

Pakistan's strategic nuclear and missile industries

**A baseline study for non-proliferation efforts –
Public version**



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NOTE: This is the public version of this report. A more detailed version with restricted distribution is available from Public Alpha. This restricted version contains additional source information and profiles a number of front companies not listed in this public report. Authorities interested in obtaining the restricted version of this report should contact Ian Stewart (ian.stewart@kcl.ac.uk).

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Abstract

This report provides an overview of Pakistan's strategic nuclear and missile programmes. It is based on original research conducted by Project Alpha at King's College London, which has focused on Pakistani procurement and research for its strategic programmes. This research has involved the discovery of a new suspected centrifuge facility that is currently under construction at Pakistan's Khan Research Laboratories.¹ This report characterises and assesses numerous Pakistani entities and facilities involved in Islamabad's strategic programmes – many of them described for the first time in the public domain.

A key finding of this research is that Pakistan continues to maintain a global network of entities and front companies that exist to service its strategic programmes. Many of these entities are based in China, which raises questions about Chinese state complicity in Pakistan's strategic programmes. No evidence of recent onward proliferation (i.e. sales of sensitive missile- or nuclear-related technologies by Pakistan to foreign customers) has been found during the course of research for this report.

NOTE: This is the public version of this report. A more detailed version with restricted distribution is available upon request from Public Alpha. This restricted version contains additional source information and profiles a number of front companies not listed in this public report. Authorities interested in obtaining the restricted version of this report should contact Ian Stewart (ian.stewart@kcl.ac.uk).

¹ See Project Alpha and IHS Jane's, 'Likely uranium facility identified in Pakistan,' *Jane's Intelligence Review*, 15 September 2016.

Executive Summary

- Pakistan's strategic industries are in a period of substantial growth. Pakistan is continuing to improve its fissile material production facilities; is developing tactical nuclear weapons; and is working on enhanced nuclear delivery systems, probably including submarine-based second strike capability.
- These improvements include a probable new uranium enrichment facility underway at Khan Research Laboratories, Pakistan's primary enrichment facility, which has been identified by Project Alpha through analysis of satellite imagery and trade data.
- Despite rhetoric to the contrary, Pakistan's strategic industries cannot be characterised as self-sufficient. Pakistan continues to import dual-use materials and technology from abroad on a massive scale. These imports are facilitating the growth of Pakistan's unsafeguarded nuclear programme and its missile systems.
- China is by far the most important supplier of all forms of goods to Pakistan's nuclear and missile programmes. Most Pakistani procurements from China are probably from unwitting private suppliers. But, on a smaller scale, Chinese state and private entities continue to knowingly supply Pakistan's strategic programmes with sensitive equipment.
- State-owned and private suppliers in other countries are also witting and unwitting suppliers to Pakistan's strategic programmes. Pakistan targets companies worldwide for nuclear- and missile-related dual-use equipment, often through layers of middlemen and front companies.
- Pakistan claims that it has built a strong record on non-proliferation issues since dismantling the AQ Khan proliferation network. However, Pakistan's widespread and ongoing use of covert procurement methods for its missile and unsafeguarded nuclear programmes undermines this claim.
- Pakistan's use of deceptive methods to obtain these goods from foreign suppliers is deliberate, well-organised and systematic. Virtually all the state-controlled main entities involved in Pakistan's strategic programmes maintain front companies, most likely for the purpose of defeating export control efforts in other countries.
- In addition, Pakistan maintains a network of trading companies in mainland China, Hong Kong, Dubai and Singapore which it uses to covertly funnel dual-use goods to its strategic programmes.
- Despite allegations in the Indian press that Pakistani entities have supplied goods to North Korea's nuclear programme in violation of UN Security Council sanctions, no evidence was found in the course of this study to suggest that Pakistan is involved in onward proliferation to the DPRK or elsewhere. However, several of Pakistan's strategic entities participate in an export sales promotion agency, known as Global Industrial and Defence Solutions (GIDS).

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i. A note on sources

Attempts to characterise the entities behind Pakistan's nuclear and missile programmes are confronted by a number of challenges. Pakistan's strategic industries operate largely in secrecy, with most of their operational activities classified for national security reasons, and the Pakistani government making few deliberate releases of information into the public domain about these programmes. Moreover, in the last decade or so, Pakistan's nuclear and missile programmes have not received the level of attention given by analysts to similar programmes in Iran and the DPRK, meaning there is less published analysis of Pakistani strategic programmes than comparable programmes elsewhere.

The development of Pakistan's nuclear programme, and the activities of the Abdul Qadeer Khan proliferation network, have been well-covered in books and monographs,² but there are few full-length works that cover developments in Pakistan's strategic industries post-2007. The semi-official history *Eating Grass: The Making of the Pakistani Bomb*, by Pakistani former strategic officer Feroz Hassan Khan, is an extremely useful study of the organisations and people involved in Pakistan's quest for deliverable nuclear weapons, and describes nuclear- and missile-related activity as recent as 2012.³ This book has been used as a reliable source on organisations involved in Pakistan's strategic programmes.

There are also several secondary reports that have been useful sources in the making of this study. The Institute for Science and International Security has published a number of invaluable reports on Pakistan's nuclear facilities, often using satellite imagery to locate sites and track their development.⁴ The Wisconsin Project on Nuclear Arms Control has provided useful summaries of Pakistan's missile programmes and some of the entities involved in the country's missile-related development and procurement.⁵ The Nuclear Threat Initiative, using analysis provided by the James Martin Centre for Nonproliferation Studies at the Middlebury Institute for International Studies, has catalogued many of Pakistan's nuclear and missile-related facilities, albeit without making precise

² See, e.g., Steve Weissman and Herbert Krosney, *The Islamic Bomb* (New York: Times Books, 1981); Zahid Malik, *Dr AQ Khan and the Islamic Bomb*, (Islamabad: Hurmat Publications, 1992); Jeffrey T Richelson, *Spying on the Bomb: American Nuclear Intelligence from Nazi Germany to Iran and North Korea* (New York: WW Norton, 2007); Adrian Levy and Catherine Scott-Clark, *Deception: Pakistan, the United States, and the Secret Trade in Nuclear Weapons* (New York: Walker and Company, 2007); Douglas Frantz and Catherine Collins, *The Nuclear Jihadist* (New York: Hachette, 2007).

³ Feroz Hassan Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford: Stanford University Press, 2012).

⁴ See, e.g., David Albright and Serena Kelleher-Vergantini, 'Pakistan's Chashma Plutonium Separation Plant: Possibly Operational,' Institute for Science and International Security, 20 February 2015, http://isis-online.org/uploads/isis-reports/documents/Chashma_February_20_2015_Final.pdf, accessed 31 August 2016.

⁵ See, e.g., Jonathan McLaughlin, 'Pakistan Missile Update - February 2016,' February 2016, The Wisconsin Project on Nuclear Arms Control, <http://www.wisconsinproject.org/countries/pakistan/PakistanMissileUpdate-2016.html>, accessed 31 August 2016.

coordinates available.⁶ Brian Cloughley and Robert Kelley have written several extremely useful articles for *Jane's Intelligence Review* on Pakistan's nuclear and missile programmes.⁷

This study incorporates findings from these earlier works along with new analysis of a trove of primary source information collated by Project Alpha. A major new source of information utilised in this report relates to Pakistani procurements, and Project Alpha has obtained a substantial tranche of data in this respect. The source is judged to be reliable, if incomplete.

Another important new dataset compiled for this report relates to Pakistani academic publications and conference proceedings. The authors, institutions and abstracts of several hundred papers were aggregated where the institutions had been identified as being involved in Pakistan's strategic programmes. Analysis of this data provided insights into the recent activities and research activities of many key entities. This data has also helped to identify links between institutes and personnel.

Other important primary sources of information for this study include Pakistani government official memoranda and circulars; United States diplomatic cables released by Wikileaks; entity watch-lists produced by the US Department of Commerce and Japanese government; commercial and business-to-business websites; and social media profiles. Each of these sources provides fragments of information that when combined, reveals a mosaic of Pakistan's hidden efforts to improve its strategic programmes.

⁶ 'Pakistan,' Nuclear Threat Initiative, December 2011, <http://www.nti.org/learn/countries/pakistan/facilities/>, accessed 31 August 2016.

⁷ See, e.g., Brian Cloughley and Robert Kelley, 'Pakistan adopts full-spectrum nuclear deterrent,' *Jane's Intelligence Review*, 26 May 2016; 'Cloud cover – Pakistan's shift towards tactical nuclear weapons,' *Jane's Intelligence Review*, 9 September 2014; 'Power boost – Pakistan develops its thermonuclear weapons,' *Jane's Intelligence Review*, 24 January 2014.

1. Introduction

Outside of South Asia, Pakistan's nuclear weapons programme is rarely in the headlines. It has been nearly two decades since Pakistan last conducted a nuclear test. It has been more than a decade since the dismantling of the notorious proliferation network of Abdul Qadeer (AQ) Khan, who furnished Pakistan with a uranium enrichment capability using technology and materials purchased or stolen from abroad, while covertly supplying nuclear technology to countries including Iran, Libya and North Korea.

Nowadays, Pakistan aspires to be considered a responsible global citizen in the non-proliferation domain. The country has declared its 'unambiguous commitment to the international objectives of the nuclear non-proliferation regime', as its ambassador to the United States told US congressional representatives in August.⁸ And Pakistan has boasted of a 'comprehensive export control regime' harmonised with that of the Nuclear Suppliers Group, a group of responsible nuclear exporters that Pakistan aspires to join.⁹

Beyond the spotlight, though, Pakistan is frenetically bolstering and improving its strategic weapons systems. As several studies have already noted, Islamabad continues to improve its fissile material production facilities; is developing tactical nuclear weapons; and is enhancing its nuclear weapon delivery systems, probably including through a submarine-based second strike capability.¹⁰

These developments in Pakistani nuclear weapon systems and their implications for regional and global strategic security have been covered in depth elsewhere. What has been comparatively lacking, though, is analysis of the organisational structure of Pakistan's nuclear and missile industries: the entities and facilities involved in developing and building nuclear weapons and their delivery systems.¹¹ This aspect of the country's programme has so far been relatively under-examined, with existing analyses fragmentary in nature or dated, making it difficult for policymakers

⁸ Embassy of the Republic of Pakistan in Washington DC, 'Ambassador of Pakistan to the United States, Mr. Jalil Abbas Jilani, has approached the White House, the State Department, important Congressional leaders and significant think-tanks and opinion makers in the US calling upon them to support Pakistan's membership of the Nuclear Suppliers Group (NSG),' 27 August 2016, http://www.embassyofpakistanusa.org/news807_08272016_2016_Press%20Release.php, accessed 31 August 2016.

⁹ Dr Maleena Lodhi, 'Statement by Ambassador Dr. Maleeha Lodhi, Permanent Representative of Pakistan to the United Nations, at the Security Council Open Debate on "Challenges in addressing proliferation of WMDs, their means of delivery, and related materials"', Pakistan Mission to the United Nations, http://pakun.org/statements/Security_Council/2016/08232016-01.php, accessed 31 August 2016.

¹⁰ See David Albright and Serena Kelleher-Vergantini, 'Pakistan's Chashma Plutonium Separation Plant: Possibly Operational,' Institute for Science and International Security, 20 February 2015, http://isis-online.org/uploads/isis-reports/documents/Chashma_February_20_2015_Final.pdf, accessed 31 August 2016; Franz-Stefan Gady, 'Does Pakistan Have a Sea-Based Second-Strike Capability?,' *The Diplomat*, 13 March 2015, <http://thediplomat.com/2015/03/does-pakistan-have-a-sea-based-second-strike-capability/>, accessed 31 August 2016; Mansoor Ahmed, 'Pakistan's Tactical Nuclear Weapons and Their Impact on Stability,' Carnegie Endowment for International Peace, 20 June 2016, <http://carnegieendowment.org/2016/06/30/pakistan-s-tactical-nuclear-weapons-and-their-impact-on-stability-pub-63911>, accessed 31 August 2016; Brian Cloughley and Robert Kelley, 'Pakistan adopts full-spectrum nuclear deterrent,' *Jane's Intelligence Review*, 26 May 2016.

¹¹ The very useful work of Cloughley and Kelley for Jane's Intelligence Review is an exception to this.

and new analysts to quickly get to speed with the depth and breadth of Pakistan's strategic programmes.

A related gap exists on Pakistan's procurement efforts for its nuclear and missile programmes. With the exception of some ad hoc efforts by analysts – such as case studies about export control violations on the part of Pakistani procurement agents – there is very little analysis in the public domain relating Pakistani nuclear, military and missile-related procurement in the post-AQ Khan era. Key questions relating to Pakistani procurement have so far remained unanswered, including:

- What technology is Pakistan procuring for its strategic programmes?
- Where is the technology coming from?
- Are Western companies unwittingly involved in supply of sensitive materials?
- What is the role of China in supplying Pakistan's strategic programmes?
- Is Pakistan still using front companies – and is it still conducting 'illicit' procurement?

The research that forms the basis for this report was guided by these questions. It was found that Pakistan maintains a vast and covert network across the globe through which it obtains dual-use goods for its strategic industries. Far from operating self-sufficient strategic industries in full compliance with non-proliferation norms, as Pakistan claims, the country is furiously procuring technology and materials from abroad while using layers of front companies to defeat national export control efforts.

There are three main areas covered by this report, which aims to function as a compendium of Pakistan's strategic programmes and their procurement efforts. These are:

- The primary entities involved in Pakistan's strategic nuclear and missile programmes, and their roles and responsibilities. This focuses on entities controlled by the Strategic Plans Division, the government entity responsible for control and oversight of Pakistan's nuclear, missile and space programmes.¹²
- The key facilities in Pakistan involved in the country's nuclear fuel cycle, missile and space programmes.
- The extent of Pakistan's procurement apparatus for its strategic industries, including domestic front companies for strategic manufacturers and domestic suppliers to the strategic industries.

This report proceeds by providing brief overviews of Pakistan's nuclear and missile programmes. It then characterises Pakistan's overseas procurement efforts for its strategic programmes. The final section of this report provides a detailed analysis of each Pakistani government entity known to be involved in the strategic programmes. This final section comprises the main text of this report.

¹² See Feroz Hassan Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford: Stanford University Press, 2012), pp.328-332.

2. An overview of Pakistan's strategic programmes

Pakistan's nuclear weapons programme is both highly developed and entrenched, having been underway for more than 40 years. This programme relies on a series of facilities dispersed across the country, most of which are closed to public or international scrutiny. This section provides a brief overview of the main sites involved in Pakistan's nuclear fuel cycle, characterises the main missile systems that Pakistan uses as the backbone of its nuclear deterrent, and summarises Pakistani procurement activity in support of these programmes.

Pakistan's nuclear programme

Pakistan's nuclear programme is both civil and military in nature. On the civil side, Pakistan has a highly advanced nuclear research sector and energy production effort, with several research and power reactors in operation or under development. On the military side, Pakistan has a complete nuclear fuel cycle capable of producing both uranium and plutonium suitable for nuclear weapons.

These programmes are not wholly separated. The Pakistan Atomic Energy Commission (PAEC) is responsible for both Pakistan's civilian nuclear programme and the production of fissile material for Islamabad's nuclear weapons. While publicly the PAEC stresses its civil role, PAEC staff likely work across civil and military projects. Indeed, the PAEC's civilian and military nuclear facilities often sit literally side-by-side, as is the case with the PAEC's PARR-1 research reactor, which is safeguarded by the International Atomic Energy Agency (IAEA), and over the fence, the unsafeguarded New Laboratories facility, which separates plutonium for use in nuclear weapons.

Indeed, IAEA safeguards have limited reach in Pakistan. Pakistan has an INFCIRC 66 safeguards agreement with the IAEA, which means that only certain specific facilities and materials are subject to safeguards. Pakistan has only six IAEA-safeguarded facilities, all of which are involved in civil nuclear research or nuclear power production. These facilities are the Pakistan Research Reactor-1 and 2 (PARR-1 and PARR-2), the Chashma nuclear power plants (C-1, C-2, C-3 and C-4), the Karachi Nuclear Power Plant (KANUPP) and the Hawks Bay Depot, a storage facility adjacent to the KANUPP complex.¹³ These sites are not the focus of this study, which focuses on the strategic elements of Pakistan's nuclear programme: those used for the production of nuclear weapons.

Pakistan's nuclear weapons are fuelled by both weapons-grade uranium and plutonium. Both routes of fissile material production are controlled largely by the PAEC, with PAEC facilities across the nuclear fuel cycle being used for the purposes of producing nuclear weapons. Pakistan's fissile material is mined, converted, and processed in a series of non-safeguarded PAEC facilities, which are described below.

¹³ Salim Khan and Muhammad Saeed Mulla (Pakistan Atomic Energy Commission), 'Safeguards in Pakistan: State-Agency Cooperation,' IAEA Safeguards Symposium 2014, <https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/sg2014-slides/000371.pdf>, accessed 1 September 2016.

Uranium mining and milling

Pakistan has at least three operational uranium mines. Pakistan's first uranium mine, built at Baghalchur along with a uranium mill in the 1970s, is now reportedly no longer in operation.¹⁴ (The Baghalchur mine (BC-I) forms the basis of a major nuclear complex at Dera Ghazi Khan, which is described below.) Additional uranium mines have since been built at Qabul Khel, Nangar Nal and Taunsa. All three mines use the in-situ leaching process.¹⁵

Pakistan has also received uranium compounds from abroad. In the late 1970s, it obtained 110-150 tonnes of yellowcake (uranium oxide) from Niger, which was put under IAEA safeguards; and then purchased 450 tonnes of Niger-origin yellowcake from Libya, which was not safeguarded and used to produce uranium hexafluoride (UF₆).¹⁶ In the 1990s, Pakistan received UF₆ from North Korea which Pakistan then transferred to Libya for Tripoli's secret nuclear weapons programme.¹⁷

Uranium conversion

The Chemical Plants Complex (CPC) at Dera Ghazi Khan is Pakistan's main uranium conversion facility, and is used to convert uranium ore to UF₆ suitable for enrichment in centrifuges. Feroz Khan has characterised the various elements of the CPC:

The CPC comprises even independent chemical plants where UF₆ is produced: a uranium mill [known as Baghalchur-1 or BC-1] that extracts uranium in the form of yellowcake, a plant to refine yellowcake to produce ammonium diuranate (ADU), a plant to convert ADU to uranium dioxide (UO₂), a plant to produce hydrofluoric acid, a plant to produce fluorine gas, a plant to convert UO₂ to uranium tetrafluoride (UF₄), and a plant for the conversion of UF₄ to uranium hexafluoride (UF₆).¹⁸

Pakistan may also maintain other uranium conversion facilities, including small-scale research or pilot sites.

Uranium enrichment

Pakistan is only known to enrich uranium by use of the gas centrifuge method, although it may have experimented with laser isotopic separation methods.¹⁹ Pakistan's primary known centrifuge enrichment facility is at Khan Research Laboratories (KRL) at Kahuta, which is most likely operated by KRL rather than the PAEC. The KRL site at Kahuta houses at least two centrifuge halls, with possibly more under operation in a southern area of the Kahuta complex, and an additional centrifuge facility

¹⁴ David Albright, Paul Brannan, and Robert Kelley, 'Pakistan Expanding Dera Ghazi Khan Nuclear Site: Time for U.S. to Call for Limits,' Institute for Science and International Security, 19 May 2009, http://isis-online.org/uploads/isis-reports/documents/PakistanExpandingCPC_19May2009.pdf, accessed 15 September 2016.

¹⁵ Maria Sultan, Zafar Nawaz Jaspal, Mohammad Riaz, Jamshed Hashmi, Jawad Hashmi and Asra Hassan, (ed Malik A. Ellahi), *Governing Uranium in Pakistan*, DIIS Report 2015:08, p.37, available online at http://pure.diiis.dk/ws/files/184536/DIIS_RP_2015_08_FINAL.pdf, accessed 1 September 2016.

¹⁶ Khan, *Eating Grass*, p.114.

¹⁷ Glenn Kessler and Dafna Linzer, 'Nuclear Evidence Could Point To Pakistan,' *The Washington Post*, 3 February 2005, <http://www.washingtonpost.com/wp-dyn/articles/A58700-2005Feb2.html>, accessed 1 September 2016.

¹⁸ Khan, *Eating Grass*, p.422.

¹⁹ The fact that Pakistan is currently constructing a new centrifuge enrichment plant suggests that the near-term prospects for laser enrichment in Pakistan are not good.

probably currently under construction. The precise number and type of centrifuges in operation at Kahuta are not known, although it is likely to house thousands of centrifuges using maraging steel and possibly carbon fibre rotors.²⁰ Also unknown is the level of enrichment undertaken at KRL – whether this site enriches natural UF₆ to weapons-grade levels, or whether a second enrichment step from LEU to HEU is undertaken elsewhere.

No other centrifuge facility in Pakistan has yet been precisely geo-located in open sources, although several sites have been referred to in credible sources. These include:

- *Chaklala* (aka Project 706 Phase I, aka Airport Development Workshop): the location next to Islamabad International Airport where in the mid-1970s Pakistan established its first experimental test-bed for centrifuges, according to Feroz Khan.²¹
- *Golra Ultracentrifuge Plant, Golra*: listed by the US Department of Commerce in 1998 as an ‘ultracentrifuge’ facility subject to export restrictions.²²
- *Sihala Ultracentrifuge Plant, Sihala* (aka Project 706, Phase II): also listed by the US Department of Commerce as an ‘ultracentrifuge’ facility subject to export restrictions.²³ Khan states that Sihala was the location where in the mid-1970s Pakistan established a working test bed for centrifuges.²⁴ The site, inside an Army barracks, contained a pilot-scale plant of up to 164 machines where uranium was enriched to 10 to 12 percent.²⁵
- *Gadwal Uranium Enrichment Plant*: listed by the US Department of Commerce in 1998 as a ‘uranium enrichment plant’ subject to export restrictions.²⁶ Albright cites a ‘knowledgeable US official who states that Gadwal ‘is primarily used to top off the enrichment level to weapon-grade.’²⁷

These centrifuge facilities have enabled Pakistan to build a large stockpile of enriched uranium suitable for nuclear weapons production. Albright estimates that by the end of 2014, Pakistan’s stockpile of weapons-grade enriched uranium was between 2,880kg and 3,290kg.²⁸

²⁰ See David Albright, ‘Pakistan’s Inventory of Weapon-Grade Uranium and Weapon-Grade Plutonium Dedicated to Nuclear Weapons,’ Institute for Science and International Security, 19 October 2015, http://isis-online.org/uploads/isis-reports/documents/Pakistan_WGU_and_WGPu_inventory_Oct_16_2015_final.pdf, accessed 14 September 2016.

²¹ Khan, *Eating Grass*, p.143.

²² US Department of Commerce, ‘Export Administration Regulations Entity List: Removal of Entities, Revision in License Policy, and Reformat of List,’ 17 March 2000, <https://www.gpo.gov/fdsys/pkg/FR-2000-03-17/html/00-6653.htm>, accessed 1 September 2016.

²³ US Department of Commerce, ‘Export Administration Regulations Entity List: Removal of Entities, Revision in License Policy, and Reformat of List,’ 17 March 2000, <https://www.gpo.gov/fdsys/pkg/FR-2000-03-17/html/00-6653.htm>, accessed 1 September 2016.

²⁴ Khan, *Eating Grass*, p.143.

²⁵ Khan, *Eating Grass*, p.143, p.154.

²⁶ US Department of Commerce, ‘Export Administration Regulations Entity List: Removal of Entities, Revision in License Policy, and Reformat of List,’ 17 March 2000, <https://www.gpo.gov/fdsys/pkg/FR-2000-03-17/html/00-6653.htm>, accessed 1 September 2016.

²⁷ David Albright, ‘Pakistan’s Inventory of Weapon-Grade Uranium and Weapon-Grade Plutonium Dedicated to Nuclear Weapons,’ Institute for Science and International Security, 19 October 2015, http://isis-online.org/uploads/isis-reports/documents/Pakistan_WGU_and_WGPu_inventory_Oct_16_2015_final_1.pdf, accessed 1 September 2016.

²⁸ David Albright, ‘Pakistan’s Inventory of Weapon-Grade Uranium and Weapon-Grade Plutonium Dedicated to Nuclear Weapons,’ Institute for Science and International Security, 19 October 2015, <http://isis->

Fuel fabrication

Natural (unenriched) uranium metal fuel for the Khushab reactors is produced at the Kundian Nuclear Fuel Complex (KNFC). The KNFC, initially built in the 1970s to provide uranium oxide fuel for the Karachi Nuclear Power Plant, had a uranium metal fuel production line added in the 1980s, according to Khan.²⁹ This site has never been put under IAEA safeguards.

Reactor operation

The four nuclear reactors at the Khushab complex, located in central Pakistan, are unsafeguarded and devoted to plutonium production. Each reactor is heavy water-moderated and fuelled by natural uranium metal fuel rods.³⁰ The original Khushab-I reactor has a capacity of about 40-50MW, and each of the three subsequent reactors probably have a capacity of somewhere between about 40MW³¹ and 120 MW.³² Albright estimates that by the end of 2014, these reactors had produced between 185-230kg of plutonium.³³

Khushab is probably also used to produce tritium, which is used as a yield booster in some nuclear weapon designs.³⁴

Reprocessing

Spent nuclear fuel from Khushab requires chemical separation – known as reprocessing – before its plutonium can be used in nuclear weapons.

Pakistan has two known reprocessing sites. Pakistan's primary reprocessing facility is the New Laboratories (New Labs) complex at the PAEC-controlled Pakistan Institute of Science and Technology (PINSTECH) in Rawalpindi. By 1998, according to Khan, New Labs could extract about 8-

online.org/uploads/isis-reports/documents/Pakistan_WGU_and_WGPu_inventory_Oct_16_2015_final_1.pdf, accessed 1 September 2016.

²⁹ Khan, *Eating Grass*, p.115, p.197.

³⁰ Mark Hibbs, 'U.S. Intelligence Now Believes Pakistan Made Khushab Heavy Water,' *Nuclear Fuel*, vol. 24, no. 10, 17 May 1999), p.1 (via Factiva); Khan, *Eating Grass*, p.197

³¹ See Tamara Patton, 'Combining Satellite Imagery and 3D Drawing Tools for Nonproliferation Analysis: A Case Study of Pakistan's Khushab Plutonium Production Reactors,' *Science & Global Security*, 20:2-3, 117-140, available online at <http://www.tandfonline.com/doi/pdf/10.1080/08929882.2012.719383?needAccess=true>, accessed 1 September 2016.

³² David Albright and Serena Kelleher-Vergantini, 'Pakistan's Fourth Reactor at Khushab Now Appears Operational,' Institute for Science and International Security, 16 January 2015, http://isis-online.org/uploads/isis-reports/documents/Khushab_January_2015_reactor_four_operational_FINAL.pdf, accessed 1 September 2016.

