

# Uranium Enrichment Technology : Proliferation by Pakistan

Professor Matin Zuberi

Several technologies for enriching uranium, including electromagnetic isotope separation and gas centrifuge, were tried during the Manhattan Project. It was, however, decided to concentrate on the gaseous diffusion process. The first American diffusion plant was spread over 640 acres and needed copious amounts of power for its operation. This was the prevailing technology when the non proliferation treaty (NPT) was drafted. The technology to produce highly enriched uranium remained classified, while the reprocessing of plutonium from spent reactor fuel was widely disseminated by the United States under the Atoms for Peace programme. Having imported the American enriched uranium reactor systems, the West European countries and Japan were sensitive about their dependence on American nuclear fuel. Germany, for instance, was spending 50 million pounds sterling annually on American fuel supplies.<sup>1</sup>

Some British, Dutch and German groups began exploring gas centrifuge technology in the early 1950s. They were determined to break the American monopoly and enrich themselves through nuclear commerce.<sup>2</sup> By 1960, however, the United States managed to prolong its enrichment monopoly by persuading them not to publish or collaborate on further centrifuge research. The development of a highly competitive alternative enrichment process was thus temporarily blocked.<sup>3</sup> Centrifuge technology, however, was "popping in and out of security wraps. Every time an experimental centrifuge blew up, which happened regularly, the Americans declassified the subject. When one ran well, they reclassified it again — the last time in March 1967."<sup>4</sup> The Dutch finally announced a breakthrough in 1968 and claimed to be two years ahead of Britain and West Germany.<sup>5</sup>

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Blocked by France from joining the Common Market, the British played the nuclear card and joined in a gas centrifuge troika with the Netherlands and West Germany. Some commentators feared that British involvement in joint research could be the first step in West Germany acquiring the capability to produce atomic and thermonuclear weapons.<sup>6</sup> It was rightly forecast that the centrifuge process of enriching uranium could "alter the technological and political balance of the nuclear world."<sup>7</sup>

Two factors make centrifuge technology attractive to states embarking on a covert weapons effort: its power consumption is less than a quarter of that of diffusion plants, and it has greater flexibility in construction and operation because of smaller unit size of centrifuges that can be scaled up whenever required. Unlike diffusion plants, it was pointed out, "centrifuges do not shout their presence to every satellite-borne reconnaissance cameras. Nor is their electricity load to give them away."<sup>8</sup> An Anglo-Dutch-West German agreement to corner a large slice of the enrichment market was accordingly signed on 4 March, 1970.

It so happened that Pakistani metallurgist Abdul Qadeer Khan worked with the Dutch engineering firm FDO between 1972 and 1975. The firm acted as consultants and subcontractors to URENCO, a consortium of the centrifuge troika involved in developing the ultracentrifuge technology at a plant in the Dutch town of Almelo. Khan's job was to translate German technical documents. He had access to complete design plans and the names of the companies supplying components for ultracentrifuges. Frits Veerman, a Dutch colleague who shared an office with him, remembers having seen top-secret technical drawings in his house. Khan became, according to a British assessment, "the most successful nuclear spy since Klaus Fuchs and Allan Nunn May took their secrets to the Kremlin." He was sentenced in absentia to four years in prison by a Dutch court but was acquitted on the technical ground that the prosecutor's office did not deliver its summons to him in a proper manner.<sup>9</sup> According to a former advisor to the Indian Minister of Defence who knew Khan during his student days, Khan wrote "plaintive letters" justifying his activities and appealing to the global community of metallurgists



to defend him. The metallurgists were, however, too appalled by Khan's betrayal of professional confidence to respond to his pleas.<sup>10</sup>

