failed to open properly and tangled with the emergency parachute. Just before ground control lost contact with Komarov, he screamed: "You've got to do something. I don't want to die."

One of the most difficult tasks of the intelligence community is to keep from drowning in a mass of raw data. The size of the Soviet Union—the world's largest country, with 8.65 million square miles of territory—complicates the organizational headache. The U.S.S.R. extends 6,000 miles from Eastern Europe to the Pacific and arches through 11 time zones. It stretches 3,000 miles from north to south. Knowing where to look, and what to look for, is the key to the photoanalysts' art.

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starting point. Unlike the United States, the Soviet Union does not have a highly developed road system, and 95 percent of its freight moves by rail or inland water. Therefore, since the balloon and U-2 spy flights of the 1950s, intelligence experts have been scrutinizing railways.

The railways lead to many interesting places—to tank and munitions factories as well as to the medium-range and intercontinental missile fields. The fields, covering dozens of square miles and containing 50 to 100 silos apiece, are typically located near spurs off the main railroad line throughout the central part of the Soviet Union.

Shipyards are relatively easy to spot because they are large installations near open water or on the Volga River where much of the work is done in the open.

Although the Soviets have begun covering over their submarine yards, eventually the boats slide down the ways and tie up at docks where their missile-launching tubes are easily counted from space.

Naval intelligence looks for other developments as well. Sometimes what is detected is confusing and deceptive, such as arbitrary changes in hull numbers. The Kiev helicopter carrier, for example, changed its hull number from 860 in 1976 to 812 in 1978.

During the last 30 years, Air Force intelligence has deployed enormous resources to identify Soviet aircraft factories and design bureaus as well as to assess their potential and actual production. History has lent a helping hand.

In 1946, the Russians dismantled whole factories from the Soviet zone of Germany and signed up thousands of German technicians to work in the Soviet Union. Knowing German factory layout and work habits, Air Force intelligence made detailed estimates of Soviet capacity. They ponents to factories and developed an input-output formula based on German experience and tested in practice, to predict Soviet aircraft output.

"In estimating aircraft production," says Ray Cline, CIA deputy director for intelligence from 1962 to 1966, "we can often observe aircraft parked outside factories. Our estimates may be as good as 1 percent. But what you worry about is whether the Russians will introduce a new factory secretly that you haven't spotted."

The Air Force has identified 16 major aircraft design bureaus which are associated with one to three factories. Where possible the Air Force has obtained photographs of these plants, some of them snapped by cooperative tourists or military attaches. U.S. experts are now watching for the appearance of at least two new Soviet strategic bombers to replace the TU-95 and Myasishchev-4 which are counted under terms of the SALT treaty.

Most Soviet weapons systems are derivatives of earlier technology, which has helped the intelligence community enormously in following Soviet missile development. The Russians, who were well-versed in the physics of rocket propulsion, used the German V-2 as the starting point for their first medium-range missiles.

Sergei Korolyov (1907-1966), who lived under the secret title of "chief designer of rocket-cosmic systems" for many years, is the designer of the SS-6, the Soviet Union's first intercontinental ballistic rocket. This ICBM first flew in August 1957 from Tyuratam and developed into the workhorse Vostok space booster which is still in use.

One of Korolyov's chief rivals, M. K. Yangel (1911-1971) and his Dnepropetrovsk design bureau is credited with developing the major Russian strategic missiles: the SS-7, SS-9, SS-17 and the SS-18, which can deliver 15,400 pounds of nuclear warheads. Chelomei is the designer of the SS-8, SS-11 and SS-19 missiles; V.N. Nadiradze is credited with the SS-13, SS-16 and SS-20s.

To follow the capabilities of these missiles, the United States monitors Soviet missile tests closely. Electronic posts near the Soviet borders capture technical data which each missile sends back to ground controllers on 50 radio channels. The data tell how well the engines burn, rate of fuel flow, performance of pumps, separation of stages, guidance, vibration and so forth.

The National Security Agency operates posts at Karamusel, Bexbasi, Princep, Sinop and Diyarbakir in Turkey to follow medium-range missile tests from Kapustin Yar in central Russia. These listening posts are being upgraded to fix on strategic rocket tests as well. Two posts in Iran—Tacksman-I and Tacksman-II—acquired data from the first stage engines of long-range missiles. The United States lost these posts in the Iranian revolution and has not been able to replace their functions entirely.

