

NEW LIGHT ON EARLY SOVIET BOMB SECRETS

David Holloway

Nuclear history has opened up remarkably since the end of the cold war and the collapse of the Soviet Union. The Soviet nuclear program and the history of the US-Soviet nuclear arms race can now be studied in quite a new way, thanks to information from Russian archives and from participants in the program itself.

In May of this year, more than 300 people gathered in Dubna, Russia, on the banks of the Volga River, for a conference on the history of the Soviet atomic program. Over 100 papers were presented, almost all of them by participants in the Soviet program or by Russian historians. The conference was an important stage in the continuing effort to study the Soviet nuclear program and to assess its significance in Soviet history and the history of the cold war.

Within Russia, there is great interest in this history, which was shrouded in secrecy for so long, and great concern about the harmful legacy of the project—the health effects, pollution and risk of further accidents. Over the last five or six years, there has also been a bitter dispute about the relative contribution of Soviet scientists and of the intelligence services to the making of Soviet nuclear weapons. More is involved than an institutional battle between the scientific and intelligence communities. A broader issue runs through it: Did Russian scientists make a real contribution, or is Russia condemned to a backwardness that it must constantly try to overcome by stealing or borrowing from the West?

The initiative for the Dubna conference came from a group of historians and physicists, who had been meeting regularly in a seminar at the I. V. Kurchatov Institute of Atomic Energy over the last three years. The Russian Academy of Sciences, the Ministry of Atomic Energy and the Kurchatov Institute provided sponsorship. As the article on page 30 by Thomas Reed and Arnold Kramish shows, the conference was a fascinating experience, in social and cultural as well as intellectual terms. There was a remarkable collection of interesting people—physicists, chemists, weapons designers, intelligence operatives and managers—including many who had participated in the making of Soviet nuclear weapons. This conference was the first open opportunity for some of them to recount their experiences.

In the late 1940s the US had very little information about the progress of the Soviet effort to build a fission bomb. There were widely different estimates of the date when the Soviet Union would have such a weapon. The article on page 38 by Herbert Friedman, Luther B. Lock-

hart and Irving H. Blifford shows how the US Naval Research Laboratory detected Joe-1, the first Soviet fission bomb test of August 1949. The detection of the test was the result of urgent efforts, initiated by Lewis Strauss of the Atomic Energy Commission, to organize a system for the long-range detection of a Soviet test. The system was ready in time. The Soviet Union made no announcement of its test until President Harry Truman declared, three weeks later, that there had been a Soviet atomic explosion. If the long-range detection system had not been set up in time, the Soviet test might have remained a secret. Friedman and his colleagues provide an instance of the importance of technical intelligence for the US; technical intelligence was crucial precisely because the Soviet nuclear program was so secret.

The development of Soviet thermonuclear weapons was the subject of three presentations at a plenary session that I had the honor of chairing. One of these papers, "On the Development of the Soviet Hydrogen (Thermonuclear) Bomb" by Yulii Khariton, Viktor Adamskii and Yuri Smirnov, is published in the November issue of the *Bulletin of the Atomic Scientists*. Another is the paper by German Goncharov that appears in this issue of *PHYSICS TODAY*, beginning on page 44 and continuing on pages 50 and 56. Goncharov's report provides the most detailed account yet of the research and the decisions that led to the development of the first Soviet thermonuclear weapons. Goncharov has worked at Arzamas-16, the first Soviet nuclear weapons institute, since the 1950s, and now heads one of the theoretical departments there. His paper is based very largely on materials from the Russian Presidential Archive, which holds the papers of the top policy-making bodies and is inaccessible to foreign scholars.

The Soviet thermonuclear program has been the subject of considerable controversy in the US. The controversy started at the time of President Truman's decision, on 31 January 1950, to proceed with development of the superbomb. The General Advisory Committee of the Atomic Energy Commission, which was chaired by J. Robert Oppenheimer, had opposed the development of the superbomb. Advocates of the new weapon nevertheless prevailed by arguing that the Soviet Union, which had tested an atomic bomb much earlier than the US had expected, might well be ahead in the effort to develop the hydrogen bomb.