By 1975, there was a nuclear recession in the United States and Western Europe leading to the emergence of a global gray market of "nuclear mercenaries" willing to sell their expertise and wares for cash. Arriving in Pakistan, Khan created an elaborate covert purchasing system between the mid-1970s and early 1980s. He contacted nearly 100 companies that supplied centrifuge components and materials. According to Veerman, Dutch companies continued to work with Khan even after it was clear that he was developing centrifuges for a Pakistani bomb. Khan sent scientists to the Netherlands in the late 1970s for centrifuge-related training. Referring contemptuously to the greed of Western companies, he boasted in 2001, "they literally begged us to buy their equipment." His "long stay in Europe and intimate knowledge of various countries and their manufacturing firms was an asset."<sup>11</sup>

Pakistan floated dummy corporations and trading companies in Britain, Canada, the Netherlands, the United States and West Germany that occasionally dissolved after a single covert purchasing operation. While major components of uranium enrichment technology were classified and subject to export control regulations, individual parts were not. Pakistani officials proceeded systematically from country to country, buying the essential items part by part from dozens of companies in several West European countries. Nuclear scientist SA Butt headed the network from his position first at the Pakistani Embassy in Brussels and later in Paris. He clinched deals worth tens of millions of dollars until his retirement in the 1990s. Western companies, secretly encouraged by their governments, eagerly joined in obtaining orders from Pakistan. The Swiss government dismissed Americans protests about the involvement of Swiss firms in these transactions as "very old hat" and added that since "many other countries" were also selling similar technology it had "no intention" of putting Swiss firms at a competitive disadvantage. Khan revealed in 1999 that sensitive items were purchased through offshore front companies in Japan, Singapore and elsewhere. These companies demanded



a cut of 15 to 25 per cent of the purchase price.<sup>12</sup> According to a West German account, more than 70 German firms helped Pakistan acquire materials and equipment needed to manufacture the bomb.<sup>13</sup>

Khan initially placed orders for twice the number of components needed for Pakistan, and then selling the excess to other countries. As one close aide to General Musharraf recently put it, "Khan had a complete blank cheque. He could do anything. He could go anywhere. He could buy anything at any price." Everybody knew that a buyer, "loaded with money" was "hell bent on getting this ultimate weapon." British engineer Peter Griffin admits that he supplied "anything that could be sent to Pakistan" for two decades with the approval of British authorities. Khan's shopping spree covered Africa, Asia, Europe and North America in order to procure uranium and sophisticated technology. Foreign orders "came on paper, in person, through third parties, in meetings with Khan himself." Having exploited a fragmented nuclear market for the Pakistani bomb, he then reversed the flow and used his old smuggling network to sell his wares abroad. "The same network, the same routes, the same people who brought the technology in, were also sending it out." Government cargo planes were pressed into service and Dubai was the place for shipments and for payments. As Pakistan's own centrifuges became more sophisticated, Khan dispensed with old centrifuges by palming them off to foreign customers.<sup>14</sup> Pakistan began providing "one-stop shopping" by selling blueprints of nuclear weapons, components and full assemblies of centrifuges, uranium hexafluoride feedstock and blueprints of nuclear weapons.<sup>15</sup>

Pakistani involvement in the North Korean nuclear weapons programme came to the surface in October 2002. In the midst of American pressure on North Korea to freeze the plutonium route to the bomb, the then Prime Minister Benazir Bhutto arrived in Pyongyang on the advice of her Chief of Army Staff General Abdul Waheed. Musharraf was then Director General for Military Operations. A barter deal was arranged: Pakistan would supply gas centrifuge technology in return for the Nodong missile that was later called Ghauri. When Karamat succeeded Waheed, he



secretly visited North Korea in December 1997.<sup>16</sup> Khan is reported to have visited North Korea 13 times under a cloak of secrecy. American intelligence agencies silently monitored this "deadly barter." They tracked in July 2002 the landing of an American-built C-130, supposed to be used in the war against the Al-Qaeda terrorists, at a North Korean airfield carrying components of ballistic missiles for Pakistan. This covert transaction took place in full view of American spy satellites.<sup>17</sup>