To monitor the reentry of warheads, the United States built an extremely sophisticated phased-array radar at Shemya Island in the Aleutians. Known as Cobra Dane, the radar is composed of 15,360 active radiating elements which can transmit pulses to track 100 objects simultaneously. Officials say Cobra Dane can detect an object the size of a basketball at 2,000 miles and help identify a missile attack on the United States coming across the North Pole.

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"I don't believe we've missed any major tests, and we were not surprised by their first ICBM tests in 1957," says Herbert Scoville, who was assistant CIA director for scientific intelligence at the time. That is important because most experts believe the Russians would not deploy a new rocket, or new warheads, without thoroughly testing them.

The likely development of the next generation of Soviet missiles is predictable, experts say. The Russians, unlike Americans, maintain permanent design bureaus. Their products are the logical development of new technology applied to earlier systems. U.S. officials predict the Soviets will develop a mobile ICBM (counterpart to the proposed American MX) which will be solid-fueled.

"I estimate they will be using a basing mode already familiar to them like the [medium-range] SS-20," says Dr. William Perry, chief of research at the Pentagon. "The SS-20 is solid-fueled and very successful.

"They'll probably go road-mobile. They have to limit size, and, therefore, if mobile, they will go small, even smaller than our MX. Since they don't have as many roads, they will be limited in size and deployment."

Perry believes the Russians are also trying to develop a high-energy laser beam to incapacitate U.S. spy satellites.

"They seem to have made a judgment that lasers ought to be introduced into weapons technology," he says. "We are watching what they are doing very carefully."

Monitoring strategic bombers, nuclear submarines, missile silos and technology limited by SALT, of course, is only part of the intelligence community's effort against the Soviet Union. A major priority is guarding against a surprise nuclear attack. If the Russians were to fire their giant SS-18s against the U.S. Minuteman missile force (eventually against the MX), the United States would get about a half hour's warning. Submarine-launched missiles could wipe out cities and industry in three minutes *or less*. No city could be warned in three minutes, but a half hour's warning would give the White House time to shift its mobile missiles about to avoid destruction—or to fire them.

To get that half hour of warning, the United States has positioned two early-warning satellites above Panama, one looking toward the Pacific, the other toward the Atlantic. A third satellite is stationed over the Indian Ocean and stares down at the Soviet land mass. These satellites are parked at an altitude of 22,300 miles in "geo-synchronous" orbit, which means they revolve at the same rate as the earth, always hovering over the same spot.

Each reportedly carries 12-foot-long, infrared telescopes that detect the searing heat of the exhaust plumes of flying missiles. Should they detect a launch, the satellites would immediately signal U.S. command headquarters. Tests have shown that the infrared sensors are not perfect and occasionally do not discriminate between exhaust plumes and radiation reflected from brightly lighted high-altitude clouds. A similar problem last September plagued the Vela satellite, which detected a flash of light in the Indian Ocean that appeared to be a nuclear explosion set off by South Africa. But the satellite was unable to positively identify it. Some experts think it may have been a super-thunderbolt.

In addition to early-warning satellites, the Navy operates a series of ocean surveillance satellites used to spot the departure of Soviet submarines from port and to keep track of surface ships plying the oceans. An ocean surveillance satellite can spot a submarine in clear water at shallow depths. Scientists are reportedly working on a sensor to detect hot water discharged by a nuclear sub from the cooling system around the reactor core.

Once a Soviet submarine leaves port, the Navy tries to keep track of its position at all times, although officers say they frequently can determine only its approximate location.

As part of its anti-submarine warfare program, the Navy has drawn on hydroacoustics, the science of underwater sound waves. It is a fact of physics that every moving hull makes its own distinctive noise. The bow wave, the flow of water along the hull, and particularly, the rhythmic thudding of the screw produce a telltale "signature."

One of the reasons the Navy follows Soviet ships during sea trials is to record these sound patterns on magnetic tape. The tapes are sent to the National Security Agency at Fort Meade, Md., where a catalogue of Soviet ship sounds is maintained.

Underwater hydrophones, helicopters with "dipping sonar," destroyers, attack submarines and reconnaissance aircraft constantly listen for the sounds of Soviet submarines, and the Russians know it, as evidenced by articles in their technical journals. They are presumably working on countermeasures, such as blowing air bubbles around the ship's hull to alter noise patterns.

Good surveillance requires an intimate knowledge of Soviet armaments. Knowing how the Russians build their weapons

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helps in designing countermeasures as well as in building effective arms for U.S. forces. U.S. intelligence is always eager to obtain Soviet weapons. The 1973 Middle East War was a bonanza, but occasional windfalls also come along. In 1976 a disaffected Soviet pilot flew a MiG-25 to Japan which proved valuable in assessing the sophistication of the Soviet aviation industry.