³³ David Albright and Serena Kelleher-Vergantini, 'Pakistan's Fourth Reactor at Khushab Now Appears Operational,' Institute for Science and International Security, 16 January 2015, http://isis-online.org/uploads/isis-reports/documents/Khushab_January_2015_reactor_four_operational_FINAL.pdf, accessed 1 September 2016.

³⁴ David Albright and Paul Brannan, 'Second Khushab Plutonium Production Reactor Nears Completion,' Institute for Science and International Security, 18 September 2008, http://www.isis-online.org/publications/southasia/Khushab_18September2008.pdf, accessed 15 September 2016.

15kg of plutonium per year from Khushab's spent fuel.³⁵ An expansion of this facility between 2002 and 2006 has likely increased this capacity,³⁶ and has possibly doubled it.³⁷ A probable second reprocessing facility has been built at the Chashma nuclear complex (see Chashma section below). Khan notes that this facility is of 'much larger capacity' than the New Labs site.³⁸ Neither of these sites are subject to safeguards.

Metallurgy

Uranium and plutonium metallurgy (i.e. the casting of metal for use in nuclear weapon pits) is conducted by the PAEC and possibly also KRL. In a credible study of Pakistan's uranium industry, Dr Maria Sultan notes that uranium metallurgy and fissile material 'fabrication falls within the purview of the PAEC [and] is done solely by PAEC. This includes work or material requirements for defence-related activities.'³⁹ Khan states that in the 1980s, KRL both enriched UF₆ gas and converted it to uranium metal, but it is unclear whether this is still the case.⁴⁰

PINSTECH's main facility at Nilore is probably a key location for Pakistan's uranium and plutonium metallurgical work. As of 1985, enriched UF₆ from KRL was converted into metal, fabricated and machined at the Uranium Metal Laboratory (UML) at PINSTECH, according to a CIA study cited by Khan.⁴¹ As of 2015, Sultan states that PINSTECH's UML still houses Pakistan's uranium metal production efforts.⁴² However, the Institute for Science and International Security states that Pakistan has a second uranium metallurgy laboratory at Dera Ghazi Khan, and Cloughley and Kelley have identified the same facility as being involved in plutonium metallurgy.⁴³

Weaponisation

While facilities and organisations involved in Pakistan's nuclear fuel cycle are fairly well understood, less clear are the roles and responsibilities of Pakistani entities and facilities involved in the weaponisation process (that is, the process of developing and manufacturing physics packages⁴⁴ for

³⁵ Khan, *Eating Grass*, p.200.

³⁶ David Albright and Paul Brannan, 'Pakistan Expanding Plutonium Separation Facility Near Rawalpindi,' 19 May 2009, http://isis-online.org/uploads/isis-reports/documents/PakistanExpandingNewLabs_19May2009.pdf, accessed 1 September 2016.

³⁷ Khan, *Eating Grass*, p.387.

³⁸ Khan, *Eating Grass*, p.387

³⁹ Maria Sultan, Zafar Nawaz Jaspal, Mohammad Riaz, Jamshed Hashmi, Jawad Hashmi and Asra Hassan, (ed Malik A. Ellahi), *Governing Uranium in Pakistan*, DIIS Report 2015:08, p.37, available online at http://pure.diiis.dk/ws/files/184536/DIIS_RP_2015_08_FINAL.pdf, accessed 1 September 2016.

⁴⁰ Khan, *Eating Grass*, p.181.

⁴¹ Khan, *Eating Grass*, p.181; see Central Intelligence Agency, 'Pakistan's nuclear weapons program: personnel and organizations,' 23 September 1985, http://www.foia.cia.gov/sites/default/files/document_conversions/89801/DOC_0000252646.pdf, accessed 21 July 2016.

⁴² Maria Sultan, Zafar Nawaz Jaspal, Mohammad Riaz, Jamshed Hashmi, Jawad Hashmi and Asra Hassan, (ed Malik A. Ellahi), *Governing Uranium in Pakistan*, DIIS Report 2015:08, p.37, available online at http://pure.diiis.dk/ws/files/184536/DIIS_RP_2015_08_FINAL.pdf, accessed 1 September 2016.

⁴³ Institute for Science and International Security, 'ISIS Nuclear Map,' 2013, <http://isis-online.org/publications/ISISNuclearMap2013-1.kmz>, accessed 1 September 2016.

⁴⁴ Defined as 'the energy-producing part of a nuclear weapon, containing explosives and fissile material.' See 'Nuclear Weapons 101,' *National Security Science*, Los Alamos National Laboratory, July 2014,

nuclear weapons). Through to about the end of the 1990s, weaponisation work was undertaken by various entities, often with duplication of effort.⁴⁵ These included:

- **PAEC:** Weapon design, 'cold tests' (tests of nuclear explosive devices using non-fissile material), probably led by the PAEC's Directorate for Technical Development (DTD).
- **KRL:** Weapon design, cold tests.
- **Pakistan Ordnance Factories (POF):** High explosive production and machining, precision manufacturing of other components.
- **National Development Complex** (previously under PAEC): Development of nuclear warheads for air-dropped nuclear weapons, cold test simulations.
- **Air Weapons Complex:** Aerodynamic assistance for air-dropped nuclear weapons, cold test simulations.

Khan states that as of 2001, weaponisation became the sole responsibility of the National Development Complex (NDC) as part of reforms creating Pakistan's National Engineering and Scientific Commission (NESCOM).⁴⁶ Cloughley and Kelley assess that POF probably remains the contractor for integrating and producing Pakistan's nuclear weapons, although this cannot be verified.⁴⁷

http://www.laao.doe.gov/discover/publications/national-security-science/2014-july/_assets/docs/NSS_JUL2014.pdf, accessed 2 September 2016.

⁴⁵ Khan, *Eating Grass*, p.190

⁴⁶ Khan, *Eating Grass*, p.335

⁴⁷ Brian Cloughley and Robert Kelley, 'Pakistan adopts full-spectrum nuclear deterrent,' *Jane's Intelligence Review*, 26 May 2016.

Table 1. Pakistan’s unsafeguarded nuclear fuel cycle – key facilities

Role	Facility	Owner	Location	Comments
Uranium mining/milling	Baghalchur-I (BC-I)	PAEC	29.984967°, 70.587937°	Mine and mill, probably no longer in operation
	Qabul Khel/Issa Khel Nangar Nal	PAEC	32.649946°, 71.132760° Possibly 29.900209°, 70.134089°	Mine and mill
Uranium conversion	Taunsa (NMC-I)	PAEC	Possibly 30.589472° 70.534936°	
	Chemical Plants Complex (CPC) Dera Ghazi Khan	PAEC	29.997745°, 70.586248°	
Uranium enrichment	Khan Research Laboratories (KRL)	KRL	33.622111°, 73.379081°	At least two centrifuge halls, third facility possibly under construction
	Gadwal	?	?	Primarily used to ‘top-off’ enriched uranium to weapons-grade ⁴⁸
Fuel fabrication	Kundian (Chashma) Nuclear Fuel Complex (KNC-I)	PAEC	32.395776°, 71.454391°	Used to produce natural uranium metal fuel for Khushab reactors
Heavy water production	Khushab Heavy Water Production Plant (KCP-I)	PAEC	31.992209°, 72.198484°	
Reactors	Khushab-I, Khushab-II, Khushab-III, Khushab-IV (KCP-II, KCP-III, KCP-IV)	PAEC	32.019615°, 72.207678°	Unsafeguarded reactors for plutonium production
Reprocessing	Chashma Reprocessing Plant (KNC-II)	PAEC	32.383006°, 71.440358°	
	New Labs (NLP PINSTECH)	PAEC	33.649304°, 73.254768°	
Metallurgy	Possibly Chemical Plants Complex (CPC) Dera Ghazi Khan	PAEC	29.995067°, 70.572573°	
	Probably Uranium Metal Laboratories (UML) at New Labs (NLP PINSTECH)	PAEC	33.649304°, 73.254768°	
Test site	Chagai Hills	-	28.830000°, 65.200000°	Used in 1998 nuclear tests
Waste	Possibly Baghalchur-I (BC-I)	PAEC	29.984967°, 70.587937°	

⁴⁸ David Albright, ‘Pakistan’s Inventory of Weapon-Grade Uranium and Weapon-Grade Plutonium Dedicated to Nuclear Weapons,’ Institute for Science and International Security, 19 October 2015, http://isis-online.org/uploads/isis-reports/documents/Pakistan_WGU_and_WGPu_inventory_Oct_16_2015_final_1.pdf, accessed 1 September 2016.

Pakistan's missile programme

Pakistan's missiles form the backbone of the country's nuclear deterrent. While Pakistan's first nuclear weapon delivery systems were air-dropped bombs carried by F-16 aircraft, the country has since supplemented this capability with ballistic and cruise missiles, and now has a 'full-spectrum' suite of delivery system options.⁴⁹ After more than thirty years of indigenous development and foreign assistance, Pakistan's missile arsenal ranges from tactical systems to medium-range ballistic missiles (see table 2 below).

Many Pakistani missile systems draw upon technology from imported platforms. The Hatf-I, Hatf-IB and Hatf-II/Abdali are probably based on sounding rockets sourced from France.⁵⁰ The Ghauri missile is based on the No-Dong, a Scud variant that Pakistan obtained from North Korea.⁵¹ The Ghaznavi system is based on reverse-engineered technology from M-11/DF-11 missile systems supplied by China.⁵² The Ra'ad cruise missile possibly uses South African technology.⁵³

Pakistan also has additional delivery platforms under development, probably including platforms which are not known in the public domain. At least one undeployed missile system is known to be under testing (the Shaheen-III MRBM, which was flight-tested in October 2015), with probably more systems being developed in secret. In 2012, Feroz Khan stated that Pakistan was 'presumably working on' a submarine-launched cruise missile, which he assessed to be a naval variant of the Hatf-VIII/Ra'ad.⁵⁴ This system is not known to be deployed yet.

Table 2. Key Pakistani rocket and ballistic missile platforms

Missile	Type	Estimated range	Estimated payload	Nuclear delivery system?
Hatf-I	Solid	70-100km	500kg	Yes
Hatf-IB	Solid	100km	500kg	Yes
Hatf-II/Abdali	Solid	40-200km	250-400kg	Yes
Hatf-III/Ghaznavi	Solid	320km	700kg	Yes
Hatf-IV/Shahen-I	Solid	750km	700kg	Yes
Hatf-V/Ghauri	Liquid	1800km	1200kg	Yes
Hatf-VI/Shahen-II	Solid	2500km	700kg	Yes
Hatf-VII/Babur	Cruise (air launched)	750km	450-500kg	Yes
Hatf-VIII/Ra'ad	Cruise (air launched)	350km	400kg	Yes
Hatf-IX/Nasr	Solid	60km	?	Yes
Shahen-III	Probably solid	2750km	?	Yes

Sources: Jane's Strategic Weapons; Pakistan Inter Services Public Relations

⁴⁹ Brian Cloughley and Robert Kelley, 'Pakistan adopts full-spectrum nuclear deterrent,' *Jane's Intelligence Review*, 26 May 2016.

⁵⁰ Khan, *Eating Grass*, p.237.

⁵¹ Khan, *Eating Grass*, pp.242-244.

⁵² Khan, *Eating Grass*, pp.238-240.

⁵³ Farhan Bokhari, 'Pakistan test fires its Raad cruise missile,' *Jane's Defence Weekly*, 3 September 2007.

⁵⁴ Khan, *Eating Grass*, p.250.

Expansion and procurement

Pakistan is expanding and refining its strategic programmes in multiple ways. This includes expanding its civil nuclear programme and nuclear power production capacity, which Islamabad considers a strategic objective, although Islamabad's nuclear energy programme is mostly outside of the scope of the present report. More problematically, Pakistan appears to be expanding its unsafeguarded plutonium production capacity and possibly also its enriched uranium production capacity for use in nuclear weapons. Pakistan is also developing new ballistic missiles capable of delivering nuclear weapons.

These efforts have long been facilitated by procurement of foreign technology. Pakistan has built its nuclear and missile programmes with technology imported from suppliers abroad, frequently purchased using both deceptive tactics, but also from witting partners. AQ Khan's theft of centrifuge designs from Urenco, a European uranium enrichment conglomerate, is the most notorious example of Pakistan's illicit procurement (see figure below), but Pakistan's strategic programmes also rely on technology that was knowingly provided from the 1970s until the early 2000s by state and private suppliers, mostly from Europe and China. These purchases include uranium enrichment technology; entire nuclear facilities; the provision of highly-enriched uranium suitable for use in nuclear weapons; missile systems; and nuclear weapon designs.



Figure 1. AQ Khan on cover of *Time* magazine, 14 February 2005

With the exception Chinese-Pakistan civil nuclear cooperation, state-sanctioned flow of sensitive technology to Pakistan's WMD programmes is supposed to have stopped. Today, it is generally understood that multilateral export control regimes like the Missile Technology Control Regime (MTCR) and Nuclear Suppliers Group (NSG) oblige member states to restrict the transfer of nuclear- and missile-related technology to Pakistan. Pakistan claims a strong non-proliferation record since dismantling AQ Khan proliferation network, basing this claim on its purportedly strong export control regime and efforts in the field of nuclear security.⁵⁵ China states that its supply relationship with

⁵⁵ See, e.g., 'Belarus, Kazakhstan assure Pakistan of support for Nuclear Suppliers Group bid,' *The Express Tribune*, 6 September 2016, <http://tribune.com.pk/story/1176782/belarus-kazakhstan-assure-pakistan-support-nuclear-suppliers-group-bid/>, accessed 9 September 2016.

Pakistan is confined to civil nuclear efforts, such as the Chashma Nuclear Power Plants, which are being built as a joint Sino-Pakistani effort.

In secret, though, Pakistan continues to procure dual-use technology from abroad for its nuclear weapon and missile programmes, on a vast scale. Analysis by Project Alpha of Pakistani procurements reveals hundreds of imports by Pakistan's strategic industries over the past five years, with most of these imports made by Pakistani front companies not obviously affiliated with the country's strategic industries. It has been possible to identify these as procurements for nuclear- and missile-related end-users mostly because of poor tradecraft on the part of Pakistani procurers: they use common addresses; common telephone numbers, and repeatedly use the same, limited network of suppliers abroad for dual-use technologies that can be clearly identified as for missile-related or nuclear-related purposes.

Pakistan's procurement methods

Project Alpha's analysis of trade data suggests that there are three main categories of procurement undertaken by Pakistan's strategic industries. In order of significance by volume and quality, these are deceptive procurements made from unwitting suppliers abroad; purchases from witting foreign companies; and state-to-state transfers.

i. Procurements by Pakistani front companies from unwitting suppliers abroad.

The vast majority of transactions seen in trade data involve deception on the part of Pakistan's strategic industries, and represent failings in due diligence on the part of suppliers rather than conscious support to WMD-related programmes. In these transactions, Pakistani strategic industries use layers of front companies to hide their involvement.⁵⁶ Most of these imports are made by Pakistani front companies with innocuous that reveal no affiliation with the missile- and nuclear-related end-users on whose behalf they are procuring.

This flow of dual-use goods from unwitting suppliers to Pakistan's strategic programmes is largely routed through Chinese territories. At least a dozen trading companies in Hong Kong and mainland China exist primarily to export dual-use goods to Islamabad's strategic industries were identified through this research.

ii. Transactions between witting foreign suppliers and Pakistan's strategic industries.

A much smaller number of transfers – perhaps ten percent of the imports examined – have been seen between foreign suppliers and Pakistani strategic entities acting under their own names, suggesting complicity between supplier and purchaser. These foreign suppliers almost certainly

⁵⁶ This is consistent with a 2015 US Government presentation on trends in South Asia, which cites Pakistan's ongoing 'use of front companies to procure nuclear, missile, and other dual-use items for unauthorized end uses.' See Jose M Rodriguez, 'Export Control Considerations South Asia Region,' United States Department of Commerce, 30 October 2015, https://www.bis.doc.gov/index.php/forms-documents/doc_download/1343-civil-military-eco-india, accessed 23 September 2016.

know that they are selling to entities like the PAEC, which are explicitly named in trade documents made by the exporters, but because of the lack of information in the public domain about the structure of Pakistan's strategic industries, these suppliers may not be aware that these entities are actually involved in missile or nuclear weapon development – as opposed to generic military or civil nuclear work.

iii. State-to-state transactions.

Relatively few transactions have been seen in trade data between foreign state-owned enterprises and Pakistani's strategic programmes – probably less than one percent of the imports examined. However, these include transfers of sensitive equipment made in violation of export control obligations, almost certainly with the knowledge of the exporting government.

As is to be expected, trade data shows that Chinese state-owned enterprises are supplying substantial quantities of equipment for use in the IAEA-safeguarded nuclear power reactors at Chashma, which are being built as a joint Sino-Pakistani effort. However, trade data also shows that Beijing's supply relationship with Islamabad stretches into WMD-related assistance, albeit probably for components and parts rather than complete systems.

Analysis conducted for this report shows that Beijing remains Islamabad's key state supplier to Pakistan's unsafeguarded nuclear and missile programmes, albeit not on a scale comparable to the period before the early 2000s. Subsidiaries of Chinese state-owned enterprises have transferred equipment to Pakistan's Khan Research Laboratories and the National Development Complex, both central entities in Pakistan's missile programmes.

Foreign trading companies

Analysis of trade data also shows that Pakistan's strategic industries rely on a network of at least 20 trading companies in mainland China, Hong Kong, Dubai and Singapore which funnel dual-use goods to its strategic programmes. While the full extent of their overseas operations are not clear, these trading companies probably purchase goods from manufacturers in China, Europe, the United States and elsewhere and then arrange their export to Pakistan. At least a few of these companies are probably controlled by Pakistani nationals, most likely including former employees of the strategic industries who have moved abroad.

These entities are ripe targets for designation under US export control measures, or for other counter-proliferation action.

What is Pakistan buying?

With the exception of nuclear power reactors supplied by China, the era of Pakistan buying complete strategic systems and facilities from foreign suppliers is most likely over. Trade data shows that the vast majority of the country's procurements for its strategic industries are of dual-use material and technology, which Pakistan is purchasing on a massive scale. While most of these procurements are generic in nature (for example, automobiles, basic electronics and standard steels), there is a steady stream of export-controlled or just sub-threshold technology and material flowing from foreign suppliers to the strategic industries.

Controlled or otherwise proliferation-sensitive items that Pakistan has been seen procuring on a regular basis from foreign suppliers items, and their utility in the nuclear and missile programmes, are shown in the table below.

Table 3. Common procurements seen by Pakistani strategic industries

Category	Area	Procurements
Missile-related	Solid propellant programme; liquid propellant programme; cruise missile programme	Transporter erector launchers and components, electronics, cutting tools and laser cutting machines, guidance components, furnaces, grinding machines, solid propellant binding compounds (such as toluene diisocyanate) solid propellant catalysts (such as tertiary butyl ferrocene and triethylene diamine) cables and connectors, transmitting and receiving equipment, epoxies and resins, measuring machines, high-strength aluminium, vibration test equipment
Nuclear-related	Uranium mining and milling	Radiometric survey equipment, drilling equipment, centrifugal pumps, earthmoving equipment, grinding equipment
	Uranium conversion	Stainless steel pipes, perfluorinated sheets, vacuum pumps and oil, ammonium bicarbonate and other conversion process-related compounds, nickel alloys (Inconel/Hastelloy)
	Uranium enrichment (centrifuge)	Milling machines, tube rolling machines, aluminium alloy tubes, spectrometers, vacuum gauges, vacuum pumps and oil, perfluorinated sheets, cryogenic equipment, stainless steel, copper-beryllium, HVAC equipment
	Reactor operation/reprocessing	HVAC systems, boron carbide, reprocessing-related chemicals
	Weaponisation	Furnaces, altitude test chambers, accelerometers, thyratrons, copper-graphite crucibles, air-ventilated plastic suits and hoods

Onward proliferation

Pakistan's non-proliferation record has long been clouded by the AQ Khan proliferation affair, where Khan and his European contacts illicitly supplied countries including Iran, Libya and North Korea with sensitive technology and expertise relating to uranium enrichment and nuclear weapon production. However, since the dismantling of Khan's network and his public confession on Pakistani television in

2004, Islamabad has publicly taken measures to improve its control and oversight of potential avenues for outward proliferation.⁵⁷

These steps seem to have been largely effective: no significant outward transfers of proliferation-sensitive nuclear-related technology have been seen in the post-Khan era, although critics of Pakistan's export control process have noted that no government licences for sensitive exports have ever actually been issued. Still, allegations that Islamabad has knowingly transferred nuclear-related material abroad in violation of non-proliferation norms cannot be supported with available evidence. As a Project Alpha case study has shown, Indian media allegations in 2016 that the PAEC has recently supplied North Korea with nuclear-related technology are unverifiable using public information.⁵⁸

While Pakistan seems to have successfully stemmed unsanctioned leakage from its strategic industries, several state-run entities involved in WMD-related development are involved in a government-run export organisation called Global Industrial Defence Solutions (GIDS). Problematically, GIDS does not make clear its relationship with Pakistan's WMD-related industries. GIDS refers to its members by their commercial pseudonyms, rather than their real names – which include KRL, PAEC and the country's ballistic and cruise missile producers.

Indeed, GIDS is most likely controlled by SPD, as all of the entities represented by GIDS are themselves subordinate to SPD.⁵⁹



Figure 2. GIDS logo⁶⁰

GIDS has appeared at several arms fairs abroad, and actively markets equipment produced by SPD subsidiaries. This includes large military capabilities including UAVs, surface-to-air missile systems, and air defence systems.⁶¹ It is unclear whether GIDS has made any exports of strategic systems or dual-use technology suitable for use in strategic programmes.

⁵⁷ See Gabrielle Kohlmeier and Miles A. Pomper, 'Pakistan Advances Export Controls,' *Arms Control Today*, September 2004, https://www.armscontrol.org/act/2004_10/Pak, accessed 23 September 2016.

⁵⁸ See Dr Stephan Blancke, 'Examining allegations that Pakistan diverted Chinese-origin goods to the DPRK,' Proliferation Case Study Series, Project Alpha, 2 August 2016, www.projectalpha.eu/news/item/download/70_5fc8f522084e66666f90074f9df8e358, accessed 23 September 2016.

⁵⁹ See 'Industrial Solutions,' Global Industrial Defence Solutions, undated, <http://gids.com.pk/industrial-english.pdf>, accessed 23 September 2016; 'Global Industrial and Defence Solutions,' Global Industrial Defence Solutions, undated, <http://gids.com.pk/defence-english.pdf>, accessed 23 September 2016.

⁶⁰ Image source: <http://gids.com.pk/defence-english.pdf>.

⁶¹ 'Exclusive interview with CEO, GIDS – Syed Guftar Shah,' Pakistan Ki Awaz News, 7 November 2012, <http://aaj.tv/2012/11/exclusive-interview-with-ceo-gids-syed-guftar-shah/>



Figure 3. GIDS stand at International Defence Industry Fair (IDF), Istanbul, 2013

Implications

Analysis of Pakistan's procurement activities raises several implications, including significant ones relating to Pakistan's relationship with China, Islamabad's non-proliferation obligations, and the reliance of Pakistani strategic programmes on foreign suppliers.

First, the scale of the procurement from China for all of Pakistan's strategic programmes is so substantial that it must be concluded that the Chinese state is either complicit in supplying Pakistan's programmes, or negligent in its control over state-owned enterprises who are supplying Pakistan with sensitive material. This conclusion is perhaps not surprising: Pakistan is a strategic ally of China. However, it does nonetheless raise questions about China's commitment to the principles of the export control regimes which it claims to subscribe.

Second, as is demonstrated by its systematic use of front companies to supply its strategic industries, Pakistan has a deliberate strategy of using deceptive methods to obtain dual-use goods. This undermines Pakistan's claim that it is a responsible actor in the non-proliferation domain: Pakistan cannot expect to be welcomed into the NSG when it continues to secretly and systematically undermine NSG members' national export control systems by targeting companies through the use of front companies and other deceptive techniques.

In addition, Pakistan's extensive and enduring procurements of dual-use goods from abroad suggests that Pakistani strategic industries are not as self-sufficient as Islamabad has long claimed. Pakistan's early reliance on foreign suppliers for its nuclear and missile programmes was an enduring source of humiliation for Islamabad, and the country has since made great strides in developing its domestic industries. Yet the strategic industries continue to buy various materials, equipment and

technology from abroad. Pakistan probably chooses to enjoy cost and quality benefits of importing from abroad rather than manufacturing at home, but certainly cannot say that its strategic industries are self-sufficient.

3. The nuclear and missile industries characterised

The organisational structure of Pakistan's strategic nuclear and missile industries has so far been largely shielded from public scrutiny. Most of Pakistan's work on nuclear weapons and their delivery systems is, obviously, classified, and Pakistan does not publicise organisational developments in this area. Indeed, Islamabad has named less than a dozen of the main organisations involved in the nuclear and missile programmes, and has certainly not made reference to the web of clandestine front companies that these organisations use to conduct procurement activity.

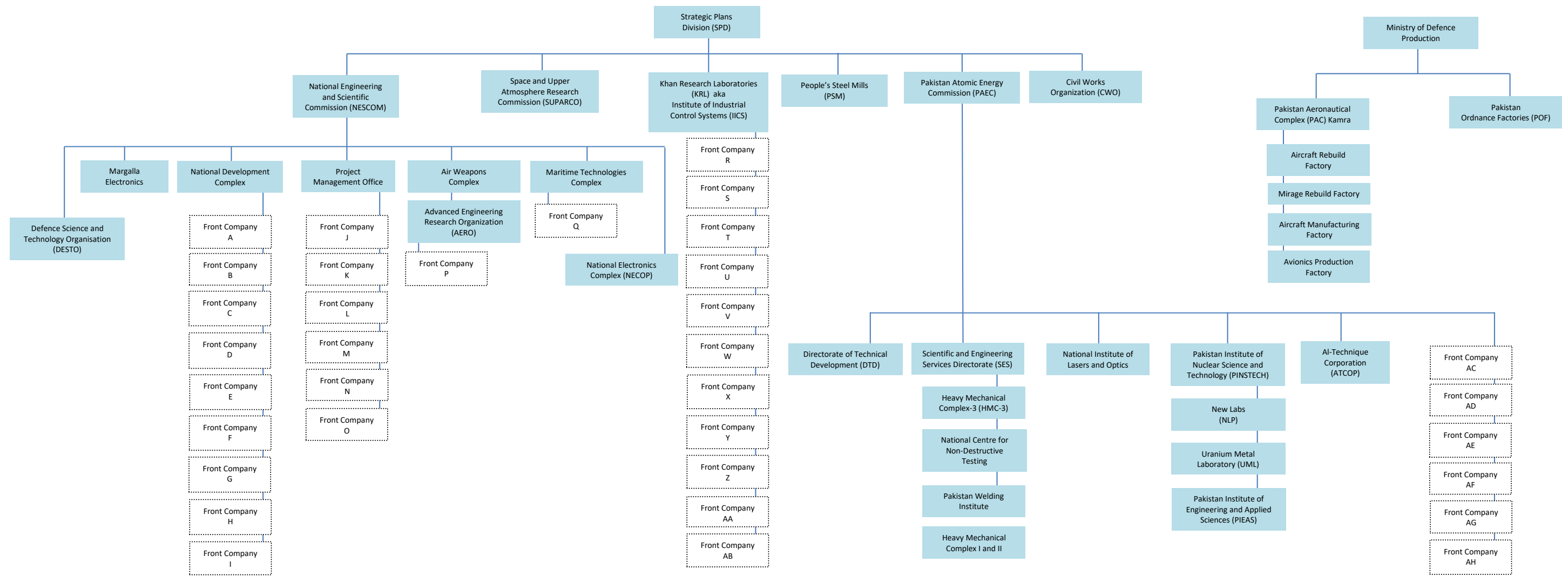
Analysis by Project Alpha of information which has until now been fragmented and uncollated – including trade data, academic papers, contractor websites, corporate newsletters and other information – has been used to develop for the first time a representation of the organisational structure of Pakistan's strategic industries and their procurement entities, which is presented below. This organisational chart forms a framework for this section of the report, which describes in detail each of the entities known or suspected to be part of Pakistan's strategic industries and their procurement networks.