At the end of that same month, January 1950, Klaus Fuchs confessed to the British authorities that he had provided the Soviet Union with a great deal of information about US nuclear weapons, including the early work at Los Alamos on the superbomb. Although Fuchs's confession came too late to affect Truman's decision, the advocates of the superbomb, including Edward Teller, stressed the need for urgency by arguing that Fuchs's information might have given the Soviet Union a headstart in devel-

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THE OLD SAROV MONASTERY is seen in this reproduction of an old print (courtesy of German Goncharov). Sarov is where the Soviet "Los Alamos" was built, the closed city known variously as Arzamas-16, KB-11 and Kremlev. Today, once again, the city is called Sarov.

oping thermonuclear weapons.

Not everyone agreed with this view. In May 1952, Hans Bethe wrote to Gordon Dean, chairman of the Atomic Energy Commission, that Fuchs's information would have been of little value to Soviet physicists. "The theoretical work of 1950," he wrote, "had shown that every important point of the American thermonuclear program had been wrong. If the Russians started a thermonuclear program on the basis of the information received from Fuchs, it must have led to the same failure." Bethe also claimed that intensive work on those early ideas would not lead in a straight line to the Teller-Ulam concept, which had been formulated in the spring of 1951 and provided the basis for a workable superbomb design.

Teller responded to Bethe's memorandum by arguing that the Soviet Union might well have advanced much farther than the US toward the development of a superbomb. He disagreed with Bethe's characterization of the discovery of the Teller-Ulam idea as "accidental." Modification of the early ideas could well have led to a similar discovery, he wrote. Besides, he was afraid that Fuchs might have disclosed to the Soviet Union the principle of radiation implosion, which was central to the Teller-Ulam configuration and had already been discussed at Los Alamos in 1946, at a conference attended by Fuchs.

Goncharov shows that the initial Soviet interest in thermonuclear weapons was triggered by intelligence information from the US. He also knows that Fuchs's reports on the early US designs did not lead Soviet scientists to a workable design for a thermonuclear weapon. Soviet scientists worked until early 1954 in a vain effort to design a practicable bomb on the basis of the "tube" (the Soviet term for Teller's "Classical Super" design). Goncharov confirms that Andrei Sakharov's *sloyka* ("layer cake"), the first Soviet hydrogen bomb, was an original Soviet design even though it bore some resemblance to the "Alarm Clock" concept elaborated by Teller. Finally, he provides evidence that Soviet weapons designers did not learn anything of interest from the US Mike

test of 1 November 1952, and that they hit upon what Sakharov calls the "Third Idea" (the Soviet analog of the Teller-Ulam configuration) only in the early months of 1954, after it became clear that there was no point in continuing with work on the "tube." Goncharov's analysis bears out Bethe's contention: Fuchs's information did not provide the basis for a workable design.

At the same time, however, Goncharov provides a great deal of new information and raises some interesting questions. He shows that Fuchs passed on more information about US work than he acknowledged in his confession. As

Teller feared he might have done, Fuchs passed on the idea of "radiation implosion," although he later told the FBI that he had not done so. But in the late 1940s, the Soviet weapons scientists did not understand the significance that this idea would have in the Teller-Ulam configuration; nor, of course, did Teller or Stanislaw Ulam before about March 1951. Nevertheless, the information obtained from intelligence was part of the store of ideas with which Soviet physicists worked in the late 1940s and early 1950s. Goncharov concludes that in 1950 the Soviet Union possessed as great a stock of ideas as the US for the development of nuclear weapons, thanks both to intelligence information and to the independent development of some key ideas.

Goncharov's paper shows how closely the Soviet authorities, including of course the intelligence services, were watching what the US was doing, and how the direction and tempo of Soviet work was affected by the American program. The information from Fuchs, Truman's decision to proceed with the superbomb, the Mike test and the Bravo test of 1 March 1954 all increased the urgency of the Soviet effort. The US had no information about the Soviet thermonuclear program before the first Soviet hydrogen bomb test in August 1953, although it assumed, as the exchange between Bethe and Teller shows, that the Soviet Union was working as hard as it could to develop thermonuclear weapons.

It is the secrecy of the Soviet nuclear program that made the Dubna conference so interesting. As Soviet nuclear history opens up, it begins to become possible to see in detail from both sides, how the Soviet Union and the US interacted in the nuclear arms race and how closely intertwined their nuclear weapons programs were. The Dubna conference was devoted to the history of the Soviet nuclear program, but it was at the same time a chance to explore a common history of rivalry and danger, which can be recalled now in a somewhat calmer atmosphere. ■