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The Mystery of
Vladimir Alexandrov

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Paul MacCready,
Gerard O'Neill, and others



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About Nuclear War

Mathematics of
Football Recruiting



M I S S I N G

ИСЧЕЗ

The Curious Case of Vladimir Alexandrov

“Dear Sir,

The mother and the wife of a Soviet scientist Vladimir Alexandrov appeal to you in this letter. . . . A tragedy happened to him: Vladimir Alexandrov disappeared on March 31, 1985, in Madrid, on his way home from Cordova. . . . We hope, that our appeal will be answered and that our son and husband is alive and will come home, where his children stay, waiting for him. Vladimir Alexandrov is a man of numerous merits and everything that happened to him is unexplainable and unforgiveable. . . .”

So read the impassioned letter addressed to Senator Edward Kennedy and received by him on February 1, 1986. The letter recounted the last-known days of Vladimir Valentinovich Alexandrov, a youthful, jet-setting luminary of Soviet science, a man who in more than eight trips to the United States had more hands-on contact with American high technology than any of his compatriots.

Alexandrov's specialty was atmospheric science. A model of the atmosphere is one of the most complex simulations in science, and so researchers in this field are always seeking out the latest in computer technology. In Colorado, Alexandrov was allowed to run an atmospheric model on a Cray supercomputer, a machine far more advanced than anything in the Soviet Union. Access to this powerful number cruncher undoubtedly made him a valuable conduit of information for the technology-hungry Kremlin—and a potential security risk for American intelligence agencies. Around the time of his disappearance, the Pentagon moved to deny access to supercomputers to all visiting Eastern-bloc scientists, no matter how legitimate their research pro-

posals. Therefore, Alexandrov had the unique distinction of being the first, and perhaps the last, Soviet scientist to extensively use American supercomputers.

Alexandrov was also valuable to the Soviet Union as its chief spokesman on the horrors of nuclear winter, the catastrophic effect of nuclear war on the atmosphere. As the American press took up the topic of nuclear winter in late 1983, Moscow encouraged Alexandrov to speak on the subject, in the hope that his oratory would further mobilize antinuclear sentiment. He spoke at Senator Kennedy's invitation at a forum in the Senate Caucus Room; he went with an international delegation to the Vatican to present a report to the Pope, and he appeared on American television with Carl Sagan.

Central Casting could not have provided the Soviets with a more attractive spokesman. Tall and charismatic, Alexandrov had a charming wife and a chubby, rock-music-loving daughter, a command of English and Italian, a craving for barbecued spareribs and hamburgers, and a taste for Western films and popular novels—everything from *Gorky Park* to *Even Cowgirls Get the Blues*. He was

BY ANDREW C. REVKIN

WITH REPORTING IN SPAIN BY KAREN POLK



Ostankino Television Tower



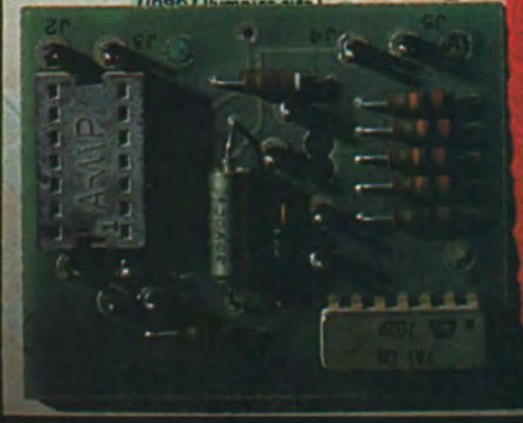
1 BOLSHOI THEATRE



3 BELL TOWER OF IVAN THE GREAT

Novodevichy Convent

LUZHNIKI SPORTS COMPLEX (1980 Olympic site)



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PHOTO-COLLAGES BY JENNY LYNN; PHOTOGRAPHS OF ALEXANDROV COURTESY HUGH LLEWELLYN; PHOTOGRAPH OF HOTEL BY KAREN POLK

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fascinated by such luxuries of American low technology as the serrated grapefruit spoon, which he took with him back to Moscow. Alexandrov had a disarming smile and an impish sense of humor; when asked for his passport in airports, he often pulled out his Oregon driver's license and said, "Will that do?" His sense of humor ultimately got him in trouble with the State Department and may have contributed to his undoing.

Fifteen months ago, this affable stalwart of Soviet science and public relations mysteriously vanished in Madrid after delivering his umpteenth talk on nuclear winter. He left behind a tangled trail that ended in a blank wall of questions.

New reports of his last-known hours show a side of Alexandrov that was unknown to his American friends. These reports paint a picture of a man in dire straits, a man who tried to drink himself into oblivion and—by one account—who tried to jump from a moving car and make a last, desperate dash for freedom outside the Soviet embassy in Madrid. At this writing, there are still as many theories about Alexandrov's fate as there are points on a compass. They run the gamut from defection to assassination. Although it is conceivable that he is now in the United States in the hands of the CIA, as early reports in the *Washington Times* speculated, the recent disclosures tend to point less toward the hopeful end of the spectrum than toward the grim.

Alexandrov was born of peasant stock on New Year's Day, 1938, in a small town in the Ukraine named after the Paris Commune. He was a stellar student at the prestigious Moscow Physical Technical Institute, from which he was graduated in 1961. Then he did experimental work in areas of physics that had military applications. He apparently did research in plasma physics, analyzing the plasma, or ionized gases, created when a projectile enters the atmosphere. By 1972 he had been taken under the wing of Nikita Moiseev, the powerful deputy director of the computing center of the USSR Academy of Sciences, the chief Soviet computer center outside the military.