While best efforts have been made to ensure the accuracy of this structure, caution should be applied before taking it as an authoritative representation. Pakistan's strategic industries have continually evolved and adapted, and relationships between entities may not be as they have been assessed below. Entities presented in the structure below may have different owners or reporting chains; front companies presented as active may no longer be so; and may actually work for more than one owner. Moreover, there are almost certainly gaps in this structure where key entities have not yet been identified.

Still, this structure should provide analysts with a basis for considering Pakistan's nuclear and missile programmes as an organisational whole. It is presented in this report with the aim of assisting counter-proliferation practitioners, due diligence professionals and others who need to understand those elements of Pakistani industry that are involved in work for the country's WMD programmes.

Note: a substantial number of front companies have been redacted from this chart.

Key entities in Pakistan's strategic industries (abridged)



This chart is based on multiple sources which are described above, including US sanctions; open source commercial information provided by Pakistani entities; and other sources. It represents an approximation of the organisational structure of core entities known to be involved in Pakistan's strategic industries. While best efforts have been made to ensure its accuracy, names and linkages presented in it may be incorrect, dated or otherwise inaccurate. Reporting structures are probably more complex than depicted.

Strategic Plans Division (SPD)

Pakistan's strategic programmes fall under the remit of the Strategic Plans Division, or SPD, an entity that was created with the aim of centralising control over nuclear and missile industries that had become unwieldy and duplicative. The Strategic Plans Division (SPD) is the secretariat of Pakistan's National Command Authority, the country's civilian-led peak strategic authority which has command of the country's nuclear weapons and guides nuclear development and strategy.⁶²

SPD was established in 1999 to create 'systematic control over strategic organisations and [provide] direction for the nuclear program.'⁶³ Today, SPD purportedly 'exercises complete command and control over the country's nuclear and strategic capability structure,' including nuclear, missile and space programmes.⁶⁴

Entities operating under SPD's authority and oversight include Khan Research Laboratories, involved in uranium enrichment and missile development; the National Engineering and Scientific Commission, which oversees the country's missile efforts; the PAEC, responsible for most of Pakistan's nuclear fuel cycle; the Space and Upper Atmosphere Research Commission, responsible for Pakistan's space programme; and others. These entities are described in detail in the following sections.

Key personnel

As of January 2016, Major General Tariq Javed is head of SPD, according to Pakistani news reporting.⁶⁵

Involvement in proliferation/procurement

SPD's security division has been seen in trade data procuring motor vehicles from abroad.⁶⁶

Entities under SPD's authority in Pakistan's nuclear and missile programmes have been responsible for extensive procurement of goods and expertise from abroad, including through the use of covert and illicit methods. These are described in detail under the entity summaries below and/or in the restricted version of this report.

⁶² Inter Services Public Relations, 'FOREIGN MEDIA BRIEFED AT STRATEGIC PLANS DIVISION,' 26 January 2008, https://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=488#pr_link488, accessed 6 September 2016.

⁶³ Khan, *Eating Grass*, p.331.

⁶⁴ 'SPD head meets PM: Nuclear and missile programmes discussed,' *The Express Tribune*, 25 June 2015, <http://tribune.com.pk/story/909326/spd-head-meets-pm-nuclear-and-missile-programmes-discussed/>, accessed 6 September 2016.

⁶⁵ 'Top-level posting, transfers in Pakistan Army,' *The Express Tribune*, 28 January 2016, <http://tribune.com.pk/story/1035393/reshuffle-top-level-posting-transfers-in-pakistan-army/>, accessed 5 September 2016.

⁶⁶ Trade data sourced by Project Alpha.

International footprint

SPD likely maintains contacts with various foreign counterparts.

Strategic Plans Division (SPD)				
Reports to	National Command Authority			
Also known as	SPD			
Current head	Major General Tariq Javed ⁶⁷			
Address	PO Box 632, Rawalpindi, Pakistan ⁶⁸			
Contact details	?			
Designated by	Japan	BIS		
	N	N		

⁶⁷ 'Top-level posting, transfers in Pakistan Army,' *The Express Tribune*, 28 January 2016, <http://tribune.com.pk/story/1035393/reshuffle-top-level-posting-transfers-in-pakistan-army/>, accessed 5 September 2016.

⁶⁸ Trade data sourced by Project Alpha.

Pakistan Atomic Energy Commission (PAEC)

PAEC is Pakistan's primary nuclear agency in both the civil and military domains. With the exception of uranium enrichment, which has historically been conducted by Khan Research Laboratories (KRL), PAEC has responsibility for development and operation of Pakistan's nuclear fuel cycle, including uranium mining, conversion, fuel production, reactor operations, reprocessing and metallurgy.⁶⁹ This means that in addition to operating Pakistan's nuclear energy programme, PAEC also produces fissile material for Pakistani nuclear weapons.

PAEC has played a key role in Pakistan's nuclear weapons programme and continues to be a critical enabler for the growth of Pakistan's nuclear arsenal. PAEC nuclear reactors at Khushab (see below) are the sources of plutonium and tritium for Pakistan's plutonium weapons. Pakistan's uranium-based nuclear weapons are fuelled by uranium that has been processed in several PAEC facilities. PAEC scientists and engineers were main developers of Pakistan's first nuclear weapon designs, and probably remain involved in weaponisation aspects under the auspices of PAEC's Directorate of Technical Development (DTD), which was established in 1974 to handle 'all aspects' of weapon design, fabrication and testing, according to Khan,⁷⁰ and which remains active today.⁷¹

PAEC operates under the direction of the SPD.⁷²



Figure 4. PAEC logo⁷³

⁶⁹ Maria Sultan et al, *Governing Uranium in Pakistan*, DIIS Report 2015:08, Danish Institute for International Studies, http://pure.diis.dk/ws/files/184536/DIIS_RP_2015_08_FINAL.pdf, p.37; Khan, *Eating Grass*, 202-3

⁷⁰ Khan, *Eating Grass*, p.177.

⁷¹ 'Three Day Hands-on Training on Advanced Analytical Techniques,' PINSTECH Newsletter, January-February 2016, p.3, <http://www.sidnlps.org.pk/pictures/PNL-Jan-Feb-2016.pdf>, accessed 8 September 2016.

⁷² Khan, *Eating Grass*, p.335; Federal Public Service Commission, 'Circular,' 2 December 2013, <http://fpsc.gov.pk/icms/admin/documents/forms/grant%20of%20age%20relaxation-04-12-2013.pdf>, accessed 2 September 2016; Pakistan Atomic Energy Commission, 'Annual Report 2009-10,' 2010, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/43/107/43107324.pdf, accessed 6 September 2016.

⁷³ Image via Wikimedia.

Key personnel

Muhammad Naeem, a forty-year PAEC veteran, is chairman of PAEC.⁷⁴



Figure 5. Muhammad Naeem (left), PAEC Chairman, with Pakistani President Mamnoon Hussein⁷⁵

Involvement in proliferation/procurement

PAEC has a long history of involvement in procurement from abroad, including covert procurement and actions in violation of national export controls.⁷⁶

Even today, PAEC maintains several front companies in Pakistan which exist for the purpose of covertly channelling dual-use goods purchased from abroad to Pakistani nuclear facilities. These companies are described in the restricted version of this report.

In addition to these covert procurements, PAEC's Directorate General of Technical Procurement has been seen in trade data making dozens of procurements of nuclear-related equipment under its own name. This includes procurements of items from companies in the UK and Austria.

Key facilities

Key facilities of PAEC are described in detail in the sections below.

⁷⁴ 'Mohammad Naeem appointed PAEC chairman,' *Dawn*, 24 April 2015, <http://www.dawn.com/news/1177846>, accessed 6 September 2016.

⁷⁵ 'PakAtom,' Pakistan Atomic Energy Commission, May-July 2016, <http://paec.gov.pk/Documents/PakAtom/P%201-8%20May-July%202016.pdf>, accessed 6 September 2016.

⁷⁶ See generally Khan, *Eating Grass*.

International footprint

PAEC is actively involved in international collaborations relating to the nuclear fuel cycle, nuclear medicine and other related projects. It is unlikely that PAEC is involved in any collaboration relating to weaponisation or other sensitive elements relating to Pakistan’s strategic nuclear programme.

Pakistan Atomic Energy Commission (PAEC)				
Reports to	SPD			
Also known as	PAEC			
Current head	Muhammad Naeem			
Address	P.O. Box 1114, Islamabad, Pakistan; ⁷⁷ PO Box 1624, Islamabad, Pakistan; ⁷⁸ PO Box 1890, Islamabad, Pakistan ⁷⁹			
Contact details	Tel (+92 51) 9209032-37 ⁸⁰			
Designated by	Japan	BIS		
	Y	Y		

⁷⁷ Pakistan Atomic Energy Commission, undated, <http://paec.gov.pk/index.aspx>, accessed 6 September 2016.

⁷⁸ Trade data sourced by Project Alpha.

⁷⁹ ‘Download form for Pakistan Atomic Energy Commission (PAEC) Jobs at P.O Box 1890 Islamabad – Daily Jang 27-01-2013,’ Daily Jobs 4 All, 27 January 2013, <http://www.dailyjobs4all.com/download-form-for-pakistan-atomic-energy-commission-paec-jobs-at-p-o-box-1890-islamabad-daily-jang-27-01-2013/>, accessed 15 September 2016.

⁸⁰ Pakistan Atomic Energy Commission, undated, <http://paec.gov.pk/index.aspx>, accessed 6 September 2016.

Power Plant Workshops is an alias of PAEC, according to the US Department of Commerce.⁸¹ It may actually be a PAEC subsidiary, and has been described as a separate, subordinate entity by former employees and contractors.⁸² It shares a telephone number with the PAEC.⁸³

Power Plant Workshops has probably been involved in construction of the PAEC's unsafeguarded nuclear facility at Khushab. A contractor describes working between 2008-10 on a 'heavy industrial project' at Khushab for Power Plant Workshops, with PAEC listed as client.⁸⁴ Another contractor describes working on a project named 'Power Plant Workshops Jaurabad Khushab', possibly a reference to the Khushab nuclear complex, which is located near to the city of Jaurabad.⁸⁵

Power Plant Workshops has possibly also been involved in construction of the PAEC's nuclear complex at Chashma. A contractor describes working on a project known as 'Power Plant Workshops – Chashma Nuclear Power', probably a reference to the Chashma nuclear complex.⁸⁶ However, it is unclear whether Power Plant Workshops has been involved in safeguarded or non-safeguarded facilities at Chashma.



Figure 6. Power Plant Workshops 'cooling tower' project for PAEC at unknown location⁸⁷

⁸¹ United States Department of Commerce, 'Supplement No. 4 to Part 744 of the Export Administration Regulations,' <https://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern/entity-list>, accessed 21 July 2016.

⁸² See, e.g., Shahzad Bhatti, 'Business and Engineering Trends,' Bin Tariq Pipes, 2013, <http://webcache.googleusercontent.com/search?q=cache:764hkVTU-dAJ:www.ist.edu.pk/downloads/iccm/bin-tariq-pipes-intro-2013.pdf+&cd=18&hl=en&ct=clnk&gl=uk>, accessed 2 September 2016; 'Muhammad Meherban Choudhry,' LinkedIn, undated, <https://www.linkedin.com/in/muhammad-meherban-choudhry-0740b465>, accessed 2 September 2016.

⁸³ 'High Burnup Fuel: Implications and Operational Experience,' IAEA, November 2013, <http://www-pub.iaea.org/MTCD/publications/PDF/TE1798CDweb.pdf>, accessed 2 September 2016.

⁸⁴ 'Quantity Surveyor,' CareerMidway, undated, <http://hiring.career midway.com/profile/86392>, accessed 2 September 2016.

⁸⁵ 'Client references,' Chase Technology and Trading Company, undated, http://chasett.com/index.php/client/?__store=default, accessed 2 September 2016.

⁸⁶ Shahzad Bhatti, 'Business and Engineering Trends,' Bin Tariq Pipes, 2013, <http://webcache.googleusercontent.com/search?q=cache:764hkVTU-dAJ:www.ist.edu.pk/downloads/iccm/bin-tariq-pipes-intro-2013.pdf+&cd=18&hl=en&ct=clnk&gl=uk>, accessed 2 September 2016

⁸⁷ 'Power Plant Workshops,' Paragon Constructors Pvt Ltd, undated, <http://www.paragon.com.pk/index.php/component/k2/item/55-power-plant-workshops>, accessed 2 September 2016.

Key personnel

Key personnel of Power Plant Workshops are not publicly known.

Involvement in proliferation/procurement

Project Alpha has seen information suggesting that Power Plant Workshops has acquired dual-use goods from suppliers in the EU and UAE in the past five years.

Power Plant Workshops also appears in Pakistani tender documents as seeking various dual-use goods, probably for nuclear facility construction. For example:

- A-312 series stainless steel pipes.⁸⁸
- An excavator, loader and lifter.⁸⁹

International footprint

Beyond its foreign procurement activity, Power Plant Workshops is not known to have an international footprint.

Power Plant Workshops			
Reports to	PAEC		
Also known as	-		
Current head	?		
Address	PO Box 3306, Islamabad, Pakistan; Plot no. 178, Phase V Extension, Industrial Estate, Hattar District, Haripur, Pakistan; ⁹⁰ House # 7, Main Double Road, G-11/3, Islamabad ⁹¹		
Contact details	Phone: 92 51-9225255, Fax 92 51-9225213 ⁹² email: inchpro@gmail.com ⁹³		
Designated by	Japan	BIS	
	Y	Y	

⁸⁸ 'Purchase of Seamless SS Pipes of different sizes,' <http://tenders.afd.dgmarket.com/tenders/np-notice.do?noticeId=1887684>, Agence Française de Développement, undated, <http://tenders.afd.dgmarket.com/tenders/np-notice.do?noticeId=1887684>, accessed 2 September 2016.

⁸⁹ 'Tender - RFP - OPEN TENDER NOTICE HEAVY MACHINERY,' LokTender, undated, <http://lokpaper.blogspot.co.uk/2013/10/tender-rfp-open-tender-notice-heavy.html>, accessed 2 September 2016.

⁹⁰ Trade data sourced by Project Alpha.

⁹¹ 'Open Tender Notice No CFPP Islamabad,' PaperPaste, undated, <http://www.paperpaste.com/open-tender-notice-cfpp-islamabad/>, accessed 2 September 2016.

⁹² 'Open Tender Notice,' undated, PaperPK, <http://tendernotice.pk/561759/power-plant-workshops-islamabad-tender-notice>, accessed 2 September 2016.

⁹³ 'Tender - RFP - OPEN TENDER NOTICE HEAVY MACHINERY,' LokTender, undated, <http://lokpaper.blogspot.co.uk/2013/10/tender-rfp-open-tender-notice-heavy.html>, accessed 2 September 2016.

The PAEC's Chemical Plant Complex (CPC), located in Dera Ghazi Khan, is one of the key nuclear facilities in Pakistan's unsafeguarded nuclear fuel cycle. The CPC undertakes the conversion of uranium into uranium hexafluoride (UF₆) – the feedstock for centrifuge uranium enrichment – as well as the production of other non-metal uranium compounds.⁹⁴

In addition to the CPC's uranium conversion facility, Brian Cloughley and Robert Kelley have assessed that the Dera Ghazi Khan complex also contains a probable plutonium processing and handling facility (see figure below) which would undertake tasks including machining and casting of plutonium metal for nuclear weapons.⁹⁵

Key personnel

CPC's senior officials are not known.

Involvement in proliferation/procurement

No procurements by the CPC have been identified. CPC or the PAEC division responsible for it probably maintains at least one front company (perhaps several) for obtaining dual-use technology from abroad.

Key facilities

The CPC is located in Dera Ghazi Khan (see below).

⁹⁴ Maria Sultan et al, *Governing Uranium in Pakistan*, DIIS Report 2015:08, Danish Institute for International Studies, http://pure.diis.dk/ws/files/184536/DIIS_RP_2015_08_FINAL.pdf, p.37.

⁹⁵ Brian Cloughley and Robert Kelley, 'Cloud cover – Pakistan's shift towards tactical nuclear weapons,' *Jane's Intelligence Review*, 9 September 2014.

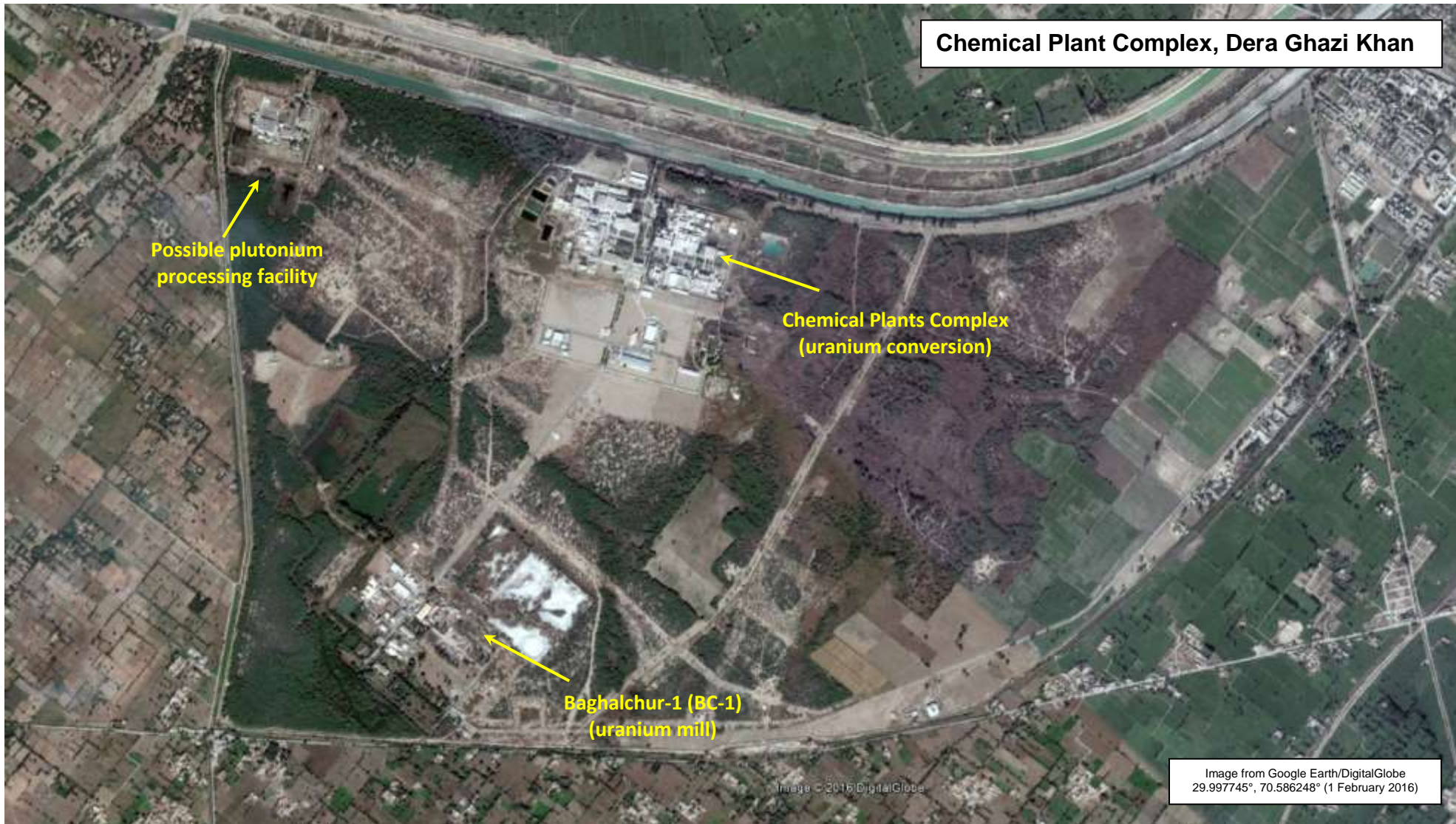
Chemical Plant Complex, Dera Ghazi Khan

Possible plutonium processing facility

Chemical Plants Complex (uranium conversion)

Baghalchur-1 (BC-1) (uranium mill)

Image from Google Earth/DigitalGlobe
29.997745°, 70.586248° (1 February 2016)



International footprint

CPC is not known to be engaged in international projects.

Chemical Plant Complex (CPC)			
Reports to	PAEC		
Also known as	CPC Project, Chemical Production Complex, ⁹⁶ Public Sector Organization ⁹⁷		
Current head	?		
Address	PO Box 35, Dera Ghazi Khan, Pakistan ⁹⁸		
Contact details	Phone: 064-9260082-86, 0321-4493400; ⁹⁹ Tel- 064-2465566, 0321-7403366; ¹⁰⁰ Ph: 064-9261076, fax 064-9261213 ¹⁰¹		
Designated by	Japan	BIS	
	N	N	

⁹⁶ Khan, *Eating Grass*, p.112.

⁹⁷ SU Rehman, *Long Road to Chagai* (1999);

<http://www.damwork.tendertiger.com/viewtenderdetail.aspx?SrNo=17058524&tendertype=9d09819bf4266dce2eviL&Year=2015&Supply%20of%20item%20-%20Calcium%20Chloride%20Prills/Flakes>.

⁹⁸ SU Rehman, *Long Road to Chagai* (1999).

⁹⁹ 'Test Centres,' 24 May 2015, Karachi Institute of Power Engineering, <http://www.kinpoe.edu.pk/TESTCENTRESPD2015.asp>, accessed 17 August 2016.

¹⁰⁰ <http://www.ndma.gov.pk/docs/booksandpublications/peer/hope.pdf>

¹⁰¹

<http://www.damwork.tendertiger.com/viewtenderdetail.aspx?SrNo=17058524&tendertype=9d09819bf4266dce2eviL&Year=2015&Supply%20of%20item%20-%20Calcium%20Chloride%20Prills/Flakes>.

Pakistan's Chashma Nuclear Complex is one of Pakistan's largest nuclear facilities, and contains a mix of IAEA-safeguarded and unsafeguarded sites.

The Chashma Nuclear Complex is the location of four nuclear power plants, known as Chashma-I (or CHASNUPP-I), Chashma-II, Chashma-III and Chashma-IV.¹⁰² These power plants, supplied by China, are civil in nature and are subject to IAEA safeguards.

Chashma is also the location of a suspected reprocessing facility (see below) for plutonium separation. This facility, also known as KNC-II, is not subject to IAEA safeguards. Its location has been identified by the Institute for Science and International Security.¹⁰³ In addition, Chashma holds an unsafeguarded fuel fabrication complex, which is described separately.

Key personnel

Chashma's senior officials are not known.

Involvement in proliferation/procurement

There have been substantial numbers of procurements for Chashma from suppliers in other countries, most notably from China. These have possibly included imports for unsafeguarded aspects of the Chashma complex.

Key facilities

Chashma's key facilities are shown in the imagery below.

¹⁰² Salim Khan and Muhammad Saeed Mulla (Pakistan Atomic Energy Commission), 'Safeguards in Pakistan: State-Agency Cooperation,' IAEA Safeguards Symposium 2014, <https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/sg2014-slides/000371.pdf>, accessed 1 September 2016.

¹⁰³ David Albright and Serena Kelleher-Vergantini, 'Pakistan's Chashma Plutonium Separation Plant: Possibly Operational,' Institute for Science and International Security, 20 February 2015, <http://isis-online.org/isis-reports/detail/pakistans-chashma-plutonium-separation-plant-possibly-operational/12>, accessed 24 August 2016.

Chashma Nuclear Power Plants, Chashma



Image © 2013 CNES/Astrium

Image from Google Earth/CNES/Astrium
32.386433°, 71.469531° (26 November 2013)

Chashma probable reprocessing facility, Chashma



Image © 2013 CNES/Astrium

Image from Google Earth/CNES/Astrium
32.383006°, 71.440358° (26 November 2013)

International footprint

The Chashma nuclear power plants are being constructed with Chinese assistance.¹⁰⁴ No additional international cooperation is known to be underway at Chashma.

Chashma Nuclear Complex				
Reports to	PAEC			
Also known as	CHASNUPP (reactors), KNC-II (reprocessing plant)			
Current head	?			
Address	PAEC, Chashma Barrage Colony, Distt. Mianwali, Pakistan ¹⁰⁵			
Contact details	?			
Designated by	Japan	BIS		
	N	N		

¹⁰⁴ See, e.g., 'Construction of Chashma nuclear power project-2 starts,' People's Daily, 29 December 2005, http://en.people.cn/200512/29/eng20051229_231667.html, accessed 15 September 2016.

¹⁰⁵ Letter, National Electric Power Regulatory Authority Pakistan to General Manager Chashma Nuclear Power Plant, 9 September 2003, available online at <http://www.nepra.org.pk/Licences/Generation/NPP/LAG-19%20Generation%20Licen%20Chashma%20Nuclear%20Power%20Plant-dated%2009-09-2003.PDF>, accessed 6 September 2016.

The Kundian Nuclear Fuel Complex (KNFC or KNC-I), located at the Chashma site, produces natural (unenriched) uranium metal fuel for Pakistan's Khushab reactors. The KNFC, initially built in the 1970s to provide uranium oxide fuel for the Karachi Nuclear Power Plant, had a uranium metal fuel production line added in the 1980s, according to Khan.¹⁰⁶ It is not under IAEA safeguards.

Key personnel

No key personnel for the KNFC have been identified.

Involvement in proliferation/procurement

No specific procurements for the KNFC have been identified.