The CIA's effort to raise a sunken Soviet ballistic missile submarine from the Pacific in 1974 with the Glomar Explorer was one of the most remarkable intelligence operations ever undertaken. Raising the Golf-class diesel-electric submarine could have yielded nuclear warheads, missiles, construction details, ciphers, codes, encryption devices, logs, even personal diaries with telling details about life on board.

The mission was aborted after the operation was publicized, despite Colby's efforts to prevent it. Nonetheless, the Glomar Explorer was reported to have raised part of the vessel's bow.

Among the gruesome finds aboard the sub were the bodies of some 10 crew members (out of 82). Officials familiar with the operation said the remains were buried at sea according to the Soviet naval manual. The ceremony was conducted in English and Russian, and both the Soviet and American anthems were played. Photographers recorded the scene in sound and color. A request to the CIA, under the Freedom of Information Act, to release the photographs was denied.

Greater U.S.-Soviet interaction has meant more frankness between Washington and Moscow, publicly and privately. Publicly the Soviets broke a 700-year-old tradition of military secrecy by agreeing to disclose the number of strategic offensive weapons they possess. More privately, other talks are being held. For example, Lt. Gen. Samuel Wilson, a former U.S. military attache in Moscow, returned to the Soviet capital as chief of the Pentagon's Defense Intelligence Agency and met quietly with Soviet military acquaintances. Defense Secretary Harold Brown has invited his counterpart, Defense Minister Dmitry Ustinov, to visit the United States to continue face-to-face contacts they initiated at the Vienna SALT summit last June.

A good espionage effort is not complete without a few exotic assets and a few old-fashioned human spies. The United States has enjoyed both from time to time. Electronics experts at the U.S. Embassy in Moscow eavesdropped on radio conversations between Soviet leaders in the early 1970s as the Soviets drove around the city and talked with each other over their car radios.

"We learned a little about their attitudes in the SALT talks and got some idea about the relationships between leading personalities," says one knowledgeable source.

Nikita Khrushchev, who ruled the Soviet Union between Stalin and Brezhnev, used to joke that the United States and the Soviet Union used the same spies because there were so many double agents. Neither has stopped seeking good spies or defectors. In the late 1950s, the United States and Britain recruited Col. Oleg Penkovsky, an officer in military intelligence. He was caught in 1963, tried and executed.

But during his service, he snapped some 10,000 microfilms which included technical descriptions of weapons and their deployment. The information he transmitted proved invaluable for the study of Soviet weapons development.

"We came under great pressure from Congress to say publicly what Penkovsky reported," recalls one former CIA official. "But we always resisted. We didn't want to help the Russians in making their damage assessment."

Ambassador Malcolm Toon, who returned last month from a three-year assignment in Moscow, says spying on the Soviets will continue.

"We're both big boys," he says, "and both of us know each is going to engage in this type of activity. We both take it in stride and we are not going to let it influence our relations negatively."

Nicholas Daniloff is the author of The Kremlin and the Cosmos, *a history of the Soviet space program. He worked in Moscow from 1961 to 1965 as a correspondent and now writes on national security issues for United Press International.*

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Chairman, Joint Chiefs of Staff
Director, Central Intelligence
Director, Arms Control and Disarmament Agency
Vice President

National Security Council
Assistant to the President for National Security Affairs
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SALT Task Force
Walter Slocombe

National Security Agency
Vice Adm. B.R. Inman

DCI's SALT Steering Group

Monitoring Work Group

JCS Representative to SALT
(Vacant)

Joint Chiefs of Staff
Chairman—Gen. David Jones

National Reconnaissance Office
Director's name secret

Defense Intelligence Agency
Lt. Gen. Eugene Tighe

Army Chief of Staff Gen. Edward Meyer	Chief of Naval Operations Adm. Thomas Hayward	Air Force Chief of Staff Gen. Lew Allen
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Office of Scientific Intelligence

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National Intelligence Officers

Office of Central Reference

Office of Imagery Analysis

Office of Weapons Intelligence

Office of Current Operations

Deputy Director for Operations
John N. McMahon

The organization of this bureau is classified. It is believed to include foreign intelligence staff (spies) and covert action personnel

Deputy Director for Science and Technology
Leslie C. Dirks

Office of Signals Intelligence Operations

National Photographic Interpretation Center

— secret agency

Who's Watching: The SALT Verification Community

Research by Nicholas Daniloff/Chart by Gail Sanders

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