Moiseev was a big thinker. For years he had nurtured a grand plan to develop a computer model not only of the atmosphere—a mammoth task in itself—but of the whole "biosphere," the entire terrestrial environment. Moiseev selected Alexandrov to design the climate part of the model. When he vanished, Alexandrov was head of the climate-research laboratory at the academy's computing center. There he had at his disposal a large staff and the best computing equipment available in Soviet science. His work reportedly met with the approval of science czar Yevgeny Velikhov, a vice-president of the academy and close confidant of Soviet leader Mikhail Gorbachev.

Award-winning science writer Andrew Revkin now works at the Los Angeles Times. He is profiled in Contributors, on page 6.

Alexandrov's first contact with an American scientist was in 1977, at a conference on climate studies in Tashkent, in Soviet Central Asia, an arid region near the border of Afghanistan. Oregon State University's Larry Gates, a veteran of atmospheric modeling, gave a talk. "Alexandrov sought me out," Gates recalls. "He introduced himself to me. He was new to the field, and I said we'd be happy to have him visit us."

Alexandrov lost no time taking Gates up on his offer. In 1978 he made the first of many long visits to the United States. Even at this relatively early point in his career, long before nuclear winter put him in the spotlight, he was beginning to break all the rules. While many older, more established Soviet scientists rarely got permission to leave the Soviet Union—and then only in groups—Alexandrov was free to travel. Moreover, he would do this again and again over the next few years, spending months at a time traveling and studying climate modeling in the United States and other Western countries. Amazingly, he often was unescorted.

What these special privileges indicate about Alexandrov is hard to say, since they are apparently unprecedented. Perhaps they indicate a close relationship with the KGB. He did visit the Soviet consulate in San Francisco, widely known to be a sophisticated espionage center, on more than one occasion. But none of more than 20 of his American colleagues interviewed by *Science Digest* report evidence that he did anything illegal or covert. They assume that he engaged in the routine, legal kind of intelligence gathering that every visiting Soviet scientist is presumed to do: reporting insights into the workings of

American scientific culture to the Soviet authorities.

On his first trip to the United States, in May 1978, under a bilateral agreement promoting U.S.-Soviet cooperation in global environmental research, Alexandrov went first to Oregon State, where he spent two weeks studying a fairly simple computer model of the global atmosphere that Gates and colleague Michael Schlesinger had refined. On May 21 he went to Colorado, where he spent the next seven months at the National Center for Atmospheric Research (NCAR), run by a consortium of more than 50 universities. Nestled against the Rockies in Boulder, in a rambling building with a basement full of advanced computers and a remarkable brain trust of scientific talent, NCAR is a more sophisticated, higher tech version of the laboratory Alexandrov ran in Moscow.

Instead of the cramped, drab quarters he was used to at home, Alexandrov had a modern office in a pink limestone castle designed by I. M. Pei, with a picture-window view of the Great Plains. Every morning, he walked to NCAR along twisting Table Mesa Drive, from an apartment he shared with another Soviet scientist, Vladimir Sergin, who was—as one American scientist put it—"built like a fireplug." The two were called Big Vladimir and Little Vla-

"I've tossed a few vodkas with him, but he certainly was not a heavy drinker."

dimir. At the time, the American scientists at NCAR thought that if either of them was a KGB plant, it was Little Vladimir.

It was at NCAR that Alexandrov learned how to use a Cray-1A supercomputer, a machine much more powerful than any he had ever used in the Soviet Union. (An atmospheric model that Alexandrov ran on the Cray-1A in six minutes would have taken 48 hours on a BESM-6, the computer he usually used in Moscow.) Alexandrov ran up more than 120 hours on the NCAR supercomputers, according to Dan Anderson, a programmer there. He was supervised all that time, so it is impossible—NCAR scientists feel—that he did anything other than what they saw him do: run a primitive model of the atmosphere. The Pentagon, however, fears otherwise. In 120 hours, the Cray-1A can perform a dazzling 30 trillion arithmetic calculations, more than enough to attack substantial military problems in anything from code breaking to bomb design. The FBI, CIA, and Pentagon began to pay a lot of attention to him, regularly debriefing his colleagues on his work, his movements, and his background.

His next long visit to the United States came in 1980, when he accepted Gates's offer to return to Oregon State University. This time he settled into the home of one of his Oregon hosts, Michael Schlesinger. "He became part of the family," recalls Schlesinger. At Christmas, the 200-pound Alexandrov played Santa Claus at the local nursery school.

At Oregon State, Alexandrov worked for the second time with one of NCAR's Crays. But he never used the machine directly; he sent his programs to NCAR, where they were executed for him and the results returned. This was the last time Alexandrov would use a supercomputer, although he would make numerous excursions, usually brief ones, to American supercomputing centers, such as Lawrence Livermore National Laboratory, east of San Francis-

co. The home of Star Wars research, Lawrence Livermore is not only a center for nuclear-weapons design but a major laboratory for unclassified research in fusion, climate modeling, and anything else that requires heavy computation. Alexandrov did use a computer there, but it was a stodgy VAX, a machine no more powerful than what he had in Moscow.