Key facilities

The location of the KNFC (see below) has been identified in a declassified 1985 CIA study.¹⁰⁷

¹⁰⁶ Khan, *Eating Grass*, p.115, p.197.

¹⁰⁷ Central Intelligence Agency, 'Pakistan's nuclear weapons program: personnel and organizations,' 23 September 1985, p.9, http://www.foia.cia.gov/sites/default/files/document_conversions/89801/DOC_0000252646.pdf, accessed 21 July 2016.

Kundian Nuclear Fuel Complex, Chashma



Image © 2016 CNES/Astrium

Image from Google Earth/CNES/Astrium
32.395776°, 71.454391° (26 November 2013)

International footprint

The KNFC is not known to have an international footprint.

Kundian Nuclear Fuel Complex				
Reports to	PAEC			
Also known as	Kundian fuel fabrication facility, KNC, KNC-I, Chashma Fuel Fabrication Facility			
Current head	?			
Address	PO, Chashma Barrage Colony, Chashma, Tehsil Piplan, Distt. Mianwali, Pakistan ¹⁰⁸			
Contact details	-			
Designated by	Japan	BIS		
	N	N		

¹⁰⁸ 'Chashma Barrage Colony Mianwali Jobs, Care taker, Tech-I 21 Feb 2012,' undated, <http://www.friendsmania.net/forum/job-pakistan-careers-pakistan/162969.htm>, accessed 6 September 2016.

The Khushab Nuclear Reactor Complex (see figure below) is operated by the PAEC and produces plutonium for use in Pakistan's nuclear weapons. It is not safeguarded by the IAEA.

Khushab's first nuclear reactor (also known as Kundian Chemical Plant-II/KCP-II¹⁰⁹) reportedly came online in about 1998.¹¹⁰ The complex now has four complete nuclear reactors, with three operational and the fourth reactor likely undergoing commissioning during 2015 and possibly now operational.¹¹¹

A heavy water production plant (probably known as KCP-I) is also present at the Khushab site. This site uses the Girdler-Sulfide separation process, according to an online resume of a former engineer there.¹¹²

Each of the Khushab reactors is heavy water-moderated and fuelled by natural uranium metal fuel rods. The original Khushab-I reactor has a capacity of about 40-50MW, and each of the three subsequent reactors probably have a capacity of somewhere between about 40MW¹¹³ and 120 MW.¹¹⁴ Albright estimates that by the end of 2014, these reactors had produced between 185-230kg of plutonium.¹¹⁵

Key personnel

Khushab's key personnel are not known.

¹⁰⁹ Based on sources including Mansoor Ahmed (Department of Defense and Strategic Studies, Quaid-i-Azam University), 'Trends in Technological Maturation and Strategic Modernization: The Next Decade,' Naval Postgraduate School, 2014, https://my.nps.edu/documents/104111744/106151936/5+Nuclear+Learning_Ahmed.pdf/5b46434b-4f40-4f32-9d83-618f8a6f7a68, accessed 8 September 2016; Ahmad et al, 'DESIGN OF MULTICHANNEL COUNTING SYSTEM-2 FOR IBM PC AND COMPATIBLES,' PINSTECH 168, April 2001, http://www.iaea.org/jinis/collection/NCLCollectionStore/_Public/38/008/38008087.pdf, accessed 8 September 2016.

¹¹⁰ Robert Kelley and Brian Cloughley, 'Power boost – Pakistan develops its thermonuclear weapons,' *Jane's Intelligence Review*, 24 January 2014.

¹¹¹ David Albright and Serena Kelleher-Vergantini, 'Khushab Reactors Operational While New Construction Progresses,' Institute for International Security, 29 February 2016, http://isis-online.org/uploads/isis-reports/documents/Three_Khushab_Reactors_Operational_February_29_2016.pdf, accessed 31 August 2016.

¹¹² 'CV of Plant Operation Chief Executives Engineering Mining, Oil & Gas From PAKISTAN (10313),' WebJobz, undated, <http://jobseeker.expatsjob.net/cvs/10313>, accessed 8 September 2016.

¹¹³ See Tamara Patton, 'Combining Satellite Imagery and 3D Drawing Tools for Nonproliferation Analysis: A Case Study of Pakistan's Khushab Plutonium Production Reactors,' *Science & Global Security*, 20:2-3, 117-140, available online at <http://www.tandfonline.com/doi/pdf/10.1080/08929882.2012.719383?needAccess=true>, accessed 1 September 2016.

¹¹⁴ David Albright and Serena Kelleher-Vergantini, 'Pakistan's Fourth Reactor at Khushab Now Appears Operational,' Institute for Science and International Security, 16 January 2015, http://isis-online.org/uploads/isis-reports/documents/Khushab_January_2015_reactor_four_operational_FINAL.pdf, accessed 1 September 2016.

¹¹⁵ David Albright and Serena Kelleher-Vergantini, 'Pakistan's Fourth Reactor at Khushab Now Appears Operational,' Institute for Science and International Security, 16 January 2015, http://isis-online.org/uploads/isis-reports/documents/Khushab_January_2015_reactor_four_operational_FINAL.pdf, accessed 1 September 2016.

Involvement in proliferation/procurement

No specific procurements for Khushab have been identified, although the PAEC is likely to maintain a dedicated front company or front companies for that purpose.

Key facilities

The location of the Khushab Nuclear Reactor Complex has been identified by the Institute for Science and International Security, Jane's, and other outlets.¹¹⁶

¹¹⁶ See, e.g., David Albright and Serena Kelleher-Vergantini, 'Pakistan's Chashma Plutonium Separation Plant: Possibly Operational,' Institute for Science and International Security, 20 February 2015, <http://isis-online.org/isis-reports/detail/pakistans-chashma-plutonium-separation-plant-possibly-operational/12>, accessed 24 August 2016.

Khushab nuclear reactor complex, Khushab

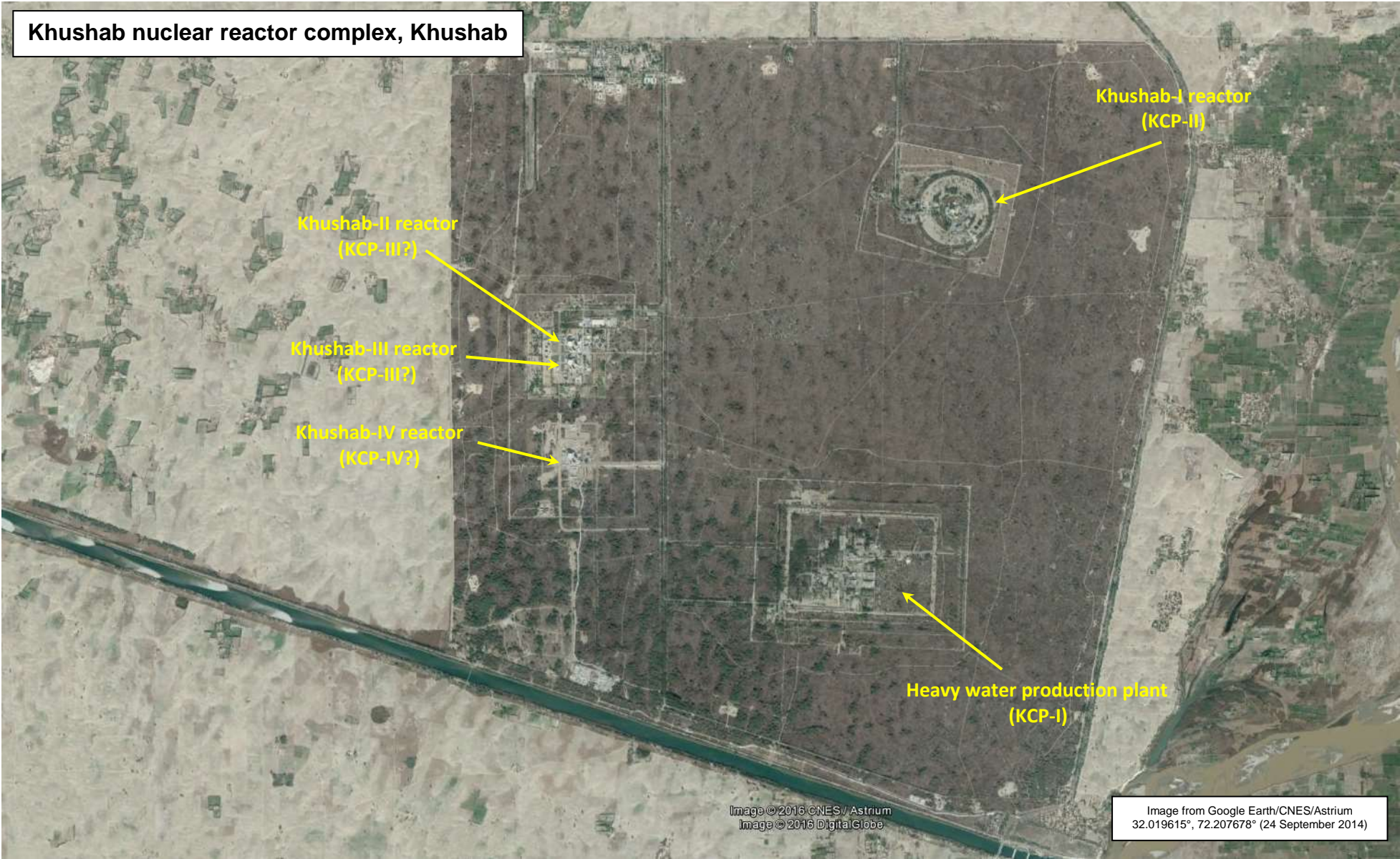


Image © 2016 CNES / Astrium
Image © 2016 DigitalGlobe

Image from Google Earth/CNES/Astrium
32.019615°, 72.207678° (24 September 2014)

International footprint

The Khushab complex is not known to have an international footprint.

Khushab Nuclear Reactor Complex				
Reports to	PAEC			
Also known as	Kundian, Khushab, Kushab, Khushab Chemical Plant, KCP, Khushab Chemical Plants, Kundian Chemical Plants			
Current head	?			
Address	KCP Colony, Girote Chowk, Jauharabad, Pakistan ¹¹⁷			
Contact details	?			
Designated by	Japan	BIS		
	N	N		

¹¹⁷ Public Procurement Regulatory Authority, 'PUBLIC PROCUREMENT REGULATORY AUTHORITY CAPACITY BUILDING TRAINING PROGRAMME ON "PUBLIC PROCUREMENT RULES & PROCEDURES"', 2013, <http://www.ppra.org.pk/nip/nip2013.htm>, accessed 24 August 2016.

The Heavy Mechanical Complex-3 (HMC-III or HMC-3) is an engineering design and manufacturing entity whose remit is focused on nuclear-related work. HMC-III is a subsidiary of the PAEC.¹¹⁸

HMC-III was established in 1992 to work exclusively on the unsafeguarded Khushab nuclear reactor complex as well as for ‘future indigenous reactors and other fuel cycle projects,’ according to Khan.¹¹⁹



Figure 7. Heavy Mechanical Complex-III, Taxila, Pakistan¹²⁰

HMC-III claims to have heavy manufacturing capabilities unique in Pakistan, including CNC bending, rolling and dish-making lines suitable for very large (multi-ton) pieces.¹²¹ HMC’s capabilities mean it is able to produce very large nuclear-related components, such as reactor pressure vessels.¹²² Many

¹¹⁸ Shahid-ur-Rehman Khan, ‘Pakistan’s indigenous nuclear power plant capability gets big boost,’ *Kyodo News*, 22 June 2016 (via Factiva).

¹¹⁹ Khan, *Eating Grass*, p.197-8.

¹²⁰ Image via hmc-3.com.pk.

¹²¹ See Abdul Hai, ‘HMC – 3 and its Role 3 and its Role in PAK – CERN Collaboration,’

http://www.ncp.edu.pk/docs/lhc_workshop/10%20Minutes%20HMC-3%20and%20its%20role%20in%20PAK%20CERN%20Collaboration%20.pdf, accessed 15 August 2016.

¹²² ‘HMC WILL NOT BE ALLOCATED FUNDS,’ *Pakistan and Gulf Economist*, 3 July 2016 (via Factiva); Shahid-ur-Rehman Khan, ‘Pakistan’s indigenous nuclear power plant capability gets big boost,’ *Kyodo News*, 22 June 2016 (via Factiva).

of these capabilities are also relevant to missile-related production: for example, ring rolling machines can be used to make stiffener rings for ballistic missile airframes.¹²³

HMC-III is a separate entity to Pakistan's Heavy Mechanical Complex (HMC), whose capabilities at its HMC-1 and HMC-II subsidiaries are mostly devoted to conventional military production. According to Feroz Khan:

The Heavy Mechanical Complex... produces tanks, guns, armored personnel carriers, and other heavy machinery, including tractors. HMC-1 and HMC-II are dedicated to such projects.¹²⁴

While HMC-III and HMC are currently separate entities, their amalgamation may be planned. In July 2016, the Pakistani media reported that HMC will be transferred to the PAEC as part of Pakistan's plan to use domestic heavy industry to underpin the construction of a series of new nuclear power plants.¹²⁵ This would place both HMC and HMC-III under PAEC control.

Key personnel

HMC-III's current leadership is not known. Previous reported managing directors have included Sohail Mazhar¹²⁶ and Dr Abdul Aleem.¹²⁷

Involvement in proliferation/procurement

HMC-III is not known to have been involved in illicit procurement or proliferation activity. However, US government cables repeatedly cite HMC as being associated with Pakistan's nuclear and missile programs and as acting as a possible procurement front for Pakistan's missile programme.¹²⁸ It is unclear whether these are references to HMC-III or to the other subsidiaries of HMC.

Key facilities

HMC-III maintains a large manufacturing facility in Taxila, Pakistan (see below).

¹²³ United States Department of State, 'SUBJECT: MTAG: MISSILE-RELATED STEEL TO DPRK AND RING-ROLLING MACHINES TO PAKISTAN (S),' 10 March 2006, 06STATE39514_a, https://wikileaks.org/plusd/cables/06STATE39514_a.html, accessed 15 August 2016.

¹²⁴ Khan, *Eating Grass*, p.442. HMC reportedly contributed to the development of the Khushab nuclear reactor prior to the establishment of HMC-III, according to Khan.

¹²⁵ 'HMC WILL NOT BE ALLOCATED FUNDS,' *Pakistan and Gulf Economist*, 3 July 2016 (via Factiva); Shahid-ur-Rehman Khan, 'Pakistan's indigenous nuclear power plant capability gets big boost,' *Kyodo News*, 22 June 2016 (via Factiva).

¹²⁶ <http://www.engineeringpakistan.com/EngPak1/compdetail.php?CompanyId=126>

¹²⁷ http://indico.cern.ch/event/330005/contributions/1714878/attachments/641830/883128/Industry-Awards-2014-Talk-ag_ab_vod.pdf

¹²⁸ United States Department of State, '(S) FOLLOWING UP WITH TAIWAN ON SALES OFFER OF MACHINE TOOLS BY TAIWAN COMPANY TO PAKISTANI ENTITY,' 09STATE77088_a, 23 July 2009, https://search.wikileaks.org/plusd/cables/09STATE77088_a.html, accessed 15 August 2016; 'MTAG: MISSILE-RELATED STEEL TO DPRK AND RING-ROLLING MACHINES TO PAKISTAN (S),' 10 March 2006, 06STATE39514_a, https://wikileaks.org/plusd/cables/06STATE39514_a.html, accessed 15 August 2016.

Heavy Mechanical Complex-III, Taxila



Image © 2016 DigitalGlobe

Image from Google Earth/DigitalGlobe
33.787611°, 72.809724° (4 April 2016)

International footprint

HMC-3 is a partner in civil nuclear activities with foreign clients. For example, since 1994, HMC-3 has manufactured equipment for the European Organisation for Nuclear Research (CERN), including end-caps for CERN's Compact Muon Solenoid.¹²⁹



Figure 8. Image from CERN press release¹³⁰

Heavy-Mechanical Complex 3 (HMC-III)			
Reports to	PAEC ¹³¹		
Also known as	HMC-3, HMC-III, HMC		
Current head	?		
Address	Kot Najeebullah Rd, Taxila, Pakistan		
Contact details	Ph: 92-596-530802-8 and 92-51-9271852-4, e-mail: info@hmc-3.com.pk ¹³²		
Designated by	Japan	BIS	
	Y	N	

¹²⁹ See Abdul Hai, 'HMC – 3 and its Role 3 and its Role in PAK – CERN Collaboration,'

http://www.ncp.edu.pk/docs/lhc_workshop/10%20Minutes%20HMC-3%20and%20its%20role%20in%20PAK%20CERN%20Collaboration%20.pdf, accessed 15 August 2016.

¹³⁰ Image via CERN, http://indico.cern.ch/event/330005/.../Industry-Awards-2014-Talk-ag_ab_vod.pdf, accessed 15 August 2016.

¹³¹ Shahid-ur-Rehman Khan, 'Pakistan's indigenous nuclear power plant capability gets big boost,' *Kyodo News*, 22 June 2016 (via Factiva).

¹³² 'HEAVY MECHANICAL COMPLEX-3,' undated, <http://www.hmc-3.com.pk/>, accessed 12 August 2016.

The National Centre for Non-Destructive Testing (NCNDT) is a PAEC subsidiary¹³³ that undertakes non-destructive testing for PAEC and other clients.

NCNDT has worked on various strategic projects, including PAEC's Khushab plutonium production reactors, and has also provided testing services to the NDC, AWC, and other strategic entities, according to a PAEC annual report.¹³⁴



Figure 9. NCNDT logo¹³⁵

Key personnel

NCNDT's current senior personnel are not known.

Involvement in proliferation/procurement

Only one import by NCNDT has been seen in trade data: a procurement of 'radiation materials' – most likely for non-destructive testing purposes – possibly from Poland's National Centre for Nuclear Research.¹³⁶

International footprint

NCNDT is not known to have an international footprint.

¹³³ Pakistan Atomic Energy Commission, 'Annual report 2009-10,' 2010, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/43/107/43107324.pdf, accessed 7 September 2016.

¹³⁴ Pakistan Atomic Energy Commission, 'Annual report 2009-10,' 2010, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/43/107/43107324.pdf, accessed 7 September 2016.

¹³⁵ 'Contact Details of NCNDT,' National Centre for Non-Destructive Testing, undated, <http://www.ncndt.org.pk/contact.html>, accessed 6 September 2016.

¹³⁶ Trade data sourced by Project Alpha.

National Centre for Non-Destructive Testing (NCNDT)				
Reports to	PAEC			
Also known as	NCNDT			
Current head	?			
Address	Plot No. 234, Street 7, Sector I-9/2, Industrial Area, Islamabad. P.O. Box No. 1781 ¹³⁷			
Contact details	Tel 92-51-9257347, 92-51-9258538, fax 92-51-9258642, 92-51-9258524 ¹³⁸			
Designated by	Japan	BIS		
	N	N		

¹³⁷ 'Contact Details of NCNDT,' National Centre for Non-Destructive Testing, undated, <http://www.ncndt.org.pk/contact.html>, accessed 6 September 2016.

¹³⁸ 'Contact Details of NCNDT,' National Centre for Non-Destructive Testing, undated, <http://www.ncndt.org.pk/contact.html>, accessed 6 September 2016.

The Pakistan Welding Institute (PWI) is a PAEC subsidiary that provides training in welding techniques to the PAEC and other clients.¹³⁹

PWI has worked on strategic projects including the Khushab plutonium production reactors, according to a PAEC annual report.¹⁴⁰



Figure 10. PWI logo¹⁴¹

Key personnel

No senior officials of PWI are known.

Involvement in proliferation/procurement

No procurements by PWI have been identified.

International footprint

PWI is not known to have an international footprint, although it probably trains some foreign students.

¹³⁹ Pakistan Atomic Energy Commission, 'Annual report 2009-10,' 2010, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/43/107/43107324.pdf, accessed 7 September 2016.

¹⁴⁰ Pakistan Atomic Energy Commission, 'Annual report 2009-10,' 2010, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/43/107/43107324.pdf, accessed 7 September 2016.

¹⁴¹ 'Pakistan Welding Institute,' Science Pakistan, undated, <http://www.pakchem.net/2011/09/pakistan-welding-institute-pwi.html#.V9AUqvkrKUK>, accessed 7 September 2016.

Pakistan Welding Institute (PWI)				
Reports to	PAEC			
Also known as	PWI			
Current head	?			
Address	Plot No. 223, Street 7, I-9/2, Industrial Area, Islamabad. ¹⁴²			
Contact details	Tel 92-51-9258534, 92-51-8257347-53. Fax 92-51-9258524 ¹⁴³			
Designated by	Japan	BIS		
	N	N		

¹⁴² 'Contacts of Pakistan Welding Institute,' Pakistan Welding Institute, undated, <http://pwi.org.pk/contact.html>, accessed 7 September 2016.

¹⁴³ 'Contacts of Pakistan Welding Institute,' Pakistan Welding Institute, undated, <http://pwi.org.pk/contact.html>, accessed 7 September 2016.

The Pakistan Institute of Science and Technology is the PAEC's premier research and development institution.¹⁴⁴ PINSTECH oversees a combination of civil and military-related nuclear research and medical isotope production,¹⁴⁵ and operates a mix of safeguarded and unsafeguarded facilities. PINSTECH's main complex at Nilore contains the unsafeguarded New Laboratories (New Labs) reprocessing facility, where Pakistan has separated plutonium for use in nuclear weapons.¹⁴⁶



Figure 11. PINSTECH logo¹⁴⁷

While PINSTECH does not widely advertise its involvement in work for Pakistan's strategic programmes, since the 1970s, PINSTECH has consistently been involved in various projects relating to Pakistan's nuclear weapons programme and unsafeguarded nuclear fuel cycle. Known examples of PINSTECH's involvement in these activities include:

- Centrifuge research aimed at highly-enriched uranium production in the 1970s.¹⁴⁸
- Work on explosive lenses for nuclear weapons during the 1970s.¹⁴⁹
- Training in chromatography of employees of the PAEC's unsafeguarded Khushab plutonium-production reactors, as well as employees of NDC and KRL, as recently as 2010.¹⁵⁰
- Training in chemical separation for employees of the unsafeguarded Chemical Plants Complex as well as for employees of the PAEC's Directorate of Technical Development (DTD), the PAEC's nuclear weapon design laboratory, as recently as 2011.¹⁵¹
- Training of reactor operators from the unsafeguarded Khushab plutonium-production reactors as recently as 2015.¹⁵²

¹⁴⁴ 'Research & Development,' Pakistan Atomic Energy Commission, undated, <http://www.paec.gov.pk/RnD/>, accessed 7 September 2016.

¹⁴⁵ Major General Mahmud Ali Durrani, 'Pakistan's Strategic Thinking and the Role of Nuclear Weapons,' SAND 2004-3375P, Cooperative Monitoring Center Occasional Paper 37, Sandia National Laboratories, http://www.sandia.gov/cooperative-monitoring-center/_assets/documents/sand2004-3375p.pdf, accessed September 2016.

¹⁴⁶ Khan, *Eating Grass*, p.122.

¹⁴⁷ Image credit: Wikimedia Commons.

¹⁴⁸ Khan, *Eating Grass*, p.153.

¹⁴⁹ Khan, *Eating Grass*, p.179.

¹⁵⁰ 'PakAtom,' November-December 2010, p.6, http://www.nti.org/media/pdfs/37_4.pdf?_=1316819477, accessed 8 September 2016.

¹⁵¹ PINSTECH Newsletter, November-December 2011, <http://www.sidnlps.org.pk/pictures/PNL-NOV-DEC-2011.PDF>, accessed 8 September 2016.

¹⁵² 'Visit of CHASNUPP and KCP Operations Crew to PINSTECH,' PINSTECH Newsletter, July-August 2015, p.3, <http://www.sidnlps.org.pk/PICTURES/PNL-Jul-Aug-2015.pdf>, accessed 8 September 2016.

- Training in analytical techniques for employees of the PAEC's unsafeguarded Uranium Metal Laboratory (UML) and the DTD, as well as for employees of the NDC, in February 2016.¹⁵³

Key personnel

As of February 2016, Engineer Iqbal Hussain Khan is director-general of PINSTECH.¹⁵⁴



Figure 12. Engineer Iqbal Hussain Khan¹⁵⁵

Involvement in proliferation/procurement

The US government has cited PINSTECH for violations of US export controls. In 2014, the US Department of Commerce added a PINSTECH scientist, Irum Mehboob Raja, for procuring US-origin goods without required licences, as well as adding PINSTECH to its list of foreign entities requiring export approval.¹⁵⁶

PINSTECH has also reportedly been involved in covert attempts to produce tritium for use in nuclear weapons. In 1986, the US government expressed concern that Pakistani agents in Germany were seeking to procure tritiated targets which could be used at the PINSTECH facility in Nilore to extract pure tritium.¹⁵⁷ In 1989, German prosecutors stated that the PAEC approached two German companies seeking lithium-6, which was to be irradiated in PINSTECH's PARR-1 reactor for the purpose of producing tritium.¹⁵⁸

¹⁵³ 'Three Day Hands-on Training on Advanced Analytical Techniques,' PINSTECH Newsletter, January-February 2016, p.3, <http://www.sidnlps.org.pk/pictures/PNL-Jan-Feb-2016.pdf>, accessed 8 September 2016.

¹⁵⁴ 'PINSTECH Newsletter,' Issue 38, January-February 2016, <http://www.sidnlps.org.pk/pictures/PNL-Jan-Feb-2016.pdf>, accessed 7 September 2016.

¹⁵⁵ 'Iqbal Hussain Khan,' LinkedIn, undated, <https://pk.linkedin.com/in/iqbal-hussain-khan-25b9aa51>, accessed 7 September 2016.

¹⁵⁶ 'Addition and Modification of Certain Persons on the Entity List; and Removal of Certain Persons From the Entity List,' United States Federal Register, Vol. 79, No. 181, 18 September 2014, https://www.bis.doc.gov/index.php/forms-documents/doc_download/1066-79-fr-5599, accessed 8 September 2016.

¹⁵⁷ Mark Hibbs, 'GERMAN FIRM'S EXPORTS RAISE CONCERN ABOUT PAKISTAN'S NUCLEAR CAPABILITIES,' *Nuclear Fuel*, 6 March 1989, Vol. 14, No. 5, p.13 (via Factiva).

¹⁵⁸ Mark Hibbs, 'PROSECUTORS LINK TRITIUM PLANT TO PAKISTAN WEAPONS PROGRAM,' *Nuclear Fuel*, 1 May 1989, Vol. 14, No. 9, p.12 (via Factiva).

PINSTECH has also been seen making several imports of dual-use goods under its own name, including from suppliers in the US and Austria.

Key facilities

PINSTECH's main facility is in Nilore, Pakistan. The Nilore site (see figure below) contains PINSTECH's IAEA-safeguarded research reactors (PARR-1 and PARR-2); the PAEC's National Institute for Lasers and Optronics (NILOP); the Pakistan Institute for Engineering and Applied Sciences (PIEAS); and the unsafeguarded New Labs reprocessing facility. Each of these entities is described below.