Meanwhile, the International Atomic Energy Agency (IAEA) inspectors stumbled upon old contaminated centrifuges in the Iranian nuclear facilities that led to suspicions about their Pakistani origin.<sup>18</sup> Moreover, under the new Proliferation Security Initiative (PSI) American spy satellites tracked the movements of a German-owned ship *BBC China* carrying suspicious cargo and bound for Libya. Its seizure by the Americans led to a concrete proof of Pakistani global nuclear black market.<sup>19</sup> The cargo contained centrifuges as well as blueprints for a nuclear weapon. The Libyans confirmed that they bought the blueprints for more than \$50 million. They resembled the warhead China tested in the late 1960s along with instructions in Chinese and English languages wrapped in plastic bags from a dry cleaner in Islamabad. According to an American weapons expert, Libya was supplied "both the kitchen equipment and the recipes."<sup>20</sup> The Americans did not hand over the centrifuges of Pakistani origin to the IAEA but took them home; they displayed 4,000 advanced centrifuges called P-2s under heavy protection at the Oak Ridge National Laboratory.<sup>21</sup> It is "a supreme irony of history" that two Islamic countries, "recipients of Pakistan's nuclear largesse spilt the beans on Pakistan." Musharraf angrily complained, "Our Muslim brothers did not ask us before giving our name."<sup>22</sup>

These revelations as well as a detailed coverage of Khan's proliferation record by American newspapers forced Musharraf to take corrective action. A meeting of Pakistan's National Command Authority chaired by him, with the Prime Minister, the Foreign, Defence, Interior, and Finance Ministers, chairman Joint Chiefs of Staff Committee, Chiefs of the Air and Naval Staffs, Vice Chief of the Army, senior civil and military officials, and the chairman of the



Khan Research Laboratories (KRL) in attendance, stated that the government condemned and distanced itself from "individual acts of indiscretion in the past." Significantly, the statement added that no such incident had taken place since the establishment of the National Command Authority in February 2002; this amounted to indirect admission that proliferation continued even during Musharraf's regime. It also asserted that Pakistan took its international obligations "with the utmost seriousness." In order to 'facilitate' the investigation, Khan was removed from the post of adviser to the Prime Minister.<sup>23</sup>

In a detailed confessional statement, Khan said he had transferred secret designs of centrifuges, and blueprints of nuclear weapons to Iranian, Libyan and North Korean scientists in covert meetings abroad; he had also given personal briefings to them. A Sri Lankan middleman established a factory in Malaysia to build components of centrifuges based on Pakistani designs. The smuggled material was shipped through Dubai, and through chartered flights as well as government planes to North Korea. Khan asserted that he provided assistance to Islamic countries in order to deflect international pressure on Pakistan's nuclear programme. He threatened to kill one of his subordinates in 2001 if he divulged anything about the secret transactions and urged Iranian officials to destroy some of their facilities.<sup>24</sup>

This confession was followed by a televised encounter between a grim-faced Musharraf and a suitably contrite Khan in which the General promised a Presidential pardon after an apology to the nation. On 4 February, 2004, Khan addressed his countrymen on television. In a carefully drafted statement, he referred to the "disturbing disclosures and evidence by some international agencies" and the investigation ordered by Pakistani government relating to "alleged proliferation activities." He confessed, "they were invariably initiated at my behest" and offered his "deepest regrets and unqualified apologies to a traumatised nation." He, however, added a caveat: his proliferation activities "were based in good faith but on errors of judgment," and simultaneously absolved government officials of complicity in his shady dealings.<sup>25</sup>



In an interview by a private Pakistani channel Geo a few weeks earlier, Khan had laughed and boasted before his countrymen, "Who made the atom bomb? I made it. Who made the missiles? I made them for you."<sup>26</sup> It is through such boasts that Khan had become a national icon. At a formal dinner in March 2001 in Khan's honour, for instance, Musharraf said that he and his team, "toiled and sweated, day and night, against all odds and obstacles, against international sanctions and sting operations, to create, literally out of nothing, with their bare hands, the pride of Pakistan's nuclear capability."<sup>27</sup> Later admitting that the metallurgist had pocketed large sums to pay for a lavish lifestyle, Musharraf confessed Khan was still his hero and "still high in the sky" for him. He added: "This hero has given us grace and respect."<sup>28</sup>