Toward the end of his six-month visit at Oregon State, Alexandrov's wife Alya (her formal name is Albine) joined him for several weeks—a rare privilege for a Soviet scientist working overseas. (Usually the wife must stay behind, apparently as a deterrent to defection.) Alya was taking a break from her job as a reviewer—some say censor—of German literature being translated into Russian. The couple wanted to drive across the Southwest to see the Grand Canyon and other sights, then to circle up toward NCAR. Alexandrov had already bought a used Chevrolet Nova for a few hundred dollars, but on the eve of their journey, the State Department canceled the pleasure drive, although it did allow the couple to crisscross the country by airplane.

Everywhere Alexandrov went, he made friends. He was a gregarious, physical man who freely gave bear hugs and imaginative gifts—a balalaika for Senator Kennedy, an antique spoon for the baby of a scientific colleague. He spent much time in the homes of his American friends, and in turn he received them into his home when they visited Moscow.

Alexandrov's American colleagues have fond memories of his Moscow apartment in an old building at 6 Arkhipov Street, a few blocks from Red Square, down the street from the largest synagogue in Moscow. The building's exterior was grimy and strewn with garbage, but the apartment inside was clean, warm, and homey. Jerry Potter, a staff scientist at Lawrence Livermore, visited Alexandrov



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several times. "By Russian standards, his apartment was really nice," Potter recalls. "It had four rooms plus a kitchen and bathroom, twelve-foot ceilings, a wall of books—many in English, Italian, and German—and souvenirs from around the world."

For many visiting American scientists, Alexandrov's apartment was a welcome refuge from the formality of his professional surroundings. "Visits to the computing center tended to be stiff," says Oregon State's Larry Gates, who has been to the Soviet Union 10 times. "You would be ushered into a big conference room, where the officials would give you a big welcoming speech." In Alexandrov's home, the only speeches were off the cuff. "There would be a dozen or so of his coworkers from the computing center over for dinner," says Gates. "A lot of food, toasts, stories, and jokes. Meat and caviar and fruit and wine. The conversations were in English, with a lot of giggling and struggling [with the language]."

For many of his friends, those visits with Alexandrov in Moscow provided their first introduction to Alya and their teenage daughter, Olga. As early as 1980, visitors began to notice that Alya didn't look well. Potter recalls that she sometimes had headaches that kept her up all night. The problem appeared to be her liver. Her illness did not detract from her charm, however. The wife of Michael MacCracken, a scientist at Lawrence Livermore, recalls how she and Alya traded recipes in Moscow. "They must have been made for an army," she says. "They always seemed to call for five pounds of flour." She says Olga was a typical teenager, partial to Izod sweaters and Western music. On one visit, Olga and the MacCracken's teenage son Chris went into another room to debate the merits of various rock groups.

In 1983 a number of American scientists, including some who had worked closely with Alexandrov, began to close in on an alarming doomsday scenario: Smoke from fires raging after a nuclear war might blot out the sun and chill the Earth. In April that year, Alexandrov attended a closed meeting of some 100 scientists at the American Academy of Arts and Sciences in Cambridge, Massachusetts; it had been convened to assess this new atmospheric phenomenon, which many were beginning to call nuclear winter.

By summer, Alexandrov had joined a growing international cadre of scientists working almost full-time on the subject. In August he flew with Velikhov and three other Russians to Sicily, where they drove up a narrow, winding road to the town of Erice, an ancient, hilltop fortress that is now the site of an annual international parley on nuclear war. At Erice's lavish Center for Scientific Culture, Alexandrov mingled not only with foreign scientists but also with political leaders such as Canadian prime minister Pierre Trudeau. There he presented a computer simulation of smoke and dust injected into the atmosphere. He was rap-

idly becoming the Soviet Union's resident expert on nuclear winter.

That fall he went to Washington, D.C., as one of 500 participants in the first public discussion of nuclear winter, "The World After Nuclear War: The Conference on the Long-Term Worldwide Biological Consequences of Nuclear War"—an event that created a worldwide sensation.

In early December he shared his expertise on nuclear aftermath with Senator Kennedy and some of his congressional colleagues. In January 1984 he joined Carl Sagan, Harvard's Stephen Jay Gould, and 15 other scientists for a three-day retreat at the Vatican to draft a report on nuclear winter for the Pope. After that, the pace of his activities accelerated; Alexandrov was becoming much more of a spokesman than a scientist.

In March he flew back to Washington for a National Academy of Sciences update on nuclear winter, and after the conference, he went with Michael MacCracken to Lawrence Livermore. "During the flight, we watched *Octopussy*," MacCracken recalls. "He made an interesting comment: 'On Soviet TV, you never see Soviet soldiers killing Americans. On Western TV, you see it all the time.'"

MacCracken and other Americans who met him sensed in Alexandrov an intense desire for peace and a firm conviction that publicizing nuclear winter, in all its horror, might pressure the superpowers to disarm. When subsequent research indicated that a nuclear winter would not be as extreme as the first studies had suggested, that it would be more of a "nuclear autumn," Alexandrov held doggedly in public to the early apocalyptic scenario that better fit the Soviet line. For the rest of 1984, he hopped around the globe from conference to conference, a traveling prophet of doom—as one American scientist

says, "serving the purpose of putting the Soviets on the side of the angels."

In January 1985, he returned to the United States for the last time before he vanished. The official purpose of his visit was to make sure the Soviet viewpoint was incorporated into a mammoth report on nuclear winter being prepared by SCOPE, the international Scientific Committee on Problems of the Environment. He also used the trip to attend the American Meteorological Society's annual meeting in Los Angeles and to visit his old haunts, from NCAR to Oregon State.