Figure 13. PARR-1 reactor at PINSTECH, Nilore¹⁵⁹

¹⁵⁹ Image credit: Mushtaq Ahmed, Pakistan Institute of Nuclear Science and Technology, 'Production of Radioisotopes in Pakistan Research Reactor: past, present and future,' July 2010, http://www-pub.iaea.org/MTCD/Publications/PDF/SupplementaryMaterials/TECDOC_1713_CD/template-cd/datasets/presentations/10_Pakistan_Mushtaq.pdf, accessed 7 September 2016.



PAEC PINSTECH complex, Nilore

Image © 2015 DigitalGlobe

Image from Google Earth/DigitalGlobe
33.657521°, 73.258273° (23 April 2015)

International footprint

PINSTECH scientists have conducted training and attended workshops at foreign institutions in countries including Canada, China, Hungary, Indonesia, Italy, Malaysia, Sri Lanka, and Thailand. PINSTECH officials also frequently attend IAEA events.¹⁶⁰

Pakistan Institute for Nuclear Technology (PINSTECH)			
Reports to	PAEC		
Also known as	PINSTECH		
Current head	Iqbal Hussain Khan		
Address	Nilore, Pakistan		
Contact details	Tel 92-51-2207201, 9248790, 9248801; Fax 92-51-2207374, 9248808 ¹⁶¹		
Designated by	Japan	BIS	
	Y	Y	

¹⁶⁰ PINSTECH Newsletter, November-December 2015, <http://www.sidnlps.org.pk/pictures/PNL-Nov-Dec-2015.pdf>, accessed 8 September 2016; PINSTECH Newsletter, January-February 2016, <http://www.sidnlps.org.pk/pictures/PNL-Jan-Feb-2016.pdf>, accessed 8 September 2016.

¹⁶¹ 'Pakistan Institute of Nuclear Science & Technology,' Phone Book Online, undated, <http://www.phonebook.com.pk/company/102889-Pakistan-Institute-of-Nuclear-Science-Technology>, accessed 15 September 2016.

Pakistan's first nuclear fuel reprocessing facility is located at the New Laboratories (New Labs) complex at the PINSTECH facility in Nilore. This unsafeguarded facility separates plutonium for use in Pakistan's plutonium-based nuclear weapons. New Labs is also known as NLP (New Labs PINSTECH).¹⁶²

By 1998, according to Khan, New Labs could extract about 8-15kg of plutonium per year from Khushab's spent fuel.¹⁶³ An expansion of the New Labs facility between 2002 and 2006 has likely increased this capacity,¹⁶⁴ and possibly doubled it.¹⁶⁵

According to a declassified CIA report, the reduction of uranium compounds to uranium metal has been undertaken at PINSTECH's Uranium Metal Labs (UML), located in the New Labs complex.¹⁶⁶ Khan states that this work has since been moved to the KRL facility at Kahuta due to security concerns regarding the transport of enriched uranium, although it is unclear whether uranium metallurgy work has ceased at PINSTECH.¹⁶⁷

New Labs also contains a plutonium metallurgy facility, used for casting and machining plutonium into a form suitable for use in nuclear weapons, according to the same CIA report. It is unknown whether this facility remains active.¹⁶⁸

Key personnel

No senior personnel of New Labs have been identified.

Involvement in proliferation/procurement

New Labs has been a beneficiary of foreign-obtained technology, and its original reprocessing capability was based on technology procured from Belgium. As Mark Hibbs has noted, during the 1970s, Pakistan obtained for New Labs a pilot-scale separation plant from a Belgian company, Belgonucleaire, as well as additional technology from a French company, SGN, and expertise from

¹⁶² See Aziz et al, 'SECTOR EMERGENCY PROCEDURES FOR PAKISTAN RESEARCH REACTOR-1 (PARR-1), PINSTECH,' PINSTECH/HPD-I43, December 1992, available online at http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/26/017/26017060.pdf, accessed 8 September 2016.

¹⁶³ Khan, *Eating Grass*, p.200.

¹⁶⁴ David Albright and Paul Brannan, 'Pakistan Expanding Plutonium Separation Facility Near Rawalpindi,' 19 May 2009, http://isis-online.org/uploads/isis-reports/documents/PakistanExpandingNewLabs_19May2009.pdf, accessed 1 September 2016.

¹⁶⁵ Khan, *Eating Grass*, p.387.

¹⁶⁶ Central Intelligence Agency, 'Pakistan's nuclear weapons program: personnel and organizations,' 23 September 1985, http://www.foia.cia.gov/sites/default/files/document_conversions/89801/DOC_0000252646.pdf, accessed 21 July 2016.

¹⁶⁷ Khan, *Eating Grass*, p.181.

¹⁶⁸ Central Intelligence Agency, 'Pakistan's nuclear weapons program: personnel and organizations,' 23 September 1985, http://www.foia.cia.gov/sites/default/files/document_conversions/89801/DOC_0000252646.pdf, accessed 21 July 2016.

the UK Atomic Energy Agency.¹⁶⁹ In 1978, West German company Nukem GmbH provided New Labs with 'waste liquid vaporizing technology,' according to Hibbs.¹⁷⁰

Subsequent procurements for New Labs have been less visible, reflecting the highly sensitivity nature of the site. In about 2001, a Chinese state-owned enterprise, the Seventh Design and Research Institute, reportedly transferred 50 ceramic capacitors to New Labs, according to an Indian media article.¹⁷¹

No procurements by New Labs have been identified in trade data. Any procurements made for New Labs would almost certainly be conducted through a PAEC front company that has not yet been identified.

Key facilities

The New Labs facility at PINSTECH, Nilore, is shown below.

¹⁶⁹ Mark Hibbs, 'PAKISTANI SEPARATION PLANT NOW PRODUCING 8-10 KG PLUTONIUM/YR,' *Nuclear Fuel*, 12 June 2000, Vol. 25, No. 12, p.1 (via Factiva); Mark Hibbs, 'AFTER 30 YEARS, PAEC FULFILLS MUNIR KHAN'S PLUTONIUM AMBITION,' *Nucleonics Week*, 15 June 2000, Vol. 41, No. 24, (via Factiva).

¹⁷⁰ Mark Hibbs, 'U.S. REPEATEDLY WARNED GERMANY ON NUCLEAR EXPORTS TO PAKISTAN,' *Nuclear Fuel*, 6 March 1989, Vol. 14, No. 5, p.12 (via Factiva).

¹⁷¹ Rahul Datta, 'China aiding Pak produce nukes,' *The Pioneer*, 14 February 2001, <http://www.hindunet.org/hvk/articles/0201/63.html>, accessed 8 September 2016.

PAEC New Labs (NLP), Nilore



International footprint

New Labs is not known to have an international footprint. However, scientists affiliated with New Labs possibly attend international conferences and workshops.

New Laboratories (New Labs)				
Reports to	PAEC			
Also known as	Nilore Factory, NLP, New Laboratories			
Current head	?			
Address	PO Box 1356, Islamabad, Pakistan; ¹⁷² Nilore, Pakistan			
Contact details	?			
Designated by	Japan	BIS		
	Y	N		

¹⁷² 'List of Islamabad Chapter (annual),' Chemical Society of Pakistan, October 2009-March 2010, http://www.chemicalsocietyofpakistan.com/downloads/Alchemy_vol17.doc, accessed 15 September 2016; Rehman et al, 'Pyrolytical characterization of transition metal complexes of cobalt, nickel, copper and zinc with ethylenediamine-N,N'-diacetate,' *Journal of Thermal Analysis and Calorimetry*, 2010, vol. 102, no. 2, pp. 715-722, <http://cat.inist.fr/?aModele=afficheN&cpsid=23351674>, accessed 15 September 2016.

The Pakistan Institute of Engineering and Applied Sciences (PIEAS) is a university that teaches postgraduate, undergraduate and short course students in engineering and scientific subjects.¹⁷³ It was established as a PAEC training school and has since become a division of PINSTECH.¹⁷⁴ It is subordinate to the PAEC.¹⁷⁵

PIEAS provides various training programmes to PAEC staff, including in vacuum technology, radiation protection, and health physics.¹⁷⁶ In addition to training PAEC staff, PIEAS probably trains graduates for other strategic organisations. In 2016, a Pakistani senior official stated that ‘PIEAS has become a provider of quality manpower to all the strategic organizations of the country including PAEC [...] NESCOM [and] KRL’.¹⁷⁷

PIEAS is involved in research collaborations with Pakistani strategic organisations beyond the PAEC. In an annual report, PIEAS states that one of its domestic research partners is NESCOM, the overseer of Pakistan’s WMD programmes.¹⁷⁸

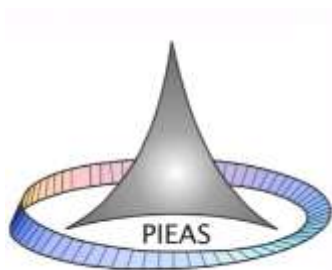


Figure 14. PIEAS logo¹⁷⁹

Key personnel

Dr Muhammad Aslam (see below) is currently rector of PIEAS.

¹⁷³ ‘Institute Profile,’ Pakistan Institute of Engineering and Applied Sciences, undated, <http://www.pieas.edu.pk/about/profile.cshtml>, accessed 7 September 2016.

¹⁷⁴ ‘Genesis,’ Pakistan Institute of Engineering and Applied Sciences, undated, <http://www.pieas.edu.pk/about/genesis.cshtml>, accessed 7 September 2016.

¹⁷⁵ ‘Research and Academic Achievements,’ Pakistan Institute of Engineering and Applied Sciences, file dated February 2015, <http://www.pieas.edu.pk/documents/piara.pdf>, accessed 7 September 2016.

¹⁷⁶ Abdullah Sadiq, ‘STATUS OF HIGHER EDUCATION IN NUCLEAR TECHNOLOGY IN PAKISTAN,’ Pakistan Institute of Engineering and Applied Sciences, undated, http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/40/102/40102286.pdf, accessed 7 September 2016.

¹⁷⁷ ‘Ahsan for adopting modern techniques in research,’ *The Nation*, 21 April 2016 (via Factiva).

¹⁷⁸ ‘Research and Academic Achievements,’ Pakistan Institute of Engineering and Applied Sciences, file dated February 2015, <http://www.pieas.edu.pk/documents/piara.pdf>, accessed 7 September 2016.

¹⁷⁹ ‘PIEAS and PAEC Introduction video,’ YouTube, 24 May 2016, <https://www.youtube.com/watch?v=MEj-x3LVXIO>, accessed 6 September 2016.



Figure 15. Dr Muhammad Aslam¹⁸⁰

Involvement in proliferation/procurement

While no procurements of particular sensitivity have been identified, PIEAS has repeatedly imported goods from US, UK and European companies and institutions.

International footprint

PIEAS is involved in multiple research collaborations with entities outside Pakistan, including several universities in the UK.¹⁸¹ Some of these collaborations are shown in the figure below.

¹⁸⁰ 'Message from the Rector,' Pakistan Institute of Engineering and Applied Sciences, undated, <http://www.pieas.edu.pk/about/rector.cshtml>, accessed 7 September 2016.

¹⁸¹ See, e.g., 'List of Current Collaborators,' Warwick University, undated, <http://www2.warwick.ac.uk/fac/sci/dcs/research/combi/people/collabs/>, accessed 7 September 2016; 'PIEAS-QTeQ paper published in PRA,' Queen's University Belfast, 10 September 2014, <http://web.am.qub.ac.uk/wp/qo/2014/09/10/pieas-qteq-paper-published-in-pra/>, accessed 7 September 2016; 'A Fault Tolerant, Dynamic and Low Latency BDII Architecture for Grids,' International Journal of Grid and Distributed Computing, University of the West of England, 2010, http://eprints.uwe.ac.uk/11918/1/IJGDC_BDII_Final.pdf, accessed 7 September 2016.

International Research Collaboration

Atmospheric Modeling

University of Mexico (UNAM)

Bioinformatics

Catholic University of Daegu, South Korea



Biophotonics

Harvard University, USA

Tufts University, USA

University of Memphis, USA

University of Dundee, UK

University of Sao Paulo, Brazil

Biomedical Engineering

Massachusetts Institute of Technology, USA

Computational Intelligence

University of Stirling, UK

Image Analysis/ Processing

Gwangju Institute of Science & Technology,
South Korea

University of Bielefeld, Germany

University of Sussex, UK

University of Warwick, UK

MEMS

University of Southampton, UK

Imperial College, UK

Materials Development

Queensland University, Aus

Zhejiang University, China

Nanoelectronics

Tokyo Institute of Technology

Nuclear Engineering

Atilim University, Turkey

Polymeric Nanocomposites

Cornell University, USA

Pusan National University, South Korea

Kuwait University

Probabilistic Risk Analysis

Kyung Hee University, South Korea

Quantum Optics

Texas A & M University, USA



Figure 16. International collaborations of PIEAS¹⁸²

¹⁸² 'Research and Academic Achievements,' Pakistan Institute of Engineering and Applied Sciences, file dated February 2015, <http://www.pieas.edu.pk/documents/piara.pdf>, accessed 7 September 2016.

Pakistan Institute of Engineering and Applied Sciences (PIEAS)				
Reports to	PINSTECH			
Also known as	PIEAS, Centre for Nuclear Studies, CNS			
Current head	Dr Muhammad Aslam			
Address	P.O. Nilore, Islamabad, Pakistan ¹⁸³			
Contact details	Tel 92 51 1111 PIEAS, 92 51 1111 74327, fax 92 51 924 8600 ¹⁸⁴			
Designated by	Japan	BIS		
	Y	N		

¹⁸³ Trade data sourced by Project Alpha.

¹⁸⁴ Genesis, 'Pakistan Institute of Engineering and Applied Sciences, undated, <http://www.pieas.edu.pk/about/genesis.cshhtml>, accessed 7 September 2016.

The National Institute for Laser and Optronics is Pakistan's premier facility for research and development in lasers and laser-based technology.¹⁸⁵ While NILOP does not widely advertise its association with PAEC, it is described in multiple official sources as being a PAEC subsidiary.¹⁸⁶ NILOP was established in about 2007 as an expansion of the PAEC's laser programme.¹⁸⁷

NILOP produces laser systems including for military use.¹⁸⁸ It is not known to have a role in Pakistan's strategic programmes, but any laser-related work for nuclear weapon design or verification, or any enrichment of uranium by laser separation, would likely be conducted at NILOP or involve NILOP resources.



Figure 17. NILOP logo¹⁸⁹

Key personnel

As of December 2015, Maqbool Ahmed Chaudry was NILOP's Director-General.¹⁹⁰

Involvement in proliferation/procurement

NILOP has been seen in trade data as importing dual-use goods from abroad. Procurements of interest include:

- Vacuum pumps and accessories from Agilent Technologies, a multinational manufacturer of vacuum equipment, probably for use in laser-related processes.
- Shipments of unknown items from a US company, Thor Labs.

¹⁸⁵ 'Nuclear research & development,' *Pakistan Observer*, 24 August 2013, 7 September 2016.

¹⁸⁶ See, eg., 'MERIT LIST OF APPROVED SCIENTISTS / ENGINEERS FOR RESEARCH PRODUCTIVITY AWARD 2011-2012,' Pakistan Council for Science and Technology, February 2012, <http://www.pcst.org.pk/docs/rpa2011-12.pdf>, accessed 31 August 2016; 'Annual report,' Pakistan Atomic Energy Commission, 2009-10, p.17, available online at http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/43/107/43107324.pdf, accessed 31 August 2016.

¹⁸⁷ 'ECNEC approves developments projects of Rs, 116 billion,' *The Baluchistan Times*, 22 October 2007 (via Factiva); 'Dr Shaukat appointed as Coordinator General COMSTECH,' Pakistan Press International Information Services, 20 July 2014 (via Factiva).

¹⁸⁸ Shaukat Hameed Khan, 'Celebrating 50 Years of the Laser,' http://www.khwarizmi.org/system/files/activities/233/laser_shaukat.pdf, accessed 6 September 2016.

¹⁸⁹ Image source: <http://www.pieas.edu.pk/events/workshop/gan2015/poster.pdf>

¹⁹⁰ 'PSF News,' Pakistan Science Foundation, December 2015, vol 3 no 2, p.3, available online at <http://www.psf.gov.pk/newsletters/dec15.pdf>, accessed 31 August 2016; 'People urged to stand up against capitalist forces,' *Dawn*, 25 November 2015, <http://www.dawn.com/news/1222142>, accessed 31 August 2016.

- A compact spectrofluorometer from a US company, Horiba Instruments, possibly useable for activities in the nuclear fuel cycle.

International footprint

NILOP probably has multiple research arrangements with overseas institutions.

National Institute for Lasers and Optronics (NILOP)			
Reports to	PAEC		
Also known as	NILOP		
Current head	Maqbool Ahmed Chaudry		
Address	Lethar Road, Nilore, Islamabad, Pakistan ¹⁹¹		
Contact details	Phone: 92-51-9248687, 92-51-2208052, Fax: 92-51-2208051 ¹⁹² email: info@nilop.edu.pk ¹⁹³		
Designated by	Japan	BIS	

¹⁹¹ Trade data sourced by Project Alpha.

¹⁹² <http://www.pieas.edu.pk/events/workshop/gan2015/poster.pdf>

¹⁹³ <https://web.archive.org/web/20120428214006/http://www.nilop.edu.pk/>

The PAEC's Directorate of Technical Development (DTD) was established in 1974 to handle 'all aspects' of the PAEC's work in nuclear weapon design, fabrication and testing, according to Khan.¹⁹⁴ DTD remains active today, according to several official PAEC documents, but its current remit is unknown.¹⁹⁵

DTD is probably also known as Ishfaq Ahmad Research Laboratories, a PAEC entity which shares the same postal address.¹⁹⁶

Key personnel

DTD's current senior personnel are not known. As of 2010, Dr Muhammad Hamid Sarwar Wattoo was listed as a DTD senior scientist, according to a Chemical Society of Pakistan document.¹⁹⁷

Involvement in proliferation/procurement

No procurements by DTD have been identified, although PAEC front companies probably import equipment for DTD from abroad.

Key facilities

DTD is probably based at the main PINSTECH facility in Nilore, Pakistan.

International footprint

DTD scientists are probably engaged in research collaboration with Chinese institutions, although it is unclear whether this has involved any research directly applicable to nuclear weapons. A PAEC scientist probably affiliated with DTD¹⁹⁸ has published several research papers on plasma physics with the Institute of Plasma Physics of the Chinese Academy of Scientists.¹⁹⁹ This person has also attended at least one international conference on plasma physics under the auspices of the IAEA.²⁰⁰

¹⁹⁴ Khan, *Eating Grass*, p.177.

¹⁹⁵ 'Three Day Hands-on Training on Advanced Analytical Techniques,' PINSTECH Newsletter, January-February 2016, p.3, <http://www.sidnlps.org.pk/pictures/PNL-Jan-Feb-2016.pdf>, accessed 8 September 2016.

¹⁹⁶ Akram et al, 'Determination of gamma-emitting radionuclides in the inter-tidal sediments off Balochistan (Pakistan) Coast, Arabian Sea,' *Radiation Protection Dosimetry*, 2007, 123(2): pp.268-73, <http://www.ncbi.nlm.nih.gov/pubmed/16899470>, accessed 15 September 2016

¹⁹⁷ 'List of Islamabad Chapter (annual),' Chemical Society of Pakistan, October 2009-March 2010, http://www.chemicalsocietyofpakistan.com/downloads/Alchemy_vol17.doc, accessed 15 September 2016

¹⁹⁸ This person lists his postal address as PO Box 2151, Islamabad. This is the PO Box used by DTD.

¹⁹⁹ See 'Study of Current drive efficiency and its correlation with photon temperature in the HT-7 tokamak,' National Centre for Physics, 2 March 2010, http://www.npc.edu.pk/docs/iss/talks/group_iii/g3_d2_dr_jawad.pdf, accessed 15 September 2016.

²⁰⁰ 'Joint ITER-IAEA-ICTP Advanced Workshop on Fusion and Plasma Physics,' Abdus Salam International Center for Theoretical Physics, October 2011, <http://indico.ictp.it/event/a10172/material/6/0.pdf>, accessed 15 September 2016.

Directorate of Technical Development (DTD)				
Reports to	PAEC			
Also known as	Probably Ishfaq Ahmad Research Laboratories			
Current head	?			
Address	PO Box 2151, Islamabad, Pakistan ²⁰¹			
Contact details	-			
Designated by	Japan	BIS		
	N	N		

²⁰¹ 'List of Islamabad Chapter (annual),' Chemical Society of Pakistan, October 2009-March 2010, http://www.chemicalsocietyofpakistan.com/downloads/Alchemy_vol17.doc, accessed 15 September 2016

The Al-Technique Corporation (ATCOP) is a PAEC subsidiary. The PAEC has described ATCOP as its ‘commercial wing’, and ATCOP functions as a means of selling PAEC services to the private sector.²⁰² According to a summary written by a former ATCOP official:

AL-TECHNIQUE Corporation of Pakistan Limited (ATCOP) was established in 1984 as a subsidiary of Pakistan Atomic Energy Commission (PAEC). It was to pave way for the interaction of public sector with the private sector in non-conventional technologies, and to bring the technologies developed in PAEC to the doorsteps of the common man. ATCOP provides services to pharmaceutical, food, agriculture, civil and electrical industries.²⁰³

In addition to undertaking services for civil industries, ATCOP also produces optoelectronic and laser-related equipment for military use. This includes laser threat warning devices for use on armoured vehicles²⁰⁴ and thermal gunsights for small arms.²⁰⁵



Figure 18. ATCOP logo²⁰⁶

It is unclear whether ATCOP has any role in PAEC’s strategic activities.

Key personnel

ATCOP’s current senior leadership are not known.

²⁰² ‘PakAtom: Newsletter of the Pakistan Atomic Energy Commission,’ Pakistan Atomic Energy Commission, September-October 2014, <http://paec.gov.pk/documents/pakatom/PakAtom%20Sep-Oct%202014.pdf>, accessed 15 August 2016.

²⁰³ Abdul Hai, ‘Al-Technique Corporation of Pakistan Ltd,’ The Dawn Sarsabz Pakistan AgriExpo, 2013, <http://agri.dawn.com/wp-content/supplement/sup-2013/agri-expo-2013-22.pdf>, accessed 15 August 2016.

²⁰⁴ ‘Designation: LTS 1,’ undated, Army Guide, <http://www.army-guide.com/eng/product3779.html>, accessed 15 August 2016.

²⁰⁵ ‘Pakistan to Produce Over 900 Thermal Gunner’s Sights,’ *Forecast International*, 15 December 2005 (via Factiva).

²⁰⁶ Image source: <http://www.technolinez.com/atcop/download.html>

Involvement in proliferation/procurement

ATCOP has not been known to be involved in instances of illicit proliferation or procurement. In response to Pakistan's nuclear tests in 1998, the US government designated ATCOP as subject to US export controls, declaring it an entity 'involved in nuclear activities', probably because of ATCOP's known role as a subsidiary of PAEC. ATCOP remains on a US Department of Commerce export control list.²⁰⁷

Key facilities

As well as an office in Islamabad, ATCOP reportedly also maintains a 7500m² facility 20km outside Islamabad on the Potohar Plateau.²⁰⁸ This facility has not been identified.

Subsidiaries and associated entities

ATCOP states on its website²⁰⁹ that it oversees six commercial entities:

- Pakistan Radiation Services (PARAS), an irradiation facility²¹⁰
- SOILCON, a geotechnical investigation laboratory
- ATCOP Medical, which undertakes sterilisation of medical disposables
- Powertech, an electrical panel manufacturer
- Agrolaser, a laser land-levelling system
- Paras Food, a food irradiation project.

International footprint

ATCOP has been recorded in trade data²¹¹ as importing a laser designator from the Malaysian Ministry of Defense's Science and Technology Research Institute for Defence (STRIDE), an entity whose stated mission is to provide 'technical support and scientific expertise to the Malaysian Armed Forces.'²¹²

²⁰⁷ United States Bureau of Industry and Security, 'Supplement No. 4 to Part 744 - ENTITY LIST,' 21 June 2016, <http://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern/entity-list>, accessed 15 August 2016.

²⁰⁸ 'Al-Technique Corporation PVT LTD,' undated, Pakistani Senate Committee on National Defence, <http://www.senatedefencecommittee.com.pk/production-detail.php?pageid=news-detail&pid=MTU=>, accessed 15 August 2016.

²⁰⁹ 'Al-Technique Corporation of Pakistan Ltd,' undated, <http://www.technolinez.com/atcop/download.html>, accessed 28 September 2016.

²¹⁰ Located at 31.439691, 74.192887.

²¹¹ Trade data sourced by Project Alpha.

²¹² 'Vision, mission and objective,' Science and Technology Research Institute for Defence (STRIDE), <http://www.stride.gov.my/v1/index.php/en/2013-07-02-08-07-42/visi-misi-objektif>, accessed 15 August 2016.

Al-Technique Corporation (ATCOP)				
Reports to	PAEC			
Also known as	Altechnique			
Current head	?			
Address	4th Floor, Dodhy Plaza, 52 Jinnah Avenue, P.O. Box 1878, Islamabad, Pakistan ²¹³			
Contact details	Ph (9251) 2207340, fax (9251) 9221453			
Designated by	Japan	BIS		
	Y	Y		

²¹³ United States Industry and Security Bureau, 'Addition of Certain Persons to the Entity List; Removal of Person From the Entity List Based on Removal Request; and Implementation of Entity List Annual Review Changes,' 19 September 2012, <https://www.federalregister.gov/articles/2012/09/19/2012-22952/addition-of-certain-persons-to-the-entity-list-removal-of-person-from-the-entity-list-based-on>, accessed 15 August 2016.

Khan Research Laboratories (also known as the Institute of Industrial Control Systems)

Khan Research Laboratories (KRL) is one of the two main organisational pillars of Pakistan's strategic nuclear programme, alongside the PAEC. Using centrifuge technology stolen from his former employer, Urenco, AQ Khan built at KRL Pakistan's industrial uranium enrichment capability, which KRL probably retains responsibility for today. In addition to its nuclear role, KRL has been one of Pakistan's primary developers of defence and strategic systems, and has been a key entity in the development of Pakistan's Ghauri/Hatf-V missile.²¹⁴

In addition to its role in Pakistan's strategic programmes, KRL also produces and markets a range of non-strategic weapons and related military items. KRL has a biomedical and genetic engineering division which probably conducts civil medical research.²¹⁵ KRL has also attempted to join at least one major civil energy project in Pakistan, the Uch-2 gas field project, although it is unclear whether this was successful.²¹⁶

KRL comes under the authority of the SPD, according to an official 2013 Pakistani government circular.²¹⁷



Figure 19. KRL logo²¹⁸

²¹⁴ Mark Fitzpatrick, ed, *Nuclear Black Markets: Pakistan, AQ Khan, and the rise of proliferation networks*, London: International Institute for Strategic Studies, 2007, p.31; Douglas Frantz and Catherine Collins, *The Nuclear Jihadist*, New York: Hachette Book Group, 2007, p.229; US State Department, 'ADDITIONAL INFORMATION TO HELP TURKEY PREVENT THE TRANSFER OF FILAMENT WINDING MACHINES TO PAKISTAN (S),' 31 March 2008, 08STATE33089_a, https://wikileaks.org/plusd/cables/08STATE33089_a.html, accessed 1 March 2016.