Khan told investigators that he helped North Korea design and equip facilities for making nuclear weapons with the knowledge of senior military commanders, including Musharraf who was aware of the agreement with North Korea because he took over responsibility for the Gauri missile programme when he became Army Chief of Staff in October 1998.<sup>29</sup> According to an American intelligence report, Pakistan provided "the complete package" including nuclear fuel, centrifuges and one or more warhead designs. North Korean scientists also worked at the KRL in the late 1990s, ostensibly on missile technology.<sup>30</sup> He also provided a "shopping list" of equipment needed to produce thousands of centrifuges.<sup>31</sup> It is worth noting that Pakistani investigators went to Iran, Libya, Dubai, and Malaysia to trace the illicit nuclear connections but excluded North Korea from their investigation.

Addressing a press conference, Musharraf contradicted Khan and emphatically denied reports by American intelligence officials that Khan had struck a barter deal with North Korea. Pakistani cargo planes spotted in North Korea in July 2002 were merely picking up surface-to-air missiles Pakistan had purchased at the height of tensions with India. He said that despite his suspicions, he had no idea how extensive Khan's network was, nor how long it had been operating. "We didn't know that this is so deep that it started somewhere in the late 80s," he said. "We didn't know that at all." He asserted that the brigadier general in charge of security



for the KRL never reported anything. "He didn't, and frankly, he hasn't even now," the General said. "He in fact has said that yes, he regrets that he was inefficient, he couldn't unearth, he didn't know. He says he didn't know whatever was going on. And he swears by that even now."<sup>32</sup>

Pakistani nuclear-missile programme, since its inception, has been under military control. "A multi-tiered system," reveals Professor Hoodbhoy of the Qaed-e-Azam University in Islamabad, "was headed by a Lieutenant General (now by two), with all its nuclear installations and personnel kept under the tightest possible surveillance. Engineers and technicians at Kahuta were required to report on colleagues who spent too much time looking out of windows." Even Benazir Bhutto as serving Prime Minister was denied clearance to visit the place.<sup>33</sup> When a French ambassador to Pakistan and his First Secretary were in the neighbourhood of the KRL a few years ago, six Pakistani toughs pulled them from the car and subjected them to a severe beating.<sup>34</sup> If successive Pakistani governments were unaware of the illicit proliferation racket, however, that is even worse because it means that "for the first time in history all of the keys to a nuclear weapon — the supplier networks, the material, the enrichment technology, and the warhead designs — were out of state oversight and control."<sup>35</sup>

Describing Khan's confession followed by Presidential pardon as a "piece of theatre" an editorial in the *New York Times* asserted that General Musharraf "was, without question," privy to the illicit transactions; yet the Bush administration's reaction was one of "grateful acceptance."<sup>36</sup> The *Washington Post* in its editorial bluntly stated, "the general and his government have been lying for years about illicit traffic." Rather than moving to impose sanctions on Pakistan the Bush administration had swallowed his coverup and even congratulated him on it. Describing Khan as "probably the worst criminal in the history of nuclear weapons proliferation" it suggested that the United States should insist that Pakistan supply the details of its trafficking to the IAEA and allow outside monitoring of its programmes.<sup>37</sup>



Rejecting the claim that a few rogue Pakistani scientists were responsible for the covert nuclear transactions without the complicity of successive governments, an intelligence official of the Bush administration asserted that this was not a rogue operation. "Suppose Edward Teller (the so-called father of the American H-bomb) had suddenly decided to spread nuclear technology and equipment around the world, he said. "Do you really think he could do that without the government knowing? How do you get missiles from North Korea to Pakistan? Do you think AQ Khan shipped all the centrifuges by Federal Express? The military has to be involved, at high levels." He added that the United States "had every opportunity to put a stop to the AQ Khan network fifteen years ago. Some of those involved today in the smuggling are the children of those we knew back in the eighties. It's the second generation now."<sup>38</sup>