In Denver, Alexandrov applied for a Mileage Plus card with United Airlines, but he used it only for his very next flight, from there to Seattle to Tokyo, for yet another conference on nuclear winter, to be held in February in Tokyo and Hiroshima. (He had to stop in Seattle to pick up his visa, which had been delayed by red tape.)

Alexandrov reportedly saved enough money from his per diem allowance in the United States to buy a videocassette recorder in Tokyo. He already had a videotape of

"The FBI wanted to know if I felt Alexandrov was a candidate for defection."





Doctor Zhivago, a film that had brought tears to his eyes when he saw it on American television with Jerry Potter; "It's more Russian than Russia," Alexandrov told Potter. Michael MacCracken gave him Jane Fonda's "Workout" tape, which Alexandrov had wanted for Olga, who aspired to be a gymnast.

When the conference in Japan wrapped up in early February, Alexandrov's Western colleagues said goodbye to him, raised cheery toasts, snapped happy photos—unaware that they might never see him again. From Tokyo he flew to wintry Moscow, for his last visit home before he vanished.

The visit could not have been all that relaxing. His wife's liver disease had worsened. A doctor in England had made a tentative long-distance diagnosis of cirrhosis. On his recent swing through the United States, Alexandrov had gotten potent drugs from a doctor in Colorado—drugs normally administered only under medical supervision. He had to give them to his wife without the authorities knowing. He had already smuggled samples of her tissue to England, but they were not usable, and for months he had been fighting to get permission to have Alya accompany him on a trip there for more tests.

There were other pressures. In April he was slated to present his scientific findings for the Soviet *doktorat*, an academic distinction far more prestigious and harder to earn than an American Ph.D. Success here would mean a lifetime of funding and a fast track to membership in the USSR Academy of Sciences. It was to be a grueling exercise, up to five hours of critiques and cross-examination by a panel of academicians and other colleagues, each picking apart or defending his research and—perhaps more excruciating—questioning the ideological and political subtleties embodied in the work. This would be followed by a secret-ballot vote. Alexandrov had powerful friends in the Soviet scientific hierarchy, but powerful rivals, too.

He was apparently worried that he had no new research to present, having spent the last year on an arduous worldwide speaking tour. Moreover, embarrassing criticism of his earlier work had just been made public in the United

States. On March 1, 1985, the Pentagon had released a report on nuclear winter that included a section on Soviet research that was little more than a broadside at Alexandrov.

"It is hard to tell the difference between [Soviet] scientific workers and propagandists," the report read. "The primary atmospheric circulation model used by the Soviets in the case of the widely publicized study by Soviet researchers V. Alexandrov and G. Stenchikov is based on a borrowed, obsolete, U.S. model. . . . Time after time their presentations contain exaggerated claims, which are criticized by their foreign colleagues. . . . but subsequent presentations do not reflect any change, even though in private the Soviets acknowledge the exaggeration."

This probably did not play well in Moscow. Nevertheless, the Soviet authorities did not stop Alexandrov from attending a short conference in Spain at the end of March.

The following is an account of the last-known days of Alexandrov in Spain, pieced together from an extensive series of interviews conducted here and abroad with eyewitnesses, Alexandrov's American and European colleagues, and State Department and other government officials. It is as accurate as the available facts allow.

Friday, March 29, 1985, Madrid

Alexandrov arrived at Barajas International Airport a day late, reportedly held up by visa problems. Probably the last thing he wanted to do was deliver yet another apocalyptic address on nuclear winter. But that's why he was there, en route to Córdoba to speak to the Second International Conference of Nuclear Free Zone Local Authorities, a gathering of representatives from municipalities around the world, including Baltimore and Hoboken, New Jersey, that had voted not to allow nuclear materials or weapons within their borders.

José Moreno, a driver for the Córdoba city hall, had been sent to the airport to greet Alexandrov, but as he stood holding up a sign with the scientist's name on it, an official from the Soviet embassy tapped him on the shoulder. He told Moreno that embassy officials were there to

meet Alexandrov, that Moreno could follow them to the embassy, wait outside and then take Alexandrov to Córdoba. Moreno dutifully complied.

Alexandrov went into the embassy for about a half hour. When he emerged, he started behaving in a fashion that was totally out of character. Normally a model of enormous self-control, Alexandrov went on a drinking binge. When he got into Moreno's car, he "asked urgently" to be taken to a bar, any bar.

"Within some ten minutes he got absolutely drunk," Moreno later told Margarita Ruiz Schrader, executive secretary of the conference organizing committee and an assistant in the Córdoba mayor's office. According to Ruiz Schrader, Moreno reported that Alexandrov stumbled out of the bar back to the car. He was white. He collapsed in the back seat in a stupor and was alternately sick and asleep for the five-hour ride to Córdoba. They got there around 7:00 P.M. Ruiz Schrader says she then took Alexandrov to a university hall that housed most of the foreign guests. He must have gone out, because later that night the Spanish police found him lying unconscious in the street in the old Jewish quarter of the city. They drove him back to the university.

Saturday, March 30, Córdoba

After such a trying night, Alexandrov probably had to force himself to get up and prepare for his 10:00 A.M. presentation. He was never a "morning person," according to several American scientists in whose houses he had spent many nights. The American delegates to the conference say his speech was brief and colorless; his responses to questions, curt and evasive. "The lecture he gave was disappointing," recalls Ruiz Schrader. "We expected something more—after all, he was a great scientist. But he didn't seem to say anything interesting; it was all more or less commonplace. I tried to talk to him several times, but I don't think I ever got through to him." That afternoon, Alexandrov walked off into town.