²¹⁵ Pakistan Council for Science and Technology, 'PROVISIONAL RESULT FOR RESEARCH PRODUCTIVITY AWARD (RPA) 2015-16,' <http://pcst.org.pk/docs/PROVISIONALRESULTFORRPA2015-16.pdf>, 2016,

²¹⁶ Zafar Bhutta, 'Chain effect: Pakistan may lose foreign investment in power sector,' *The Express Tribune*, 9 July 2011, <http://tribune.com.pk/story/205562/chain-effect-pakistan-may-lose-foreign-investment-in-power-sector/>, accessed 14 September 2016.

²¹⁷ Federal Public Service Commission, 'Circular,' 2 December 2013, <http://fpsc.gov.pk/icms/admin/documents/forms/grant%20of%20age%20relaxation-04-12-2013.pdf>, accessed 2 September 2016.

²¹⁸ Image via <http://www.krl.com.pk/>.

Institute of Industrial Control Systems

Since the public disclosure of AQ Khan's proliferation network in the early 2000s, KRL's public profile has largely been superseded by that of the 'Institute of Industrial Control Systems' (IICS). IICS utilises many of the addresses that were associated with KRL. IICS is also the name most commonly used by KRL employees for academic publications – including by authors who had previously published with AQ Khan, and who have previously listed KRL as their affiliation in academic papers.

The Institute of Industrial Control Systems (IICS) has been described by US and Japanese authorities as a KRL alias, but it also appears to operate like a subordinate entity for outward-facing activity, including commercial sales and academic publications.²¹⁹

IICS is involved in marketing conventional arms and weapon systems. According to a 2015 Pakistani defence industry marketing brochure, IICS produces 'a wide range of defence related products including sophisticated weapon systems like Surface-to-Air missile ANZA Mk-II, anti-tank guided missile weapon system Baktar Shikan, and laser range finder... [as well as] some other products in the field of lasers like laser actuated target, laser threat sensor and laser aided automatic fire control system for manual anti-aircraft gun'.²²⁰



Figure 20. IICS logo²²¹

Proliferation and procurement

When under the leadership of AQ Khan, KRL was a hive of illicit procurement from foreign suppliers. From 1976 until 2002, Khan ordered 'enormous amounts of all kinds' of dual-use equipment from abroad required for KRL's enrichment programme, initially from contractors for Urenco whose details had been taken by Khan.²²² These included specialty metals, vacuum and process equipment, and electronics useable for the centrifuge enrichment process.

US diplomatic cables record further instances of illicit procurement by KRL dating past Khan's forcible retirement by the Pakistani government. In 2008, KRL was attempting to obtain four- and six-axis filament winding machines from a Turkish company, Tet Makina Metal Sanayi Ve Ticaret, according to a US diplomatic cable.²²³ These filament winding machines may have been intended for producing missile airframes or centrifuge rotors at KRL.

²¹⁹ http://www.meti.go.jp/policy/anpo/law_document/tutatu/kaisei/20160122_4.pdf;
https://www.bis.doc.gov/index.php/forms-documents/doc_view/627-77-fr-58006

²²⁰ 'Global Industrial & Defence Solutions Pakistan,' file dated April 2015, <http://www.gids.com.pk/defence-english.pdf>, accessed 21 July 2016.

²²¹ Image via <http://www.gids.com.pk>.

²²² Mark Hibbs, 'KRL hid purchase of sensitive goods in orders for 'junk,' records say,' *Nuclear Fuel*, 21 November 2005, Volume 30, Number 24, p.7 (via Factiva).

²²³ United States Department of State, 'ADDITIONAL INFORMATION TO HELP TURKEY PREVENT THE TRANSFER OF FILAMENT WINDING MACHINES TO PAKISTAN (S),' 31 March 2008, 08STATE33089_a, https://wikileaks.org/plusd/cables/08STATE33089_a.html, accessed 14 September 2016.

KRL has not been seen making any procurements under its own name following the Khan network revelations. KRL probably recognises that foreign exporters would be reluctant to supply it directly, given the notoriety of AQ Khan. However, front companies for KRL, described below, have been seen conducting extensive procurements of dual-use technology from abroad.

Under the guise of IICS, KRL has conducted several procurements of military- and security-related goods.

Key personnel

As of July 2016, Ejaz Ahmed Mukhtar (see probable image below) is chairman of KRL, according to a KRL newsletter.²²⁴



Figure 21. Image of probably Ejaz Ahmed Mukhtar²²⁵

Involvement in strategic weapon systems

While the extent of KRL's historic involvement in Pakistan's nuclear weapons programme is hotly debated, KRL has unquestionably been central to Pakistan's production of enriched uranium for nuclear weapons. KRL's former head AQ Khan is notorious for his theft of centrifuge designs from his former employer, the European company Urenco, which he then developed at KRL to provide Pakistan with an industrial-scale uranium enrichment capability. In the 1980s, KRL controlled Pakistan's centrifuge uranium enrichment programme, according to a declassified CIA report.²²⁶ KRL probably remains Pakistan's sole industrial operator of uranium-enriching centrifuges.

In addition to its nuclear work, KRL has also led the development and production of a key Pakistani liquid-propellant missile system. In the 1990s, using North Korea's No Dong missile as a template,

²²⁴ KRL Foundation, 'Newsletter,' vol 3 issue 1, July 2016, http://krlfoundation.com/wp-content/uploads/2016/08/KRLF_Newsletter_2016_V3.pdf, accessed 7 September 2016.

²²⁵ KRL Foundation, <http://krlfoundation.com/wp-content/uploads/2016/07/cdd.jpg>, accessed 7 September 2016.

²²⁶ Central Intelligence Agency, 'Pakistan's nuclear weapons program: personnel and organizations,' 23 September 1985, http://www.foia.cia.gov/sites/default/files/document_conversions/89801/DOC_0000252646.pdf, accessed 21 July 2016.

KRL developed the Ghauri/Hatf-V missile.²²⁷ As of 2008, KRL continued to be involved in Pakistan's ballistic missile programme, according to a US State Department cable,²²⁸ and it likely remains so today. As evidence of this, a Ghauri missile test-launched in 2012 was marked with KRL's name on the missile airframe (see below), probably reflecting KRL's role as manufacturer.

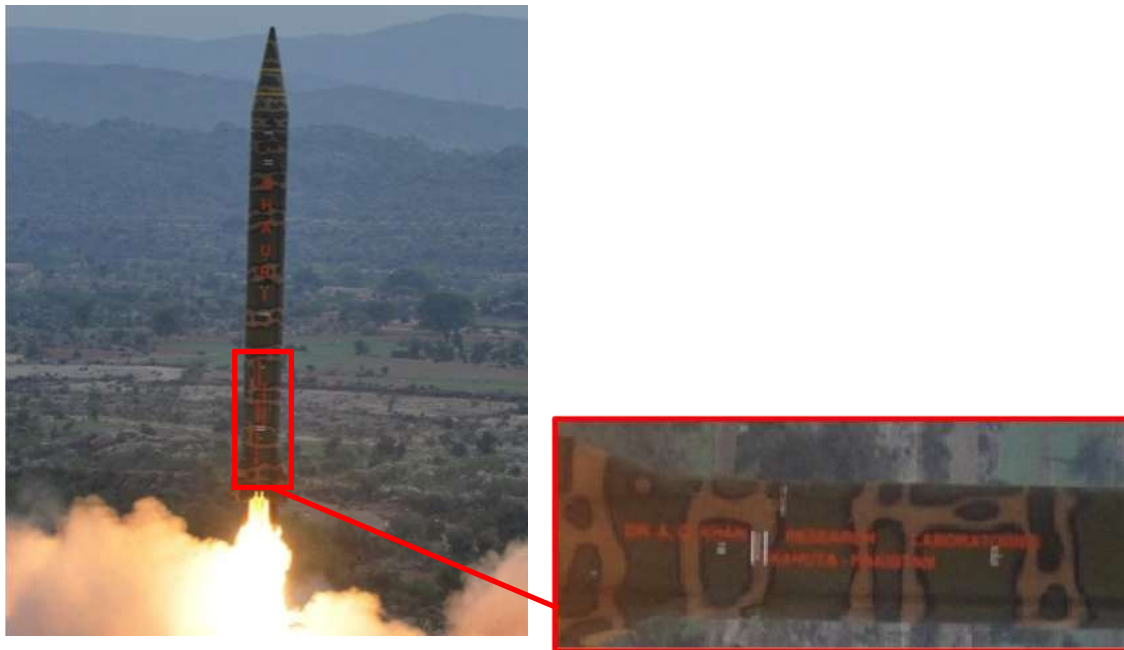


Figure 22. Ghauri missile launched in 2012 marked with 'Dr AQ Khan Research Laboratories, Kahuta, Pakistan'.²²⁹

Key facilities

KRL's main facility is located in Kahuta, Pakistan (see below). This facility contains a northern production area, which is known to contain two centrifuge halls, and a southern production area which possibly contains additional halls. There is also a site that has been identified as the location for KRL's work on the Ghauri missile system.

Project Alpha has identified a building under construction at this site which is possibly a new centrifuge uranium enrichment facility.²³⁰ The facility under construction at KRL appears suitable for use as an industrial-scale uranium enrichment plant, although no conclusive indicators of this function yet seen in satellite imagery. A uranium enrichment facility of this size using gas centrifuges would be consistent with procurements seen in Pakistani trade data – although it is possible that these procurements are related to another, as yet unidentified facility.

²²⁷ Mark Fitzpatrick, ed, *Nuclear Black Markets: Pakistan, AQ Khan, and the rise of proliferation networks*, London: International Institute for Strategic Studies, 2007, p.31; Douglas Frantz and Catherine Collins, *The Nuclear Jihadist*, New York: Hachette Book Group, 2007, p.229;

²²⁸ United States State Department, 'ADDITIONAL INFORMATION TO HELP TURKEY PREVENT THE TRANSFER OF FILAMENT WINDING MACHINES TO PAKISTAN (S),' 31 March 2008, 08STATE33089_a, https://wikileaks.org/plusd/cables/08STATE33089_a.html, accessed 1 March 2016.

²²⁹ Image source: https://www.ispr.gov.pk/archive_images/4095.jpg

²³⁰ See Project Alpha and IHS Jane's, 'Likely uranium facility identified in Pakistan,' *Jane's Intelligence Review*, 15 September 2016.

Khan Research Laboratories North, Kahuta



Khan Research Laboratories South, Kahuta



Image from Google Earth/DigitalGlobe
33.612842°, 73.384076° (30 March 2016)

KRL probable missile production area, Kahuta



Image from Google Earth/DigitalGlobe
33.604855°, 73.358462° (30 March 2016)

KRL suspected new uranium enrichment facility, Kahuta



Image from Google Maps/Digital Globe
33.612951°, 73.371411° (July 2016)

International footprint

In addition to its foreign procurement activity, KRL (under the name IICS) also produces goods for international sale. This has included participation in SPD's Global Industrial Defence Solutions (GIDS), a consortium of defence producers marketing goods to domestic and foreign customers.²³¹

Khan Research Laboratories				
Reports to	SPD			
Also known as	Engineering Research Laboratories (ERL), Institute of Industrial Control Systems (IICS), Kahuta Nuclear Facility, Kahuta Research Facility, Abdul Qader Khan Research Laboratories, ²³² Kahuta Research Laboratories			
Current head	?			
Address	Head Office: PO Box 1398, Rawalpindi, Pakistan; ²³³ Dhoke Nusah, Dakhli Gangal, Near Chatri Chowk, Rawalpindi, Pakistan (33.626003, 73.112643?) ²³⁴ Box 852, Rawalpindi, Pakistan; and P.O.Box 502, Kahuta, Pakistan; and 24 Mauve Area G 9/1, GPO Box 2891, Islamabad; ²³⁵ 191-K, Abid Majeed Road, Cantt., Lahore, Pakistan ²³⁶			
Contact details	Tel +92 51 928 0541, fax +92 51 928 0164, email info@iics.com.pk ²³⁷ , tel: +92 51 447 0070 , fax: +92 51 4470076 ²³⁸ ; Email iics@mail.comsats.net.pk ²³⁹			
Watchlisted?	Japan	BIS		
	Y	Y		

²³¹ <http://gids.com.pk/GIDS-BROCHURE-2012.pdf>.

²³² http://www.meti.go.jp/policy/anpo/law_document/tutatu/kaisei/20160122_4.pdf;
https://www.bis.doc.gov/index.php/forms-documents/doc_view/627-77-fr-58006.

²³³ Trade data sourced by Project Alpha.

²³⁴ Trade data sourced by Project Alpha.

²³⁵ https://www.bis.doc.gov/index.php/forms-documents/doc_view/627-77-fr-58006.

²³⁶ 'DR. A.Q. KHAN RESEARCH LABORATORIES KAHUTA,' undated, <http://pkpedia.com/dr-aq-khan-research-laboratories-kahuta>, accessed 7 September 2016.

²³⁷ <http://www.epicos.com/EPCompanyProfileWeb/GeneralInformation.aspx?id=22135>.

²³⁸ http://armscom.net/company/institute_of_industrial_control_systems.

²³⁹ http://wysecorp.org/idex_2005.pdf.

The Civil Works Organisation (CWO) is a division-sized Pakistan military unit which is under the control of SPD and possibly KRL.²⁴⁰ A former director of works for CWO has described CWO as ‘const[ituted] of [a] divisional size cantt[onment] spread over 2500 acres [of] land.’²⁴¹ CWO is thought to manage the military cantonment on which KRL’s main site in Kahuta is situated. The following additional factors connect CWO with KRL.

- CWO has shared a Rawalpindi post office box address (GPO Box 502) with KRL.²⁴²
- CWO manages the KRL Institute of Technology, a declared KRL subsidiary, according to the institute’s website.²⁴³
- The Construction Materials Testing Laboratory, a laboratory described as being founded by AQ Khan and operating ever since under the sponsorship of KRL, is described on its website as being ‘an integral part’ of CWO.²⁴⁴
- Peter Griffin, a member of the AQ Khan proliferation network, has described CWO as an alias of KRL.²⁴⁵
- A German trial of members of the AQ Khan network found that the CWO was ‘under the control’ of KRL.²⁴⁶

Feroz Khan states that the Pakistani Army created the Civil Works Organisation (CWO) in the 1970s to assist Pakistan’s nuclear weapons project, by supplying construction and technical support as well as personnel.²⁴⁷ CWO has undertaken construction projects for Pakistan’s military: for example, a 2003 report describes CWO as building a monument for a Pakistan Air Force college.²⁴⁸ CWO’s known status as a subordinate of SPD, outlined in a 2013 government decree, means that it is involved in Pakistan’s strategic programmes.²⁴⁹ The extent and nature of this involvement is not known, though.

²⁴⁰ Federal Public Service Commission, ‘Circular,’ 2 December 2013, <http://fpsc.gov.pk/icms/admin/documents/forms/grant%20of%20age%20relaxation-04-12-2013.pdf>, accessed 2 September 2016.

²⁴¹ ‘Ajmal Rasheed,’ LinkedIn, undated, <https://www.linkedin.com/in/ajmal-rasheed-b773a345>, accessed 22 September 2016.

²⁴² Trade data sourced by Project Alpha.

²⁴³ ‘Introduction,’ KRL Institute of Technology, undated, <http://kit.edu.pk/about-us/introduction/>, accessed 5 September 2016.

²⁴⁴ ‘Home,’ Construction Materials Testing Laboratory, <http://www.cmtl.gov.pk/>, accessed 5 September 2016.

²⁴⁵ Adrian Levy and Catherine Scott-Clark, *Deception: Pakistan, the United States, and the Secret Trade in Nuclear Weapons* (New York: Walker and Company, 2007), p.40.

²⁴⁶ Klaus-Peter Ricke, ‘Pakistan’s Rise to Nuclear Power and the Contribution of German Companies,’ Peace Research Institute Frankfurt, PRIF-Report No. 118, http://www.hsfk.de/fileadmin/HSFK/hsfk_downloads/PRIF_118_download.pdf, p.22.

²⁴⁷ Khan, *Eating Grass*, p.144.

²⁴⁸ ‘The Golden Jubilee Monument,’ PAF College Sargodha, undated, <http://pafcollegesargodha.com/pages/display/61>, accessed 5 September 2016.

²⁴⁹ Federal Public Service Commission, ‘Circular,’ 2 December 2013, <http://fpsc.gov.pk/icms/admin/documents/forms/grant%20of%20age%20relaxation-04-12-2013.pdf>, accessed 2 September 2016.

CWO probably undertakes general service for KRL including security, construction and maintenance work. An online profile of an individual who has worked for the CWO indicate that CWO is involved in:

Land Acquisition, Survey, Town Planning, Project Estimates, Billing, Site Supervision, Transmission Lines including Electric, Water and Sui Gas. Planning and Execution of External Services. Const and provision of Electric, Water Supply, Sewerage, Roads and Storm Water Drainage System. Planning and Execution of Water Treatment System. Planning & Execution of Reverse Osmosis System Plant.²⁵⁰

Key personnel

It is not clear who the current commanding officer of CWO is. An online profile indicates that Sohail Abrar Ahmed was director until 2013.²⁵¹

Involvement in proliferation/procurement

During the 1980s and 1990s, CWO functioned as a front company for procurement efforts for KRL and Pakistan's uranium enrichment programme (sometimes under the name Special Works Organisation).²⁵² A German trial of members of the AQ Khan network found that the CWO had been used in the 1990s to obtain enrichment-related goods from Germany including:

- Viton sheeting, used as a sealing material for KRL's Kahuta centrifuge plant.
- Process chemical cooling plants for Kahuta.
- Ring magnets for use in KRL's centrifuge operations at Kahuta.²⁵³

CWO continues to be a prolific importer of equipment and material from abroad, apparently including a biological safety cabinet.²⁵⁴

International footprint

Beyond its foreign procurements, CWO is not known to have an international footprint.

²⁵⁰ 'Ajmal Rasheed,' LinkedIn, https://www.linkedin.com/in/ajmal-rasheed-b773a345?authType=name&authToken=Nknh&locale=en_US&srchid=1214108741474403761454&srchindex=1&srchtotat=1&trk=v srp_people_res_name&trkInfo=VSRPsearchId%3A1214108741474403761454%2CVSRPtargetId%3A159217867%2CVSRPcmpt%3Aprimary%2CVSRPnm%3Afalse%2CauthType%3Aname, accessed 20 September 2016.

²⁵¹ 'Engr Sohail Abrar Ahmed,' LinkedIn, undated, <https://www.linkedin.com/in/engr-sohail-abrar-ahmed>, accessed 19 September 2016.

²⁵² See, e.g., United States Government, 'Pakistan's procurements for its nuclear programmes – examples of materials and equipment,' 1984, available online at Institute for Science and International Security, http://isis-online.org/uploads/isis-reports/documents/1984_Demarche.pdf, accessed 5 September 2016; David Albright, *Peddling Peril* (New York: Free Press, 2010) pp. 33-4.

²⁵³ Klaus-Peter Ricke, 'Pakistan's Rise to Nuclear Power and the Contribution of German Companies,' Peace Research Institute Frankfurt, PRIF-Report No. 118, http://www.hsfk.de/fileadmin/HSFK/hsfk_downloads/PRIF_118_download.pdf, p.22.

²⁵⁴ Trade data sourced by Project Alpha.

Civil Works Organisation			
Reports to	SPD, probably Pakistani Army		
Also known as	CWO		
Current head	Not known		
Address	PO Box No.368 Rawalpindi; Opposite EME College, Peshawar Road, Rawalpindi, Pakistan; GPO Box No.502 Rawalpindi, Pakistan ²⁵⁵		
Contact details	Tel: 92 2190300, Fax: 92 2190399 ²⁵⁶		
Designated by	Japan	BIS	
	N	N	

²⁵⁵ Trade data sourced by Project Alpha.

²⁵⁶ Trade data sourced by Project Alpha.

National Engineering and Scientific Commission (NESCOM)

The National Engineering and Scientific Commission (NESCOM) was created in 2001 to oversee three institutions which had themselves been created to develop aspects of Pakistan's nuclear weapons and delivery systems, the National Development Complex (NDC), Project Management Organisation (PMO) and Air Weapons Complex (AWC).²⁵⁷ NESCOM is subordinate to the SPD. NESCOM now oversees the Maritime Technologies Complex (MTC) as well as other entities (see below).

NESCOM plays a key oversight role in Pakistan's strategic programmes. NESCOM coordinates the activities of Pakistan's nuclear and missile programs, according to a US diplomatic cable, and is responsible for overseeing Pakistan's weapons of mass destruction (WMD) programs.²⁵⁸



Figure 23. NESCOM logo²⁵⁹

Key personnel

Dr Muhammad Irfan Burney (see below) has been chairman of NESCOM since at least 2008.²⁶⁰

²⁵⁷ Khan, *Eating Grass*, p.239.

²⁵⁸ United States Department of State, 'PAKISTANI WMD/MISSILE ENTITY SEEKS GYROTHEODOLITES FROM UKRAINIAN FIRM (S),' 11 June 2009, 09STATE60143_a, https://www.wikileaks.org/plusd/cables/09STATE60143_a.html, accessed 25 August 2016.

²⁵⁹ Image source:

https://en.wikipedia.org/wiki/National_Engineering_and_Scientific_Commission#/media/File:NESCOM_logo.png

²⁶⁰ 'OPCW Director-General Visits Pakistan, Organisation for the Prohibition of Chemical Weapons, 19 November 2015, <https://www.opcw.org/news/article/opcw-director-general-visits-pakistan-6/>, accessed 25 August 2016;' '北京理工大学国际/港澳台交流与合作简报,' Beijing Institute of Technology, 1 March 2013, <http://international.bit.edu.cn/docs/20151118134201181871.pdf>, accessed 25 August 2016; 'Gen.Tariq Majid visits Air Weapons Complex,' *The Baluchistan Times*, 18 August 2008 (via Factiva).



Figure 24. NESCO Chairman Dr Muhammad Irfan Burney (right) with a representative of the Beijing Institute of Technology, January 2013.²⁶¹

Involvement in proliferation/procurement

NESCO has been seen making several procurements of from foreign suppliers under its own name. In addition, front companies and NESCO subsidiaries have made extensive procurements of dual-use technology (see entity summaries below.)

International footprint

NESCO has multiple research projects underway with foreign partners. Known international collaborations and proposals for collaboration include:

- An electronics centre project with Chinese state-owned military electronics developer NETC International (described below),²⁶² and
- A memorandum of understanding signed in 2015 with Okan University, Turkey, for scientific and technical cooperation.²⁶³
- Discussions in 2015 on future technology cooperation between NESCO's chairman and Azerbaijan's Azerbaijani Minister of Communications and High Technologies.²⁶⁴

²⁶¹ 'The delegation of BIT participated in the 10th International Bhurban Conference on Applied and Science & Technology held in Pakistan,' Beijing Institute of Technology, 27 March 2013, <http://english.bit.edu.cn/International/internationalcooperation1/84791.htm>, accessed 25 August 2016.

²⁶² 'Pakistan, China to jointly set up national electronics complex,' *The Nation*, 29 October 2008, <http://nation.com.pk/business/29-Oct-2008/Pakistan-China-to-jointly-set-up-national-electronics-complex>, accessed 25 August 2016.

²⁶³ 'OKAN - NESCO collaboration has been established,' Okan University, 10 February 2015, <https://www.okan.edu.tr/en/news/1804/okan-nescom-collaboration-has-been-established/>, accessed 26 August 2016.

²⁶⁴ 'Azerbaijan, Pakistan to cooperate in nuclear research,' *Trend*, 31 August 2015 (via Factiva).

National Engineering and Scientific Commission (NESCOM)				
Reports to	SPD			
Also known as	NSCOM			
Current head	Dr Muhammad Irfan Burney			
Address	Plot no. 94, H-11/4, Islamabad, Pakistan ²⁶⁵			
Contact details	?			
Designated by	Japan	BIS		
	N	N		

²⁶⁵ Trade data sourced by Project Alpha.

The Defence Science Technology Organisation (DESTO) is a military research and development organisation. In 2004, the Pakistani Ministry of Defence described DESTO as being ‘dedicated to applied & innovative defence related research and development in disciplines like Bio-defence, propulsion, aerospace, ballistics, aerodynamics, electronics, propellants, metallurgy etc.’²⁶⁶

DESTO is part of SPD, according to an official public service circular²⁶⁷ and a US diplomatic cable,²⁶⁸ and is almost certainly part of NESCOM. It is described in various official documents as being controlled by NESCOM.²⁶⁹ This is consistent with a 2011 official awards ceremony for NESCOM, KRL and PAEC officials where a DESTO scientist was awarded a prize, presumably under the auspices of his work for NESCOM.²⁷⁰

DESTO has had a historic role in Pakistan’s nuclear weapons programme, but the extent to which it still does is unclear. According to one authoritative account, explosive lenses and other key components for Pakistan’s first nuclear weapons were partly developed by Dr Zaman Sheikh, a DESTO scientist seconded to the nascent weapons programme located at the Pakistan Ordnance Factory in the 1970s.²⁷¹ DESTO was also designated by the US government in 1998 for its role in Pakistan’s nuclear and missile programme.²⁷² DESTO formerly controlled SUPARCO, according to a declassified CIA study, but almost certainly no longer does.²⁷³

DESTO is likely Pakistan’s main hub for research on CBW-related technology. DESTO is involved in biological and chemical detection and response capability development, according to a US

²⁶⁶ ‘Defence Production Division,’ Ministry of Defence (Government of Pakistan) (via Internet Archive), undated, <https://web.archive.org/web/20040223185006/http://www.pakistan.gov.pk/defenceproduction-division/highlight-services.jsp>, accessed 2 September 2016.

²⁶⁷ Federal Public Service Commission, ‘Circular,’ 2 December 2013, <http://fpsc.gov.pk/icms/admin/documents/forms/grant%20of%20age%20relaxation-04-12-2013.pdf>, accessed 2 September 2016.

²⁶⁸ United States Department of State, ‘PROGRESS UNDER THE BIOSECURITY ENGAGEMENT PROGRAM,’ 9 February 2008, 08ISLAMABAD580_a, https://wikileaks.org/plusd/cables/08ISLAMABAD580_a.html, accessed 2 September 2016.