American officials have admitted that they knew about the Pakistani network for a long time.<sup>39</sup> Khan's audacious global black market was merely an extension of his illicit transactions of the 1970s and 1980s. His escapades were tracked by American intelligence agencies. Occasionally these covert transactions were detected and the persons involved apprehended. A Pentagon office tracking foreign scientific publications had found many scientific papers and reports on classified centrifuge technology written by Khan and his associates. A more conspicuous evidence of the KRL's proliferation activities was a sales brochure, its cover bearing a seal of "Government of Pakistan" and Khan's photograph set in a drawing of a mushroom cloud. The brochure was being secretly circulated within the community of aspiring proliferators, middlemen and suppliers of contraband. The network stretched "from Germany to Dubai and from China to South Asia." Its tracks led to the KRL and Khan directed what a former official in the Clinton administration called a "brotherhood of rogues."<sup>40</sup>

Khan and his collaborators brazenly advertised their wares for years. As late as 2003, the KRL disseminated centrifuge technology by holding workshops on "Vibrations In Rapidly Rotating Machinery, and Advanced Materials" in Islamabad. "It could hardly be more blatant."<sup>41</sup> While attending an exhibition of military

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technology held in Karachi in 2000, Andrew Koch of *Janes Defense Weekly* picked up brochures offering uranium enrichment equipment at the booth of the KRL. When he asked, "whether everything inside was for sale" he was told, 'yes, of course, it all had government approval and was available for sale and export.'<sup>42</sup> American nuclear expert Leonard Weiss testifies that he was involved in preparing "numerous legislative actions designed to stop the Pakistanis through the threat of sanctions." These measures were approved by Congress and "signed by three presidents, but their implementation was nearly always blocked because of other foreign policy concerns."<sup>43</sup>

According to an American official, the transfer of enrichment technology by Pakistan to North Korea "is a direct outgrowth of the failure of the United States to deal with the Pakistani programme when we could have done so. We've lost control."<sup>44</sup> The State Department concluded in a letter to key members of Congress on 12 March, 2003 that "the administration carefully reviewed the facts relating to the possible transfer of nuclear technology from Pakistan to North Korea, and decided that they do not warrant the imposition of sanctions under the applicable US laws."<sup>45</sup> Washington imposed sanctions on a North Korean Corporation for transferring missile technology to the KRL, which in turn, was sanctioned for receiving it. In an extraordinary statement, however, a State Department spokesman clarified that the KRL had been brought into the orbit only for a "missile-related transfer" and not for the transfer of technology to North Korea.<sup>46</sup>

Colin Powell praised Musharraf's handling of the scandal during a visit to Islamabad and said the United States would not request that American investigators be allowed to interrogate Khan. "This is a Pakistani internal matter," he asserted, adding that Pakistani investigators were relaying the findings of their inquiry to American intelligence officials. "Our services work very well together." He did not ask Musharraf about a recent Central Intelligence Agency (CIA) report that revealed the most active exchange of nuclear and missile technology occurred between 1998 and 2002. Musharraf was appointed Pakistan's Army Chief in October 1998 and staged a coup in October 1999. "No, we



didn't get into that detail." Powell even rewarded Pakistan by declaring that the Bush administration would designate Pakistan a "major non-NATO ally."<sup>47</sup>

Successive American administrations continued to monitor the nuclear black market for years without informing the IAEA about this audacious subversion of the non proliferation regime. Nor did they force Pakistani governments to dismantle the covert network and punish the guilty. This silence by the foremost upholder of the non proliferation regime must have emboldened the peddlers of nuclear knowledge and hardware. Even after the revelations about the global nuclear black market, the extraordinary fact remains that "the worst nuclear arms proliferator in the world" was pardoned "with not a squeak from the White House."<sup>48</sup>

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