Ron Santoni, a philosophy professor at Denison University in Granville, Ohio, also addressed the conferees that day, on "the immorality of nuclear weapons." That evening Santoni and Alexandrov were scheduled to hold a press conference, but the Russian never showed. Earlier in the day, Santoni recalls, "he seemed sullen and gray-looking, almost ghostlike." Reports indicate that he went on another drinking spree.

Officials in the Córdoba city hall made several phone calls to the Soviet embassy in Madrid to report Alexandrov's unruly behavior and ask for advice. This may have proved his downfall, by giving Soviet authorities advance notice that they had a problem to deal with.

Ruiz Schrader and the other conference organizers stayed up through the night, drafting a series of 15 resolutions. She was there at 3:00 A.M. when Alexandrov pulled

up in a cab. He was extremely drunk, so disoriented that he tried repeatedly to pay the cabdriver with a U.S. \$50 bill. Ruiz Schrader paid the driver for him, although she says it took her several minutes to realize that she had taken care of the situation.

Bob Cess, an atmospheric scientist at the State University of New York, Stony Brook, is one of many friends of Alexandrov's who told *Science Digest* that he never seemed to have a drinking problem. "I've tossed a few vodkas down with him on occasion, but he certainly was not a heavy drinker." Cess, who has been to the Soviet Union 13 times and has hosted many Soviet scientists in the United States, says the fact that Alexandrov had a large-denomination American bill is unusual. "They give them local currency when they go to a foreign country. I doubt he was given American dollars for a trip to Spain. They're very tight about this. When you come back you have to account for everything."

Sunday, March 31, Córdoba

It was a sunny spring day. Palm Sunday. The people of Córdoba prepared for a centuries-old ritual in which a large pallet crammed with religious statues is paraded through the cobblestone streets, held aloft by as many as 50 people and accompanied by costumed figures wearing hooded white robes.

Ruiz Schrader says the conference organizers decided to have a second driver join Moreno for the trip back to Madrid. "We were concerned that there might be trouble," she says.

The man at the wheel for the return trip, Francisco Delgado, reportedly said

that every time they passed something that looked like a roadside café, Alexandrov, almost as an afterthought, said, "Restaurant. Stop." "But we didn't stop," Delgado told *El País*, Spain's largest daily newspaper. "We only did one time during the whole trip . . . so that he could do his necessities."

It is impossible to know what was going through Alexandrov's mind as the car sped across the dry plains, past acres of vineyards and olive orchards beneath the bright sun. But, given his behavior in Spain, he must have known that his future was dim. At the very least, he undoubtedly would never be allowed to go abroad again. Soviet travelers who misbehave are dealt with harshly. Cecil Leith, an atmospheric scientist at Lawrence Livermore, recalls how a Soviet physicist who spent a night drinking with an American colleague was demoted to the equivalent of janitor. Defector Arkady Shevchenko, who was a high-ranking Soviet UN diplomat, recalls similar incidents in his memoirs, in which improper behavior resulted in a quick trip to a sanatorium.

Sunday, March 31, Madrid

The car carrying Alexandrov reached Madrid in the ear-

"Spain is not the quietest place in the world. Of course, the body wasn't found."

MISSING

ly evening. As Delgado wound through the city streets, Alexandrov, still somewhat hazy from his lost weekend, reportedly told him, "Airport, airport." According to Ruiz Schrader, Delgado said that he responded "Yes, yes, yes," even though he was taking Alexandrov straight to the Soviet embassy, as he had been instructed to do by city hall officials in Córdoba. As the car approached the embassy, says Ruiz Schrader, Alexandrov "suddenly realized where they were taking him."

What happened next is cloaked in contradictions, but the consistent refrain is that Alexandrov did not want to go to the embassy. Recounting what Moreno and Delgado reported to her, Ruiz Schrader told *Science Digest* in three interviews over a two-day period that Alexandrov became violent and tried to wrench open the car door while it was still moving, breaking the door handle in the process.

When the car pulled up to the embassy, Alexandrov bolted down the street. An embassy official ran after him and caught him. "At first, the embassy people asked the drivers to take him to the Hotel Habana," Ruiz Schrader says. The Hotel Apartamentos Habana, a few blocks north of the embassy, is reportedly a frequent way station for Soviet visitors. But the drivers refused, saying they were under instructions from Córdoba to take Alexandrov only to the embassy and no farther. The officials, she says, then "put him into a van."

In subsequent interviews with *Science Digest*, Ruiz Schrader changed important details, downplaying how hard Alexandrov tried to get away and how much force the embassy used to keep him there. She says that he ripped off the car's ashtray, not the door handle; that he walked, not ran, away from the embassy; and that an embassy official persuaded him to come back without resorting to force. Ruiz Schrader refused to provide *Science Digest* with the addresses or phone numbers of the two drivers so that her story could be checked. She became increasingly nervous and asked that *Science Digest* remove her name from this article.

According to an American expert on Soviet foreign relations who also talked with Ruiz Schrader at length and found her "not just backing off on particulars but closing down on information," she may have come under political pressure. Her boss, Julio Anguita, the mayor of Córdoba, is the only Communist mayor of a major Spanish city (his nickname is "The Red Caliph"). The Spanish Communist Party prides itself on not being a dupe of Moscow.