²⁶⁹ Office of the Auditor-General of Pakistan, ‘Notification,’ 23 November 2015, <http://www.agp.gov.pk/images/notification-2015/notification-23-11-15.pdf>, accessed 2 September 2016; See, eg., ‘MERIT LIST OF APPROVED SCIENTISTS / ENGINEERS FOR RESEARCH PRODUCTIVITY AWARD 2011-2012,’ Pakistan Council for Science and Technology, February 2012, <http://www.pcst.org.pk/docs/rpa2011-12.pdf>, accessed 31 August 2016.

²⁷⁰ ‘Pakistan Atomic Energy Commission, KRL, NESCOM scientists conferred civil awards,’ *The Patriot*, 31 March 2011 (via Factiva).

²⁷¹ Shahid-ur-Rehman, *Long Road to Chagai*, p.74.

²⁷² United States Department of Commerce, ‘India and Pakistan Sanctions and Other Measures,’ 15 CFR Parts 742 and 744, <https://www.gpo.gov/fdsys/pkg/FR-1998-11-19/pdf/98-30877.pdf>.

²⁷³ Central Intelligence Agency, ‘Pakistan: Defense Industry Struggles for Self-Sufficiency,’ October 1989, p.12, available online at https://www.cia.gov/library/readingroom/docs/DOC_0000424275.pdf, accessed 2 September 2016.

diplomatic cable.²⁷⁴ A Pakistani newspaper has described DESTO as ‘Pakistan’s premier chem-bio defence institution.’²⁷⁵

DESTO is also involved in civilian projects, including work on dengue fever control.²⁷⁶



Figure 25. DESTO logo²⁷⁷

Key personnel

As of September 2014, Maj Gen Muhammad Junaid was DESTO’s director-general.²⁷⁸ It is unknown whether he still holds this post, although a 2016 Pakistani news website states that he does.²⁷⁹

Involvement in proliferation/procurement

DESTO is known to have acquired equipment with utility for CBW defence programmes.

Subsidiaries and affiliates

In 1998, the US Department of Commerce designated two DESTO and two entities described as subordinate to DESTO for its work for Pakistan’s military or nuclear weapons programme. These entities are the Daud Khel Chemical Plant, Lahore; and the Karachi CBW & BW Warfare R&D Laboratory.²⁸⁰

²⁷⁴ United States Department of State, ‘BIOSECURITY ENGAGEMENT PROGRAM: BALANCING PUBLIC HEALTH WITH NATIONAL SECURITY IN PAKISTAN,’ 9 February 2008, 08ISLAMABAD581_a, https://wikileaks.org/plusd/cables/08ISLAMABAD581_a.html, accessed 2 September 2016.

²⁷⁵ ‘Pakistan remains committed to objectives of CWC; Sartaj,’ *Daily Balochistan Express*, 21 November 2015 (via Factiva).

²⁷⁶ Faiza Ilyas, ‘41-year-old Baldia resident dies of dengue,’ *Dawn*, 1 April 2014 (via Factiva).

²⁷⁷ Image via Wikimedia.

²⁷⁸ ‘COAS opts for new generation of generals,’ *The News*, 23 September 2014, <https://www.thenews.com.pk/archive/print/640614-coas-opts-for-new-generation-of-generals>, accessed 2 September 2016.

²⁷⁹ ‘Gen. Raheel, Rashad retiring on Nov 29, 4 more top Generals to retire in Jan,’ *Weekly Corporate Ambassador*, 5 April 2016, <https://weeklycorporateambassador.wordpress.com/2016/04/05/gen-raheel-rashad-retiring-on-nov-29-4-more-top-generals-to-retire-in-jan/>, accessed 2 September 2016.

²⁸⁰ Department of Commerce, ‘India and Pakistan Sanctions and Other Measures,’ 15 CFR Parts 742 and 744, <https://www.gpo.gov/fdsys/pkg/FR-1998-11-19/pdf/98-30877.pdf>.

Key facilities

DESTO reportedly has at least three facilities.²⁸¹ Known sites are:

- DESTO Laboratories Complex, Chattar (probably aka DESTO Explosives Labs Chattar – see figure below). This site is suitable for research work on explosives.
- DESTO Laboratories, Karachi (probably aka Karachi CBW & BW Warfare R&D Laboratory) – this site has not yet been geo-located.
- DESTO Laboratories, Chaklala – this site has not yet been geo-located.

²⁸¹ 'Pakistan Intelligence, Security Activities & Operations Handbook,' 2006, p.201, <https://books.google.co.uk/books?id=ud8TM7Pc67sC&pg=PA201&lpg=PA201&dq=%22DESTO+Laboratories+Complex,+Chattar%22&source=bl&ots=y1U8Cr5E2g&sig=AlttS6YPELDU5PNwA2W2OATHWIo&hl=en&sa=X&ved=0ahUKÉwiMrtuR8fDOAhXmKsAKHQDaCY8Q6AEILTAC#v=onepage&q=%22DESTO%20Laboratories%20Complex%2C%20Chattar%22&f=false>, accessed 2 September 2016.

Probable DESTO complex, Chattar



Image from Google Earth/DigitalGlobe
33.786238°, 73.231374° (14 May

Image © 2016 DigitalGlobe

International footprint

DESTO has been involved in multiple projects with foreign entities. In 2010, DESTO was part of a biosecurity joint project with the US Department of Defence.²⁸² In 2006, DESTO entered into a joint project with a state-owned Chinese firm, China Electronics Technology Group Corporation, to establish a 'joint modern electronics complex'.²⁸³

Defence Science and Technology Organisation (DESTO)			
Reports to	POF		
Also known as	Defense Science and Technology Center; Chaklala Defense Science and Technology Organization.		
Current head	Maj Gen Muhammad Junaid		
Address	182 Sir Syed Road, Chaklala Cantt, Rawalpindi 46200, Pakistan; and Headquarters, Chaklala Cantt, Rawalpindi, 46200, Pakistan ²⁸⁴ ; possibly House no. 46, Street no. 5 Chaklala Scheme-III, Rawalpindi, Pakistan; ²⁸⁵ 34-37, PNH Lines, Cantt., Karachi, Pakistan ²⁸⁶		
Contact details	Tel 9251 2860090, fax 9251 2860091; tel 92 51 280161 fax 92 51 9280502 ²⁸⁷		
Designated by	Japan	BIS	
	Y	Y	

²⁸² 'DOD LAUNCHES FIVE-YEAR BIOSECURITY EFFORTS IN PAKISTAN, AFGHANISTAN,' *Inside Missile Defense*, 17 November 2010 (via Factiva).

²⁸³ 'Pakistan, China to set up electronics complex for defence technology,' PTV World Television, 25 November 2007 (via BBC Monitoring and Factiva).

²⁸⁴ Department of Commerce, 'India and Pakistan Sanctions and Other Measures,' 15 CFR Parts 742 and 744, <https://www.gpo.gov/fdsys/pkg/FR-1998-11-19/pdf/98-30877.pdf>.

²⁸⁵ 'Walk in test/interview,' Pakistan Jobs Bank, October 2013, <http://www.pakistanjobbank.com/Jobs/26936/Progressive-Public-Sector-Organization-Jobs-2013-October-Advertisement-No-03-13-3-13/>, accessed 2 September 2016.

²⁸⁶ 'DESTO Karachi Laboratories,' *The Pakistan Business Journal*, undated, http://www.pakistanbusinessjournal.com/b2b-directory/desto-karachi-laboratories_87317.html, accessed 2 September 2016.

²⁸⁷ 'List of delegates,' ASEAN Regional Forum on Biorisk management, 29 September 2010, available online at <http://studylib.net/doc/8999436/arf-list-of-delegates>, accessed 2 September 2016.

Advanced Computing and Engineering Solutions is an ostensibly private company that is almost certainly a subsidiary of or controlled by NESCOM, based on its procurement activity for NESCOM and participation in an SPD-run sales organisation. ACES is possibly a front for AWC, based on the work that ACES has been seen undertaking.

ACES is involved in UAV development and probably also involved in missile-related research. In 2009, ACES marketed tactical Uqab/Eagle-PI & Eagle-P-II drones at a UAE exhibition.²⁸⁸ ACES personnel have published research on aerodynamics of supersonic and hypersonic flight launch vehicles and sounding rockets.²⁸⁹



Figure 26. ACES logo²⁹⁰

In addition to its work on UAVs and probably missiles, ACES also advertises products and services including civil engineering services, encryption devices, ballistic protection clothing, and information technology products.²⁹¹

Key personnel

Key personnel of ACES are not publicly known.

Involvement in proliferation/procurement

In 2009, ACES possibly acted as an intermediary in an attempt by NESCOM to procure gyrotheodolites suitable for ballistic missile use from a Ukrainian manufacturer, the Arsenal Design Bureau, according to a US diplomatic cable.²⁹²

²⁸⁸ 'Eagle-Eye P-I & P-II Tactical UAVs of ACES: Pakistani UAV Industry,' Pakistan Military Review, <http://pakmr.blogspot.co.uk/2011/04/eagle-eye-pi-eagle-eye-pii-tactical-uav.html>, accessed 25 August 2016; 'Pakistan looks to develop indigenous UAV capability,' *Flight International*, 18 September 2007 (via Factiva).

²⁸⁹ S. R. Chaudhry, N. U. Saqib, and F. Umar, 'ESTIMATION OF SKIN SURFACE TEMPERATURE OF SPACE VEHICLES DURING THE WHOLE FLIGHT ENVELOP [sic],' 24th International Congress of the Aeronautical Sciences, http://www.icas.org/ICAS_ARCHIVE/ICAS2004/PAPERS/350.PDF, accessed 25 August 2016.

²⁹⁰ Image via <http://www.gids.com.pk/industrial-english.pdf>.

²⁹¹ 'Advanced Computing and Engineering Solutions Pvt Ltd,' undated, <http://www.aces.com.pk>, accessed 28 September 2016.

²⁹² United States Department of State, 'PAKISTANI WMD/MISSILE ENTITY SEEKS GYROTHEODOLITES FROM UKRAINIAN FIRM (S),' 11 June 2009, 09STATE60143_a, https://www.wikileaks.org/plusd/cables/09STATE60143_a.html, accessed 25 August 2016.

International footprint

In addition to its foreign procurement activity, ACES also produces goods for international sale. This has included participation in SPD's Global Industrial Defence Solutions (GIDS), a consortium of defence producers marketing goods to domestic and foreign customers.²⁹³

Advanced Computing and Engineering Solutions (ACES)				
Reports to	Almost certainly NESCOM			
Also known as	-			
Current head	?			
Address	House No. 156, Street # 5, F11/1, Islamabad, Pakistan. ²⁹⁴			
Contact details	Tel: 92-51-2224451-3, Fax: 92-51-2224454 ²⁹⁵			
Designated by	Japan	BIS		
	N	N		

²⁹³ 'About us,' Global Industrial & Defence Solutions, undated, <http://gids.com.pk/about>, accessed 28 September 2016.

²⁹⁴ 'Contact us,' ACES, undated, <http://www.aces.com.pk/contact-us.htm>, accessed 25 August 2016.

²⁹⁵ 'Contact us,' ACES, undated, <http://www.aces.com.pk/contact-us.htm>, accessed 25 August 2016.

Scientific Engineering & Technology Services (SETS) PVT LTD is an ostensibly private company that is probably a subsidiary of or controlled by SPD, based on its participation in SPD's Global Industrial Defence Solutions (GIDS), a consortium of defence producers marketing goods to domestic and foreign customers. SETS is possibly a front for DESTO, based on its known product range.

SETS advertises products and services including explosive detectors,²⁹⁶ mine detectors, CBW defence and decontamination equipment, and artillery range extension services.²⁹⁷



Figure 27. SETS logo²⁹⁸

Key personnel

Key personnel of SETS are not publicly known.

Involvement in proliferation/procurement

No procurements by SETS have been identified.

International footprint

In addition to its foreign procurement activity, SETS also offers services for international sale. This has included participation in GIDS.²⁹⁹

²⁹⁶ 'Industrial Solutions,' Global Industrial & Defence Solutions, undated, <http://www.gids.com.pk/industrial-english.pdf>, accessed 28 September 2016.

²⁹⁷ 'SETS Pvt Ltd, Pakistan,' TradeKey, undated, <http://www.tradekey.com/company/SETS-Pvt-Ltd-Pakistan-4827222.html>, accessed 26 August 2016.

²⁹⁸ Image via <http://www.gids.com.pk/industrial-english.pdf>

²⁹⁹ 'About us,' Global Industrial & Defence Solutions, undated, <http://gids.com.pk/about>, accessed 28 September 2016.

Scientific Engineering & Technical Services (SETS) PVT LTD			
Reports to	Probably NESCOM		
Also known as	SETS PVT LTD		
Current head	?		
Address	Chaklala, Rawalpindi, Punjab, Pakistan; ³⁰⁰ House #808-A, Street #1, Park Lane, Chaklala Scheme-3, Cantt, Pakistan ³⁰¹		
Contact details	Tel: 92-322-5111052; ³⁰² Tel: (051) 5781749, fax: (051) 5781750, email info@sets.com.pk dratiq962@hotmail.com ³⁰³		
Designated by	Japan	BIS	
	N	N	

³⁰⁰ 'SETS Pvt Ltd, Pakistan,' TradeKey, undated, <http://www.tradekey.com/company/SETS-Pvt-Ltd-Pakistan-4827222.html>, accessed 26 August 2016.

³⁰¹ 'SETS (PVT) LTD. -SCIENTIFIC ENGINEERING & TECHNICAL SERVICES,' Trade Directory of Pakistan, undated, <http://www.timespublishers.com/compdetails.asp?compcode=111837>, accessed 26 August 2016.

³⁰² 'SETS Pvt Ltd, Pakistan,' TradeKey, undated, <http://www.tradekey.com/company/SETS-Pvt-Ltd-Pakistan-4827222.html>, accessed 26 August 2016.

³⁰³ 'SETS (PVT) LTD. -SCIENTIFIC ENGINEERING & TECHNICAL SERVICES,' Trade Directory of Pakistan, undated, <http://www.timespublishers.com/compdetails.asp?compcode=111837>, accessed 26 August 2016.

NECOP is a Pakistan Ministry of Defence project executed by NESCOM in partnership with the National Institute of Electronics (NIE), an arm of Pakistan's Ministry of Science and Technology. NECOP was established as an 'information and electronic complex covering civilian, information technology and defence electronic domains.'³⁰⁴ NESCOM is responsible for strategic aspects of NECOP's work,³⁰⁵ which possibly include work on components for missiles and nuclear weapons.

In June, the Pakistani government allocated nearly USD \$10m for construction of phase one of probably a new NECOP facility.³⁰⁶ Plans and images presumably of this facility are available online.³⁰⁷



Figure 28. Proposed NECOP building.³⁰⁸

³⁰⁴ 'Pakistan, China to jointly set up national electronics complex,' *The Nation*, 29 October 2008, <http://nation.com.pk/business/29-Oct-2008/Pakistan-China-to-jointly-set-up-national-electronics-complex>, accessed 25 August 2016.

³⁰⁵ Dr. Basharat Mahmood, 'A presentation to Honorable Members of National Assembly Standing Committee on Science & Technology,' 6 July 2015, <http://most.comsatshosting.com/Files/Final%20National%20Assembly%20Standing%20Comittee%20Presentation%2006-07-2015.pptx>, accessed 25 August 2016. In this presentation, Dr Mahmood states that NIE has produced printed circuit boards for PMO, DESTO and NESCOM.

³⁰⁶ 'Rs 2526.658 mln earmarked for 10 schemes of Defence Division,' Associated Press of Pakistan, 3 June 2016, <http://www.app.com.pk/rs-2526-658-mln-earmarked-for-10-schemes-of-defence-division/>

³⁰⁷ 'National Electronic Complex of Pakistan,' Behance, undated, <https://www.behance.net/gallery/5369707/National-Electronic-Complex-of-Pakistan>, accessed 26 August 2016.

³⁰⁸ 'National Electronic Complex of Pakistan,' Behance, undated, <https://www.behance.net/gallery/5369707/National-Electronic-Complex-of-Pakistan>, accessed 26 August 2016.

Key personnel

NECOP's key personnel are not publicly known.

Involvement in proliferation/procurement

No procurements by NECOP have been identified.

International footprint

NECOP was initially established in cooperation with Chinese state-owned military electronics developer NETC International.³⁰⁹ As of 2013, NECOP was still referred to as being provided with funding and expertise from China.³¹⁰ The extent of NETC's ongoing involvement with NECOP is unclear.

National Electronics Complex (NECOP)			
Reports to	NESCOM		
Also known as	-		
Current head	?		
Address	Plot no. 17, Sector H-9, Islamabad, Pakistan ³¹¹		
Contact details	Tel 051-4434977, 4865475, fax: 051-4865472 ³¹²		
Designated by	Japan	BIS	
	N	N	

³⁰⁹ 'Pakistan, China to jointly set up national electronics complex,' The Nation, 29 October 2008, <http://nation.com.pk/business/29-Oct-2008/Pakistan-China-to-jointly-set-up-national-electronics-complex>, accessed 25 August 2016.

³¹⁰ 'LED lights to be installed in major cities,' Pakistan Today, 18 July 2013, <http://www.pakistantoday.com.pk/2013/07/18/city/islamabad/led-lights-to-be-installed-in-major-cities/>, accessed 26 August 2016.

³¹¹ 'Invitation for bids,' Jang Newspaper, 5 June 2016, available online at <http://tendernotice.pk/598770/national-electronics-complex-of-pakistan-islamabad-tender-notice>, accessed 26 August 2016.

³¹² 'Invitation for bids,' Jang Newspaper, 5 June 2016, available online at <http://tendernotice.pk/598770/national-electronics-complex-of-pakistan-islamabad-tender-notice>, accessed 26 August 2016.

Margalla Electronics is a defence and electronics firm, established in the 1980s to work on ground-based radar projects for Pakistan's air force.³¹³ It is described in an official government circular, academic papers and by former officials as a subsidiary of NESCOM.³¹⁴

Margalla Electronics's precise role in Pakistan's strategic programmes is unclear. An archived version of Margalla Electronics's website states that the company has developed air defence radar systems as well as cryptographic equipment.³¹⁵ Margalla has reportedly contributed to the development of the Babur/Hatf-VII cruise missile, according to unverified accounts.³¹⁶

Key personnel

Margalla Electronics's senior officials are not publicly known.

Involvement in proliferation/procurement

Margalla Electronics has not been seen making any procurements under its own name.

International footprint

Margalla Electronics is not known to have an international footprint.

³¹³ A. Siddiq-Agha, *Pakistan's Arms Procurement and Military Buildup, 1979-99: In Search of a Policy*, p.152.

³¹⁴ 'Syed Bilal Haider,' LinkedIn, undated, <https://pk.linkedin.com/in/syed-bilal-haider-23a2b513>, accessed 6 September 2016; 'Comparison of 16 GHz Microstrip patch antenna array configurations,' Applied Sciences and Technology (IBCAST), 2009 6th International Bhurban Conference on, 19-22 January 2009, <http://ieeexplore.ieee.org/document/5596195/>, accessed 6 September 2016.

³¹⁵ 'Margalla Electronics,' (via Internet Archive), undated, <https://web.archive.org/web/20030701154902/http://www.depo.org.pk/products/me/index.htm>, accessed 6 September 2016.

³¹⁶ See, e.g., 'Babur Cruise Missile,' Defence.pk, 7 June 2012, <http://defence.pk/threads/babur-cruise-missile-database.185609/>, accessed 6 September 2016.

Margalla Electronics				
Reports to	NESCOM			
Also known as	-			
Current head	?			
Address	Plot. 22 H-9, Islamabad, Pakistan ³¹⁷			
Contact details	Tel 92519257480, fax 92519257478 ³¹⁸			
Designated by	Japan	BIS		
	N	N		

³¹⁷ 'Margalla Electronics,' Infoisinfo, undated, <http://islamabad.infoisinfo.com.pk/card/margalla-electronics/64430>, accessed 6 September 2016.

³¹⁸ 'Margalla Electronics,' Infoisinfo, undated, <http://islamabad.infoisinfo.com.pk/card/margalla-electronics/64430>, accessed 6 September 2016.

The National Development Complex (NDC) is an arm of NESCOM involved in missile development and production, as well as conventional weapon and UAV production. It was created after 1988 to develop the delivery system design for Pakistan's air-dropped nuclear weapons, and was formerly subordinate to the PAEC before merged into NESCOM in 2001.³¹⁹

NDC is one of Pakistan's key missile entities. NDC is responsible for developing Pakistan's Shaheen series of solid-fuelled, nuclear-capable ballistic missiles, according to a US State Department cable.³²⁰ In June, Jane's reported that NESCOM had set up an assembly line at NDC to assemble transporter-erector launchers (TELs) for Shaheen-III missiles.³²¹

NDC is likely also involved in production of Ghauri liquid-fuelled ballistic missiles. In 2004, Pakistan's president and prime minister congratulated both KRL and NDC after a successful Ghauri/Hatf-V test launch.³²² One plausible account states that while KRL was originally wholly responsible for Ghauri production, NDC now produces all aspects of the Ghauri missiles other than rocket motors, which are produced by KRL.³²³



Figure 29. A Ghauri /Hatf-V missile, probably produced by NDC.³²⁴

³¹⁹ Khan, *Eating Grass*, p.186-7, p.239.

³²⁰ United States Department of State, 'ADDITIONAL INFORMATION ON EFFORTS BY PAKISTAN TO PROCURE MISSILE PRODUCTION EQUIPMENT IN CHINA (S),' 17 September 2007, 07STATE130635_a, https://wikileaks.org/plusd/cables/07STATE130635_a.html, accessed 23 August 2016.

³²¹ Richard D Fisher, 'Pakistan's new Shaheen-III MRBM uses Chinese transporter, says source,' *Jane's Defence Weekly*, 29 June 2016, <http://www.janes.com/article/61862/pakistan-s-new-shaheen-iii-mrbm-uses-chinese-transporter-says-source>, accessed 8 September 2016.

³²² 'Pakistan successfully tests Intermediate Range Ballistic Missile Hatf V,' *Pakistan Press International Information Services*, 12 October 2004 (via Factiva).

³²³ Haris N. Khan, 'Pakistan's Nuclear Program: Setting the Record Straight,' *Defence Journal*, 31 August 2010, p.14 (via Factiva).

³²⁴ Image via <http://defence.pk/threads/pakistan-missile-milestones-ranges.235978/>.

In addition to its missile work, NDC conducts a wide range of military development projects. NDC has been involved in the development of Pakistan's armed Burraq UAV³²⁵ as well as the 200km-range Vector surveillance UAV.³²⁶ Other NDC projects include the Baktar Shikan anti-tank guided weapon (ATGW).³²⁷

Key personnel

NDC's key personnel are not publicly known. An individual named Syeed Mustaneer-al-Hasan has acted as NDC's purchasing manager, according to an online résumé.³²⁸

Involvement in proliferation/procurement

NDC has been involved in extensive procurement activity of dual-use goods from abroad, as has been revealed in US diplomatic cables.

- In July 2008, a Pakistani weapons broker, Arms Trade Pakistan was seeking on behalf of NDC to procure a variety of guidance and control equipment from a Ukrainian manufacturer, according to a US diplomatic cable.³²⁹
- In 2006-8, the HMC was seeking to procure possibly on behalf of NDC ring-rolling and flow-forming machines from Chinese manufacturers, according to a US diplomatic cable.³³⁰
- In 2007, NDC attempted to procure Swiss-origin coating and dispensing equipment via Pakistani company Mechanical Engineering Workshop (MEW), according to a US diplomatic cable.³³¹
- In 2006, a Singapore company, Weining Pte Ltd, was possibly working to procure Japanese-origin carbon fibre on behalf of possibly the NDC, according to a US diplomatic cable.³³²
- In 2005, MEW possibly purchased Taiwanese-origin hydraulic cylinders, which were reportedly transferred to NDC for research and development of 'short-mid range missiles', according to a US diplomatic cable.³³³

³²⁵ 'Armed drone, laser-guided missile tested,' *Dawn*, 14 March 2015 (via Factiva).

³²⁶ 'Pakistan to export Vector by year-end,' *Flight International*, 27 March 2001 (via Factiva).

³²⁷ 'New Warhead for Pakistani anti-tank guided weapon,' *Press Trust of India*, 6 December 2000 (via Factiva).

³²⁸ 'Resume/curriculum vitae – Syeed Mustaneer-al-Hasan,' AskEdu, undated, <http://www.askedu.net/job/resume.asp?u=834#.V8axhPkrKUK>, accessed 31 August 2016.

³²⁹ United States Department of State, 'UKRAINE: REPORTING ON THE NONPROLIFERATION WORKING GROUP DISCUSSIONS JULY 31 AND AUGUST 1, 2008,' 20 October 2008, 08STATE111716_a, https://wikileaks.org/plusd/cables/08STATE111716_a.html, accessed 23 August 2016.

³³⁰ United States Department of State, 'ADDITIONAL INFORMATION ON EFFORTS BY PAKISTAN TO PROCURE MISSILE PRODUCTION EQUIPMENT IN CHINA (S),' 17 September 2007, 07STATE130635_a, https://wikileaks.org/plusd/cables/07STATE130635_a.html, accessed 23 August 2016.

³³¹ United States Department of State, 'SWITZERLAND DENIES EXPORTS OF NON-CONTROLLED GOODS BASED ON USG INFORMATION -- REQUEST USG COOPERATION IN AVOIDING UNDERCUTTING OF DENIAL BY U.S. FIRM,' 07BERN1101_a, 21 November 2007

³³² United States Department of State, 'MFA PROVIDES BLOCKED SHIPMENTS UPDATES,' 3 January 2007, 07SINGAPORE23_a, https://wikileaks.org/plusd/cables/07SINGAPORE23_a.html, accessed 23 August 2016.

³³³ United States Department of State, 'MTAG: TAIWAN INVESTIGATION RESULTS ON XTRA AND SHE HONG,' 23 September 2005, 05TAIPEI4068_a, https://wikileaks.org/plusd/cables/05TAIPEI4068_a.html, accessed 23 August 2016.

- In 2004, Pakistani company K.M. Enterprise sought to purchase a CNC vertical machining centre from a Taiwanese company, possibly on behalf of NDC, according to a US diplomatic cable.³³⁴
- In 2001, the US State Department placed sanctions on NDC for purchasing missile-related technology probably including flight-control systems and other components from a state-owned Chinese company, China Metallurgical Equipment Corporation (CMEC).³³⁵

More recently NDC's commercial arm, Integrated Defence Systems, is known to have procured materials with possible missile-related applications from the China Precision Machinery Import-Export Corporation (CPMIEC).

Key facilities

The NDC controls a number of facilities, including a headquarters at NESCOM's Rawalpindi complex, and at least one major production and testing facility at Fateh Jang (see below). These sites include infrastructure suitable for production of missiles and their erector vehicles.

