before an explosive device could be detonated.[14]

Bush reconstituted the National Academy of Sciences committee and instructed it to assess the recommendations contained in the first report from an engineering standpoint. On July 11 the second committee endorsed the first report and supported continuation of isotope separation work and pile research for scientific reasons, though it admitted that it could promise no immediate applications. The second report, like the first, was a disappointing document from Bush's point of view.[15]

The Office of Scientific Research and Development

By the time Bush received the second National Academy of Sciences report, he had assumed the position of director of the Office of Scientific Research and Development. Established by an executive order on June 28, 1941—six days after German troops invaded the Soviet Union—the Office of Scientific Research and Development strengthened the scientific presence in the federal government. Bush, who had lobbied hard for the new setup, now reported directly to the President and could invoke the prestige of the White House in his dealings with other federal agencies. The National Defense Research Committee, now headed by James B. Conant, president of Harvard University, became an advisory body responsible for making research and development recommendations to the Office of Scientific Research and Development. The Uranium Committee became the Office of Scientific Research and Development Section on Uranium and was codenamed S-1 (Section One of the Office of Scientific Research and Development).

Turning the Corner: The MAUD Report

Bush's disappointment with the July 11 National Academy of Sciences report did not last long. Several days later he and Conant received a copy of a draft report forwarded from the National Defense Research Committee liaison office in London. The report, prepared by a group codenamed the MAUD Committee and set up by the British in spring 1940 to study the possibility of developing a nuclear weapon, maintained that a sufficiently purified critical mass of uranium-235 could fission even with fast neutrons.[16] Building upon theoretical work on atomic bombs performed by refugee physicists Rudolf Peierls and Otto Frisch in 1940 and 1941, the MAUD report estimated that a critical mass of ten kilograms would be large enough to produce an enormous explosion. A bomb this size could be loaded on existing aircraft and be ready in approximately two years.[17]

Americans had been in touch with the MAUD Committee since fall 1940, but it was the July 1941 MAUD report that helped the American bomb effort turn the corner. Here were specific plans for producing a bomb, produced by a distinguished group of scientists with high credibility in the United States, not only with Bush and Conant but with the President.[18] The MAUD report dismissed plutonium production, thermal diffusion, the electromagnetic method, and the centrifuge and called for gaseous diffusion of uranium-235 on a massive scale. The British believed that uranium research could lead to the production of a bomb in time to effect the outcome of the war. While the MAUD report provided encouragement to Americans advocating a more extensive uranium research program, it also served as a sobering reminder that fission had been discovered in Nazi Germany almost three years earlier and that since spring 1940 a large part of the Kaiser Wilhelm Institute in Berlin had been set aside for uranium research.

Bush and Conant immediately went to work. After strengthening the Uranium Committee, particularly with the addition of Fermi as head of theoretical studies and Harold C. Urey as head of isotope separation and heavy water research (heavy water was highly regarded as a moderator), Bush asked yet another reconstituted National Academy of Sciences committee to evaluate the uranium program. This time he gave Compton specific instructions to address technical questions of critical mass and destructive capability, partially to verify the MAUD results.

Bush Reports to Roosevelt

Without waiting for Compton's committee to finish its work, Bush went to see the President. On October 9 Bush met with Roosevelt and Vice President Henry A. Wallace (briefed on uranium research in July). Bush summarized the British findings, discussed cost and duration of a bomb project, and emphasized the uncertainty of the situation. He also received the President's permission to explore construction needs with the Army. Roosevelt instructed him to move as quickly as possible but not to go beyond research and development. Bush, then, was to find out if a bomb could be built and at what cost but not to proceed to the production