After Alexandrov's attempted flight, be it at a run or a walk, it seems illogical that the embassy officials would leave him unattended. But employees of the Hotel Habana and other nearby businesses say that he was dropped off at the hotel that evening by an embassy official.

[Because of the close relationship between the Hotel Habana and the Soviet embassy, several American sources, including one with close ties to intelligence agencies, question the credibility of the following accounts:]

A receptionist at the hotel, who was not on duty the night of March 31 but whose friend was, says that Alexandrov, who did not appear drunk or disheveled, was given the key to room 614 and went to his room carrying one bag

and a knapsack. He left the hotel around 11:00 P.M. that night, appearing drunk. He did not return and did not spend the night in his room.

Adjoining the hotel is a bingo parlor. The attendant there says Alexandrov tried to enter the parlor "very late" that night, appearing drunk and asking for Spanish wine. He was led out the main door but tried to get back in through an entrance from the hotel. He was escorted out again. The trail fades there.

Monday, April 1, Madrid

The hotel receptionist says that representatives from the Soviet embassy came to the hotel to pick up Alexandrov. He wasn't there. They went up to his room, recovered his belongings, paid his bill, and left. According to some press reports, the embassy officials took his passport with them. Other press reports have his passport showing up in a trash bin—variously said to be in his hotel room or just outside the hotel.

Later that day the Soviet embassy "unofficially" asked the Spanish police to look into the whereabouts of Alexandrov, according to José Antonio Linares, spokesman for the General Police Directorate. There the story ends.

Alexandrov's disappearance was not reported in the press for months. And when it finally was, the source was not a Spanish one, but Alexandrov's American and British colleagues.

Stony Brook's Bob Cess was one of the first who knew that something fishy had happened. On April 3, just three days after the last sighting in Madrid, two FBI agents walked into Cess's office. It was not unusual for him to get such visits. He was often debriefed because he had made so many trips to the Soviet Union and entertained Soviet scientists at Stony Brook. This time was different, however. For 30 minutes they focused on one question. "They wanted to know," says Cess, "if I felt Alexandrov was a candidate for defection." About the same time, several of Alexandrov's American friends at Lawrence Livermore received similar queries. "Somebody came out here in early April," MacCracken recalls, "asking, 'You guys hear anything from Vladimir?' They must have picked up that the Soviets were making inquiries."

At 8:00 A.M. on May 3, 1985, John Wallace, chairman of the atmospheric sciences department at the University of Washington, got a call from Moscow. It was Alya. She called Wallace because she knew his wife spoke Russian. But Suzie was out. Alya's English was bad, but Wallace could tell that she was extremely upset about Vladimir, that he had not returned from Spain. After several days of trying to call her back, Wallace and his wife got through to her. They spoke at length several times over the next few days. Alya seemed to know nothing.

Word spread quickly through the nuclear-winter research community that Alexandrov was missing. But the scientists made an informal pact to suppress the news, just in case he had defected or was in hiding.

As the months passed, Alexandrov's colleagues grew more apprehensive. On July 4, Vera Rich, a reporter for the

Why Moscow Covets U.S. Supercomputers

When Alexandrov was in the United States, it took him six minutes to run a primitive atmospheric model on a supercomputer. If he had run the same model on the BESM-6 computer that he normally used in Moscow, it would have taken 48 hours. The most advanced computers in the Soviet Union are thought to perform just over 10 million basic operations per second (10 "megaflops"). That may sound impressive, but American and Japanese companies are beginning to market machines that break the "gigaflop" barrier—billions of operations per second.

By most accounts, the Soviet Union has trouble producing machines that come even close to equipment already hitting the scrap heap in the United States. The Soviet military probably has fairly capable computers, some acquired illegally. But Soviet industry and the scientific community have to suffer with makeshift collections of imported parts or balky, jerry-rigged equipment such as the plodding BESM-6, which has the speed of an IBM mainframe but not much more memory than an IBM PC. "It's just amazing," says Michael Schlesinger, a climate modeler at Oregon State University who worked closely with Alexandrov and visited his computing center in Moscow. "They haven't been able to bring their hardware into the seventies, let alone the eighties."

In the West, the hardware of the eighties is the supercomputer. The domain of this powerful machine is the world of simulation, prediction, and data processing. The National Security Agency uses supercomputers to crack codes. The Los Alamos and Lawrence Livermore National Laboratories rely on them to refine the design of nuclear weapons and the Star Wars missile-defense scheme. The private sector is exploiting them to prospect for oil, design drugs, sculpt new cars and aircraft, and create space-age television advertisements and feature-film special effects. At universities they are being used to model black holes, predict the behavior of subatomic particles, study the genesis of severe storms, and even analyze the serpentine swimming motion of eels.



The main computer room at the National Center for Atmospheric Research, where Alexandrov used a Cray-1A supercomputer.

Now that the "missile gap" between the Soviet Union and the United States has closed to a virtual tie, the Pentagon is eager to maintain the "computing gap." Already, it has effectively blocked the flow of high-tech hardware to the Eastern bloc. The big push now is to prevent Eastern bloc scientists who visit the United States on academic exchange programs from using supercomputers. The fear is that the visitors might secretly run programs with military value that they can't run at home.

The term *supercomputer* represents a moving target: the most powerful machine available at the time. For the past decade, the champions have been Control Data Corporation's Cyber 205 and a series of models from Cray Research, variously capable of between 70 and 1,000 megaflops. At the end of 1985, most of the approximately 160 supercomputers in existence were built by these two Minnesota-based companies. Three Japanese firms have entered the market, and competition from other American companies will come later this year.

The current crop of supercomputers, called Cray-class machines, achieve their speed more through what one engineer calls "solid Germanic engineering and brute force" than

through advanced technology. The secret, unraveled by Cray's founder, Seymour Cray, was to lay out a central processing unit (CPU)—the calculator—and hundreds of memory chips as close together as possible and to make them run as fast as possible. The challenge was to keep the whole thing from burning up in the process. Cray's solution was to marry microchip and refrigerator technology.

The Cyber 205 has an antiquated look. Each machine is a branching maze of large cabinets, filled behind smoked-glass doors with bundles of white wiring and a plumber's nightmare of thin copper tubes that circulate coolant through layers of memory chips and microprocessors. The Crays are more stylish and compact but rely on the same basic design.

In the coming generation of machines, much of this hardware has been shrunk onto a single board. The ETA 10, for example, built by a subsidiary of Control Data Corporation, will have as many as eight CPUs immersed in a bath of liquid nitrogen; each CPU will be three to five times faster than the Cyber 205, and all eight will be able to work at the same time on different aspects of one large problem.

—A.R.

MISSING

British science journal *Nature*, broke the news. The article was a string of third-hand reports, but it immediately stirred things up. The *New York Times* ran a short piece. The Spanish press, particularly the Madrid daily *El Pais*, picked up on the story.

But the accounts made no mention of any reluctance on Alexandrov's part to return to the Soviet embassy. One of them had Alexandrov try the embassy door and, upon failing to get in, ask the drivers to take him to the Hotel Habana. Another reported that an embassy official and two guards were outside the building. The drivers left him at the embassy, noting that a van and a car were waiting to take Alexandrov to the hotel.

On July 17, 1985, 108 days after Alexandrov disappeared and one day after the story broke in the *New York Times*, the Soviet embassy made its first formal request to the Spanish police and the Foreign Ministry to look for Alexandrov.

The first accounts of the mystery did not appear in the Soviet press until December. Many of them pointed an accusing finger at the CIA, referring to an article by conservative columnist Ralph de Toledano, in the October 29, 1985, issue of the *Washington Times*, which, citing anonymous intelligence sources, said Alexandrov was being debriefed by the CIA after defecting to the West.

That is the one possibility that Alexandrov's closest American friends say is the least likely. "It's possible that the pressures of the kind of role he was having to play over a sustained period of time and his concerns about his wife's health may have pushed him to the point of a nervous breakdown," John Wallace says. "But whatever happened, I can't see it as a rational, calculated decision. He was a very devoted family man, with a lot of fondness for his wife and daughter. He was also a real Russian. He loved the Russian culture and just being a part of that. He was amused by many Western things, but not at any depth."

Perhaps Alexandrov was the victim of random violence. According to Mark Kuchment, a Soviet émigré who is a historian at Harvard's Russian Research Center, "Bizarre things happen. Terrorism, mistaken identity. Spain is not the quietest place in the world. Of course, the body was never found."

Another possibility is that he was killed or spirited away by the Soviet Union because he had become a liability of some sort or was about to defect, but no hard evidence of this has been uncovered. "Unless it is terribly urgent, this type of abduction is a very dangerous thing," Kuchment says, "especially because he was on a political trip." Kuchment points to an incident in Madrid late last year, when Cuban embassy officials tried to kidnap a Cuban at gunpoint in front of a bank. They were caught. "That incident created an enormous scandal," he says.

Moreover, there are some indications that the Soviet establishment does not know Alexandrov's fate. One is an inconsistency that cropped up in recent Soviet publications. *The Night After...* is a slick English-language book about nuclear winter that was published in the Soviet Union late last year, months after Alexandrov's disappearance. The

introduction, which is a review of the origins of the nuclear-winter theory, contains no mention of Alexandrov. His name is also missing from the bibliography; any paper that was authored by him has only the title.

This expunging from the public record is the way that Moscow treats many defectors and even some scientists who emigrate legally. But, strangely, in the few months since *The Night After...* was published, Alexandrov's name has started to appear in the literature again, according to several American scientists.

Another indication that his fate is not known is the treatment—or lack thereof—that his wife has been receiving. So far, Alya has not been given a pension of any sort. In fact, Alexandrov's Soviet colleagues have reportedly taken up a collection to make sure she is provided for.

Besides the unresolved question of Alexandrov's fate, there is another question—one that is perhaps even more painful for his American friends: What drove him to self-destructive drinking? Here was a man in his forties heading for the top echelon of Soviet science, a realm inhabited mostly by older, privileged men. For two years he had been riding a wave of publicity for nuclear winter.

His friends have considered the following possibilities:

■ The embarrassment caused by the harsh criticism of Alexandrov's work in the Pentagon's report on nuclear winter may have pushed him out of favor. Also, there was a reference in the report that Alexandrov privately held opinions on nuclear winter that were at odds with the party line. In fact, he had been under mounting pressure from American colleagues to make more realistic approximations of the severity of a nuclear winter. "We were working him over pretty hard in private," says an atmospheric scientist at NCAR. "His nuclear-winter stuff was at the extreme fringe, but he was beginning to come down. The reason I believe he's probably dead and [the Soviets] probably did it is that if you look at who really stood to benefit the most from the way Alexandrov appeared to be evolving, it was the West."

■ Infighting within the Soviet scientific hierarchy had driven him out of favor. Alexandrov's American colleagues say he did have rivals, but no one has replaced him yet. The two names most frequently mentioned as Alexandrov's successors are Georgii Golitsyn, head of the laboratory at the Institute of Atmospheric Physics of the academy—called "Prince George" by some of his colleagues because of his relationship to a noble Russian family—and Kiril Kondratyev, a corresponding member of the academy. Although both were much higher in the scientific hierarchy than Alexandrov, they had fewer overseas trips and other perks—a situation that may have sparked professional jealousy and rivalry.

■ He simply cracked—had a nervous breakdown—in Spain. "All these pressures," says MacCracken, "could have started Alexandrov drinking. He could have said, 'I'm not getting on that plane,' and is just holed up underground somewhere in Europe." John Wallace says that the "occasional uncontrolled drinking bout" happens a lot more in Soviet culture than it does here. But both men insist, as do others, that they saw no signs of trouble, right up to their

last contact with Alexandrov in February 1985, just before he vanished.

Information uncovered by *Science Digest* points to yet another, even more disturbing, possibility. On Alexandrov's last visit to the United States, in January 1985—two months before he disappeared—the visa stamped in his passport by the American embassy in Moscow had a handwritten condition added to it. According to a State Department spokesman, the scrawled note read: "Not permitted direct or indirect access to supercomputers in the United States." This was the first time that this specific condition had been applied to any Soviet scientist. According to a source on the Soviet Affairs Desk at the State Department, "Alexandrov was such an expert, a lot of people were worried about him being here. We thought that was a way to keep track of him."

A government scientist says he assured Alexandrov that the restriction was a temporary response to a wide governmental review of supercomputer security. But Alexandrov started to joke self-consciously about the restriction. While at Lawrence Livermore on that last swing through the West, one of his jokes reportedly got him into serious trouble.

A State Department official close to the case says Alexandrov cheerfully boasted that he would get access to supercomputers—restriction or no restriction. Lawrence Livermore's Jerry Potter, who once had Alexandrov as a houseguest, says, "He prided himself on what he knew about the Cray. He would name-drop. He told someone he could access the Cray X-MP anytime he wanted to." (The Cray X-MP at Lawrence Livermore is more powerful than the Cray-1A that Alexandrov used at NCAR.)

Word of the boast got back to Washington, and, as one scientist put it, there was "significant unhappiness with Alexandrov's games"—so much so that his chances of ever visiting again had been jeopardized.

The kicker came in February 1985, less than a month after Alexandrov left the United States, and it was anything but a joke. Someone tried to log onto Lawrence Livermore's Cray X-MP by phoning from Moscow, according to two scientists close to the situation who learned about this from a government source in Washington. (In conversations with *Science Digest*, no one at the laboratory could confirm this report.) The two scientists say that as a result the State Department decided that Alexandrov was too much of a security risk ever to be allowed back in the United States.

If this is true, it may explain Alexandrov's sudden, tragic fall. "It would give the Soviets good reason to be angry," says one of the scientists. "He blew his chance ever to have access to supercomputers again."

Information provided by the American Geophysical Union (AGU) confirms that the State Department had seri-

ous reservations about letting Alexandrov return. On April 1, 1985 (the day after Alexandrov vanished), Brenda Weaver, meeting manager for the AGU, sent the State Department a list of more than 10 Soviet scientists who were slated to attend an August 1985 conference in Hawaii on the atmosphere and oceans.

About three days later, her notes show, she spoke with an official on the Soviet Affairs Desk who said that the outlook on all the scientists was good, with the sole exception of Alexandrov. The official put it this way: "There will be great difficulty getting him a visa. We probably won't be able to."

Amid the morass of speculation about Alexandrov, there is only one undeniable fact: The man is missing, a man who had many talents and many friends. Unless Alexandrov surfaces, the whole story may never be revealed. "There are elements in this that we don't know and may never know," says John Wallace. "I don't think any of us know the details of the pressures he was subject to on the Soviet side. It's probably all very consistent and logical."

What is being done to find Alexandrov? Not much. There have been several claims in the Soviet press that Spanish authorities have not helped in the investigation. But the Madrid police department says that it has not received "one bit of pressure" from Moscow to pursue the case.

One intelligence expert says that American intelligence agencies must have a good idea of what happened outside the Soviet embassy in Madrid on March 31, 1985. But neither the FBI nor the CIA will comment on Alexandrov. When State Department officials were queried, they asked more questions than they answered. A spokesman for the U.S. embassy in Madrid says the embassy has not tracked the case closely. A spokesman for Senator Kennedy says that his office has not

made inquiries because the senator, who recently visited the Soviet Union, is hoping to get concessions from Moscow on human rights issues.

American scientists and scientific organizations have not made formal appeals—because there is a fear, some say, that that might impede scientific exchange between the two superpowers. Some of Alexandrov's American colleagues regret they didn't break the news when they first heard from Alya that he was missing. "At the end of May [1985], President Reagan was in Madrid," says Alan Robock, an atmospheric scientist at the University of Maryland. "There were all these reporters hanging around with nothing to do. I regret now not having gone to the press."

Alexandrov's friends alternate between hope and despair. Says Robock, "Who knows? Maybe it'll have a happy ending and we'll find him on a beach in Greece with a girlfriend." Bob Chervin, a staff scientist at NCAR, says "My gut feeling? I think I'm fairly safe in saying we will never hear from him again or see him again." ■

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