³³⁴ United States Department of State, 'MTAG: TAIWAN ENTITIES SUPPORTING PAKISTANI MISSILE PROGRAM; FOLLOW-UP ON TRANSFERS TO SYRIA (C),' 14 February 2005, 05STATE26545_a, https://wikileaks.org/plusd/cables/05STATE26545_a.html, accessed 24 August 2016.

³³⁵ 'Bureau of Nonproliferation; Imposition of Missile Proliferation Sanctions Against a Chinese Entity and a Pakistani Entity,' Federal Register, 11 September 2001, Vol. 66, No. 176 (via Factiva); Joe McDonald, 'China, Pakistan Deny Missile Trading,' Associated Press Online, 3 September 2001 (via Factiva).

Fateh Jang East Complex (NDC), Fateh Jang



Image from Google Earth/DigitalGlobe
33.627880°, 72.698282° (4 April 2016)

Fateh Jang Central Complex (possibly NDC), Fateh Jang



Image © 2016 DigitalGlobe
Image © 2016 CNES / Astrium

Image from Google Earth/DigitalGlobe
33.623108°, 72.572655° (28 November 2013)

Talagang Missile Complex (possibly NDC), Talagang



© 2013 Google
Image © 2013 DigitalGlobe
Image © 2013 CNES / Astrium

Image from Google Earth/DigitalGlobe
33.676537°, 72.220672° (24 September 2013)

International footprint

Beyond foreign procurement activity and probable weapon sales through its commercial arm, Integrated Defence Systems, NDC is not known to be involved in further projects abroad.

National Development Complex (NDC)				
Reports to	NESCOM			
Also known as	National Defense Complex; National Development Centre ³³⁶			
Current head	?			
Address	Fateh Jang, Punjab, Rawalpindi, Pakistan; and P.O. Box 2216, Islamabad, Pakistan; ³³⁷ Plot No. 120, Street No. 8, I-10/3, Islamabad, Pakistan ³³⁸			
Contact details	?			
Designated by	Japan	BIS		
	Y	Y		

³³⁶ United States Department of Commerce, 'Addition and Modification of Certain Persons on the Entity List; and Removal of Certain Persons From the Entity List,' 18 September 2014, <https://www.federalregister.gov/articles/2014/09/18/2014-22277/addition-and-modification-of-certain-persons-on-the-entity-list-and-removal-of-certain-persons-from>, accessed 18 August 2016; Department of Commerce, 'India and Pakistan Sanctions and Other Measures,' 15 CFR Parts 742 and 744, <https://www.gpo.gov/fdsys/pkg/FR-1998-11-19/pdf/98-30877.pdf>.

³³⁷ United States Department of Commerce, 'Addition and Modification of Certain Persons on the Entity List; and Removal of Certain Persons From the Entity List,' 18 September 2014, <https://www.federalregister.gov/articles/2014/09/18/2014-22277/addition-and-modification-of-certain-persons-on-the-entity-list-and-removal-of-certain-persons-from>, accessed 18 August 2016.

³³⁸ Pakistan Standards Authority, 'EMBERS LIST OF THE TECHNICAL COMMITTEE FOR "PIEZOELECTRIC DEVICES FOR FREQUENCY CONTROL AND SELECTION (ESTC-10)",' undated, <http://www.psqca.com.pk/NEP/%5B11%5D%20TC%20member%20list%20%5B0ct%202011%5D/Electronics/MEMBER%20LIST%20ESTC-10.pdf>, accessed 2 September 2016.

The PMO was established in 1994 to provide Pakistan with a permanent capability for development and production of solid-propellant missile technology, using missile systems procured from China as a basis.³³⁹ As Feroz Khan has noted:

The principal task of the PMO was to create the foundations for a solid fuel missile, absorb the transfer of technology, and learn the art of reverse engineering and assembly techniques for the unassembled [Chinese-supplied] M-11 (DF-11) and M-9 (DF-15) ballistic missiles.³⁴⁰

In 2001, PMO was made subordinate to NESCOM.³⁴¹ As of 2008, the PMO was responsible for development of Pakistan's nuclear-capable Ghaznavi/Hatf-III ballistic missile (a system based on the M-11) according to a US State Department cable.³⁴² The PMO likely retains responsibility for production of this system, and possibly others.



Figure 30. Ghaznavi/Hatf-III missile developed by PMO.³⁴³

Key personnel

As of April 2016, Maj Gen Khalid Mehmood was director-general of PMO, according to a Pakistani news website.³⁴⁴

³³⁹ Khan, *Eating Grass*, p.239.

³⁴⁰ Khan, *Eating Grass*, p.239.

³⁴¹ Khan, *Eating Grass*, p.239.

³⁴² United States Department of State, 'MACHINE TOOL PROCUREMENT EFFORTS BY ENTITIES OF PROLIFERATION CONCERN (S),' 08STATE57067_a, 28 May 2008, https://wikileaks.org/plusd/cables/08STATE57067_a.html, accessed 17 August 2016; United States Department of State, 'COOPERATION BETWEEN SOUTH KOREAN FIRM AND ENTITIES ASSOCIATED WITH PAKISTAN'S MISSILE PROGRAM (S),' 08STATE26305_a, 13 March 2008, https://wikileaks.org/plusd/cables/08STATE26305_a.html, accessed 17 August 2016.

³⁴³ Image credit: Inter-Services Public Relations via <http://www.thehindu.com/news/international/south-asia/pakistan-successfully-testfires-ghaznavi-missile/article5989507.ece>.

Involvement in proliferation/procurement

PMO has been involved in multiple instances of procurements of dual-use goods from foreign suppliers, including frequent use of intermediaries and other deceptive techniques, according to US diplomatic cables.

- In 2009, a Pakistani intermediary, Intralink Incorporated, attempted to procure an electrodynamic vibration test system from a Chinese firm, Suzhou Testing Instrument Factory, possibly on behalf of PMO, according to a US State Department cable.³⁴⁵
- In 2008, PMO attempted to procure machine tools from a South Korean company through two intermediaries, Intralink Incorporated and United Engineering, according to a US State Department cable.³⁴⁶
- In 2008, a Pakistani intermediary, Aerolite, attempted to procure Taiwanese-origin machine tools from a Chinese company, Dalian Machine Tool Group, which were possibly intended for use by the PMO, according to a US State Department cable.³⁴⁷
- In 2008, two Pakistani intermediaries, Sahara International and Progressive Engineering, attempted to procure CNC machine tools from a Singaporean company, Ace Pressureweld, possibly on behalf of PMO, according to a US State Department cable.³⁴⁸
- In 2008, two Pakistani intermediaries, K.M. Enterprises and Progressive Engineering, attempted to procure a dial gauge calibrator from a German firm, possibly on behalf of the PMO, according to a US State Department cable.³⁴⁹
- In 2005, PMO was attempting to procure a an industrial X-ray system from a Chinese state-owned military manufacturer, Poly Technologies Inc., through a PMO front company, Star Industries, according to Indian information cited in a US State Department cable.³⁵⁰

No procurements by PMO have been seen recently, but PMO front companies have been seen making extensive and systematic procurements of dual-use equipment from abroad.

³⁴⁴ 'Gen. Raheel, Rashad retiring on Nov 29, 4 more top Generals to retire in Jan,' *Weekly Corporate Ambassador*, 5 April 2016, <https://weeklycorporateambassador.wordpress.com/2016/04/05/gen-raheel-rashad-retiring-on-nov-29-4-more-top-generals-to-retire-in-jan/>, accessed 2 September 2016.

³⁴⁵ 'ADVISING BEIJING OF PAKISTANI ENTITY'S INTEREST IN CHINESE TEST EQUIPMENT (S),' 27 March 2009, 09STATE30001_a, https://wikileaks.org/plusd/cables/09STATE30001_a.html, accessed 17 August 2016.

³⁴⁶ United States Department of State, 'COOPERATION BETWEEN SOUTH KOREAN FIRM AND ENTITIES ASSOCIATED WITH PAKISTAN'S MISSILE PROGRAM (S),' 08STATE26305_a, 13 March 2008, https://wikileaks.org/plusd/cables/08STATE26305_a.html, accessed 17 August 2016.

³⁴⁷ United States Department of State, 'MACHINE TOOL PROCUREMENT EFFORTS BY ENTITIES OF PROLIFERATION CONCERN (S),' 08STATE57067_a, 28 May 2008, https://wikileaks.org/plusd/cables/08STATE57067_a.html, accessed 17 August 2016

³⁴⁸ United States Department of State, 'CONTINUED COOPERATION BETWEEN SINGAPORE'S ACE PRESSUREWELD AND PAKISTAN (S),' 08STATE93765_a, 2 September 2008, https://wikileaks.org/plusd/cables/08STATE93765_a.html, accessed 17 August 2016.

³⁴⁹ United States Department of State, 'PAKISTANI PROCUREMENT FIRM SEEKS GERMAN-ORIGIN CALIBRATION EQUIPMENT ON BEHALF OF MISSILE-AFFILIATED ENTITIES (S),' 16 December 2008, 08STATE131705_a, https://wikileaks.org/plusd/cables/08STATE131705_a.html, accessed 17 August 2016.

³⁵⁰ United States Department of State, 'INDIAN NON-PAPER ON PAKISTANI EFFORTS TO PROCURE MISSILE TECHNOLOGY FROM CHINA,' 21 June 2005, 05NEWDELHI4719_a, https://wikileaks.org/plusd/cables/05NEWDELHI4719_a.html, accessed 17 August 2016.

Key facilities

The PMO likely maintains a number of facilities. This includes a substantial production and testing facility originally built with Chinese assistance for production of M-11 (i.e. Ghaznavi/Hatf-V) type missiles.³⁵¹ This facility is located at Tarwanah, north of Rawalpindi (see below).

³⁵¹ Described by Feroz Khan as ‘the PMO facility for the M-11 assembly’: see Khan, *Eating Grass*, p.240.

PMO missile production and testing facility, Tarwanah



Image © 2016 DigitalGlobe

Image from Google Earth/DigitalGlobe
33.783421°, 72.893353° (28 September 2015)

International footprint

Beyond PMO's procurement activity abroad, it is not known to have an international footprint.

Subsidiaries and affiliates

PMO retains several front companies in Pakistan which it uses to procure dual-use goods from abroad. These entities are detailed in the restricted version of this report.

Project Management Organisation (PMO)			
Reports to	NDC		
Also known as	Project Management Office		
Current head	?		
Address	Khanpur Road, Tarwanah, Pakistan ³⁵²		
Contact details	Tel 92 51-2229530, 03455678300 ³⁵³		
Designated by	Japan	BIS	
	N	N	

³⁵² 'Project Management Organization, Tarnawa,' Yalwa, undated, http://abbottabad.yalwa.com.pk/ID_106808590/Project-Management-Organization.html, accessed 28 September 2016.

³⁵³ Public Procurement Regulatory Authority, 'PUBLIC PROCUREMENT REGULATORY AUTHORITY CAPACITY BUILDING TRAINING PROGRAMME ON "PUBLIC PROCUREMENT RULES & PROCEDURES",' 2013, <http://www.ppra.org.pk/nip/nip2013.htm>, accessed 24 August 2016.

The Air Weapons Complex (AWC) was established after 1988 to help develop the delivery system design for Pakistan’s air-dropped nuclear weapons. As Khan notes, the NDC was in charge of the overall delivery system, and the AWC was created to assist with aerodynamics of the air-dropped weapons.³⁵⁴ AWC possibly retains responsibility for development of Pakistan’s air-dropped nuclear weapons.

AWC has since adopted a broader role in Pakistan’s strategic programmes. A 2008 US State Department cable notes that AWC ‘has participated in Pakistan’s efforts to develop nuclear weapon delivery systems, cruise missiles, and unmanned aerial vehicles.’³⁵⁵ As of 2014, AWC was responsible for Pakistan’s cruise missile and strategic UAV programs, according to the US Department of Commerce.³⁵⁶ AWC is subordinate to NESCOM.³⁵⁷



Figure 31. AWC logo³⁵⁸

Cruise missile systems developed by AWC include:

- the Babur/Hatf-VII ground-launched, nuclear-capable cruise missile (see below); and
- the Ra’ad/Hatf-VIII air-launched, nuclear-capable cruise missile (see below).

³⁵⁴ Khan, *Eating Grass*, p.186.

³⁵⁵ United States Department of State, ‘CHINESE ENTITY TO SUPPLY PAKISTAN WITH MISSILE-RELATED PRODUCTION TECHNOLOGY (S),’ 3 July 2008, 08STATE71613_a,

³⁵⁶ United States Department of Commerce, ‘Addition and Modification of Certain Persons on the Entity List; and Removal of Certain Persons From the Entity List,’ 18 September 2014, <https://www.federalregister.gov/articles/2014/09/18/2014-22277/addition-and-modification-of-certain-persons-on-the-entity-list-and-removal-of-certain-persons-from>, accessed 18 August 2016.

³⁵⁷ United States Department of State, ‘(S) FOLLOWING UP WITH RUSSIA ON CASE OF PROLIFERATION CONCERN,’ 21 July 2009, 09STATE75993_a, https://wikileaks.org/plusd/cables/09STATE75993_a.html, accessed 18 August 2016.

³⁵⁸ ‘Air Weapons Complex,’ undated, <http://www.awc.com.pk> (via <http://www.archive.org>), accessed 28 September 2016.



Figure 32. AWC Director General Air Vice Marshall Zubair Iqbal Malik presents Ra'ad model to NESCOM Chairman Irfan Burney after successful test launch of nuclear-capable Ra'ad cruise missile, May 2008³⁵⁹



Figure 33. Babur/Hatf-VII cruise missile, produced by AWC.³⁶⁰

Key personnel

AWC's current senior officials are not known.

Involvement in proliferation/procurement

The AWC's commercial arm, AERO (see below), and a number of AERO-related front companies and intermediaries have been heavily involved in procurement of dual-use goods from abroad.

³⁵⁹ Image source: <http://www.pakwheels.com/forums/non-wheels-discussions/88549-source-pride-strength>

³⁶⁰ Image source: <http://www.hollilla.com/reader.php?action=thread&thread=3874924&offset=30>

Key facilities

AWC's main facility is located in Hasan Abdal, near Wah Cantonment (see figure below).

Air Weapons Complex, Hassan Abdal



Image © 2016 DigitalGlobe

Image from Google Earth/DigitalGlobe
33.847910°, 72.728501° (4 April 2016)

International footprint

AWC maintains a relationship with South African defence manufacturer Denel. IHS Jane's has assessed that the Ra'ad/Hatf-VII cruise missile is possibly based on designs or technology provided by Denel,³⁶¹ and the relationship between AWC and Denel may involve transfer of technology related to cruise missiles.

Air Weapons Complex (AWC)				
Reports to	NESCOM			
Also known as	-			
Current head	?			
Address	E-5, Officers Colony, Wah Cantt, 47040, Pakistan; ³⁶² PO Box 91, Wah Cantton, Pakistan; ³⁶³ Lab Thatoo, Haripur Road, Hassan Abdal, Pakistan ³⁶⁴			
Contact details	Tel 92-51-9270548, 92-5772-520522, fax 92-51-9270545, 92-5772-520069, marketing@awc.com.pk ³⁶⁵			
Designated by	Japan	BIS		
	N	N		

³⁶¹ Jeremy Binnie, 'Pakistan tests Ra'ad ALCM,' *Jane's Defence Weekly*, 3 February 2015.

³⁶² 'Air Weapons Complex,' undated, <http://www.awc.com.pk> (via <http://www.archive.org>), accessed 28 September 2016.

³⁶³ Trade data sourced by Project Alpha.

³⁶⁴ Hyderabad Plus Phone Directory, undated, <http://webcache.googleusercontent.com/search?q=cache:jJEg3Fz4xF0J:www.hyderabadplus.com/directory/%3Fcity%3D0995,Haripur%26mode%3DN%26enter%3Da%26Page%3D48+&cd=8&hl=en&ct=clnk&gl=uk>, accessed 2 September 2016.

³⁶⁵ 'Air Weapons Complex,' undated, <http://www.awc.com.pk> (via <http://www.archive.org>), accessed 28 September 2016.

The Advanced Engineering Research Organisation (AERO) is the AWC's commercial arm and has acted as a procurement agent and alias for AWC, according to US diplomatic cables.³⁶⁶ In 2012, a former AWC official described AERO as a commercial spin-off entity of the AWC.³⁶⁷



Figure 34. AERO logo³⁶⁸

Key personnel

AERO's current senior personnel are not publicly known.

Involvement in proliferation/procurement

AERO has persistently sought dual-use goods from foreign suppliers for AWC, often using deceptive techniques and acting in violation of national export controls. The US Department of Commerce's Bureau of International Security (BIS) has noted:

Since 2010, Pakistan's AERO has used intermediaries and front companies to procure U.S.-origin items by disguising the end-uses and end-users of the items from U.S. exporters thereby circumventing BIS licensing requirements.³⁶⁹

These efforts are ongoing and recent. In January 2016, for example, US authorities charged a Pakistani national with attempting to procure for AERO a number of low-drift gyroscopes, suitable for use in UAVs, through two front companies, I&E International and Innovative Links.³⁷⁰

AERO has made extensive procurements of dual-use goods under its own name. This includes procurements from companies in China, Singapore and South Korea.

³⁶⁶ United States Department of State, '(S) FOLLOWING UP WITH RUSSIA ON CASE OF PROLIFERATION CONCERN,' 21 July 2009, 09STATE75993_a, https://wikileaks.org/plusd/cables/09STATE75993_a.html, accessed 18 August 2016; United States Department of State, 'CHINESE ENTITY TO SUPPLY PAKISTAN WITH MISSILE-RELATED PRODUCTION TECHNOLOGY (S),' 3 July 2008, 08STATE71613_a, https://wikileaks.org/plusd/cables/08STATE71613_a.html, accessed 18 August 2016.

³⁶⁷ Mustafa Z Paras and Ata ul Haq, 'Mansoor Malik: An innovation policy maker rather than a think tank,' *Technology Times*, 30 September 2012 (via Factiva).

³⁶⁸ 'About Us,' Global Industrial & Defence Solutions (GIDS), <http://gids.com.pk/about>, accessed 18 August 2016.

³⁶⁹ United States Department of Commerce, 'Addition and Modification of Certain Persons on the Entity List; and Removal of Certain Persons From the Entity List,' 18 September 2014, <https://www.federalregister.gov/articles/2014/09/18/2014-22277/addition-and-modification-of-certain-persons-on-the-entity-list-and-removal-of-certain-persons-from>, accessed 18 August 2016.

³⁷⁰ 'Pakistani citizen indicted for trying to smuggle drones for Pak Army,' *Deccan Chronicle*, 9 January 2016 (via Factiva).

International footprint

In addition to its foreign procurement activity, AERO also produces goods for international sale. This has included participation in SPD's Global Industrial Defence Solutions (GIDS), a consortium of defence producers marketing goods to domestic and foreign customers (see below).³⁷¹ As of 2012, a former AWC official stated that AERO had exported over \$100 million of products and services to customers in Africa, the Middle East, and South-East Asia.³⁷²



Figure 35. Marketing stand for AERO air combat training system

AERO maintains a number of intermediaries outside Pakistan. Known AERO intermediaries outside Pakistan cited by the US Department of Commerce include:

- Izix Group Pte Ltd, a Singapore company
- Vortex Electronics, an Australian company
- Wei Lai Xi Tong Ltd (aka Beijing Lion Heart International Trading Company), a company with branches in Beijing and Hong Kong.³⁷³

³⁷¹ 'Global Industrial & Defence Solutions,' LinkedIn, undated, <https://www.linkedin.com/company/gids>, accessed 20 September 2016.

³⁷²Mustafa Z Paras and Ata ul Haq, 'Mansoor Malik: An innovation policy maker rather than a think tank,' *Technology Times*, 30 September 2012 (via Factiva).

³⁷³ United States Department of Commerce, 'Addition and Modification of Certain Persons on the Entity List; and Removal of Certain Persons From the Entity List,' 18 September 2014, <https://www.federalregister.gov/articles/2014/09/18/2014-22277/addition-and-modification-of-certain-persons-on-the-entity-list-and-removal-of-certain-persons-from>, accessed 18 August 2016.

Advanced Engineering Research Organisation (AERO)				
Reports to	NESCOM			
Also known as	Advance Engineering Research Organisation			
Current head	?			
Address	Lub Thatoo, Hazara Road, Tehsil, Taxila District, Rawalpindi, Pakistan; ³⁷⁴ PO Box 91, Wah Cantonment, Pakistan ³⁷⁵			
Contact details	?			
Designated by	Japan	BIS		
	Y	Y		

³⁷⁴ Trade data sourced by Project Alpha.

³⁷⁵ Abdul Manan and Haroon A. Baluch, 'Analysis of a Casted Control Surface using Bi-Linear Kinematic Hardening,' available online at <https://support.ansys.com/staticassets/ANSYS/staticassets/resourcelibrary/confpaper/2004-Int-ANSYS-Conf-29.PDF>, accessed 2 September 2016.

The Maritime Technologies Complex (MTC) is a research and development organisation dedicated to projects for Pakistan's Navy. MTC is involved in design of marine platforms including ships and submarines,³⁷⁶ and former employees of MTC have described working on underwater vehicles, and electronic systems for ships.³⁷⁷

MTC is frequently referred to as subordinate to NESCOM, including in official Pakistani government publications.³⁷⁸

MTC is probably responsible for developing any sea-launched nuclear weapons that Pakistan has under development. According to Feroz Khan, as of 2012, MTC was nearing completion of a 'sea-based deterrent...most likely based on a naval version of the [Babur/Hatf-VII] cruise missile.'³⁷⁹ Future efforts by Pakistan to develop additional ship or submarine-launched missiles (such as new cruise missiles, or submarine-launched ballistic missiles), will probably involve the MTC.

MTC is reportedly also involved in the development of a nuclear reactor for use in future Pakistani nuclear-propelled submarines. In April, a Pakistani official was quoted as stating that the Pakistan Atomic Energy Commission and the Maritime Technology Complex were collaborating to 'design a miniaturised reactor for a nuclear submarine.'³⁸⁰

Key personnel

MTC's current senior personnel are not publicly known. As of 2012, Rear Admiral Saleem Akhtar was director general of MTC, according to Pakistani media reporting.³⁸¹

Involvement in proliferation/procurement

MTC is known to have made several procurements of dual-use technology including from the US-UK defence supplier, Teledyne Defence.

³⁷⁶ 'Karachi Shipyard, Maritime Technologies Complex sign MOU to undertake design, construction of ships, submarines,' *Pakistan Press International Information Services*, 16 March 2012 (via Factiva).

³⁷⁷ 'Syed Ashad Mustufa Younus,' 22 August 2013, https://reginnovations.org/wp-content/uploads/2013/09/02-AM_Resume.pdf, accessed

³⁷⁸ See, e.g., 'OFFICIAL/GRATIS PASSPORT,' Pakistan Directorate General Immigration and Passports, 11 October 2013, <http://www.nescom.gov.pk/>, accessed 22 August 2016; also 'Dr. Syed Saif-ur-Rahman,' undated, Habib University, <https://habib.edu.pk/SSE/dr-syed-saif-ur-rahman/>, accessed 22 August 2016; 'HAFEEZULLAH QAZI,' file dated 10 February 2015, http://es.mueta.edu.pk/iwemsa/profile_hafeezullah_kazi.pdf, accessed 22 August 2016; 'YASER KHAN,' undated, LinkedIn, <https://uk.linkedin.com/in/yaser-khan-a5a9b414>, accessed 22 August 2016; 'Dr. Muhammad Bilal Sajid,' undated, Ghulam Inshaq Khan Institute, <http://www.giki.edu.pk/Faculty/Dr-Muhammad-Bilal-Sajid>, accessed 22 August 2016.

³⁷⁹ Khan, *Eating Grass*, p.396-7.

³⁸⁰ 'Pakistan worried about Indian nuclear submarine fleet,' *Kyodo News*, 21 April 2016 (via Factiva).

³⁸¹ 'Karachi Shipyard, Maritime Technologies Complex sign MOU to undertake design, construction of ships, submarines,' *Pakistan Press International Information Services*, 16 March 2012 (via Factiva).

International footprint

Beyond its foreign procurement activity, no additional international activity of MTC is known.

Key facilities

MTC likely maintains a number of facilities, including its headquarters at the NESCOM complex in Islamabad. An additional MTC facility at Fateh Jang has been referred to by a contractor, but is as yet unlocated.³⁸²

Subsidiaries and affiliates

MTC almost certainly owns or controls Marine Systems Limited (see below), a private Pakistani company involved in maritime projects for military customers.

Maritime Technologies Complex (MTC)				
Reports to	NESCOM			
Also known as	Maritime Technology Complex, Maritime Technology Organization (MTO) ³⁸³			
Current head	?			
Address	139/2, Karachi, Pakistan; Plot no. 94, NESCOM Complex, H-11/4, Islamabad, Pakistan ³⁸⁴			
Contact details	Tel 051-2271039, 051-2222029, 0345-5430644, 051-2271039, 906723327, 0346-5316294, procurement@msl.com.pk ³⁸⁵			
Designated by	Japan	BIS		
	N	N		

³⁸² 'Gammon Pakistan Limited,' file dated 12 January 2016, <http://www.gammonpakistan.com/uni/uploads/brochure.pdf>, accessed 24 August 2016.

³⁸³ Khan, *Eating Grass*, p.396-7.

³⁸⁴ Trade data sourced by Project Alpha.

³⁸⁵ Public Procurement Regulatory Authority, 'PUBLIC PROCUREMENT REGULATORY AUTHORITY CAPACITY BUILDING TRAINING PROGRAMME ON "PUBLIC PROCUREMENT RULES & PROCEDURES",' 2013, <http://www.ppra.org.pk/nip/nip2013.htm>, accessed 24 August 2016.

Space and Upper Atmosphere Commission (SUPARCO)

The Space and Upper Atmosphere Commission (SUPARCO) is Pakistan's national space agency. It coordinates Pakistan's space programme, including remote sensing and satellite tracking efforts.³⁸⁶ SUPARCO is subordinate to SPD, according to a Pakistani government circular.³⁸⁷



Figure 36. SUPARCO logo³⁸⁸

SUPARCO has been a key entity in Pakistan's ballistic missile programme. At the outset of Pakistan's ballistic missile development efforts in the 1980s, SUPARCO held responsibility for that entire programme. According to a 1990 CIA intelligence assessment:

Islamabad's ballistic missile programme is supervised by [SUPARCO]... SUPARCO headquarters in Karachi coordinates all aspects of the missile programme...³⁸⁹

While SUPARCO is no longer in charge of Pakistan's ballistic missile development and production efforts, it has been the primary agency responsible for development of the nuclear-capable³⁹⁰ Abdali/Hatf-II short-range ballistic missile, according to a US diplomatic cable.³⁹¹

³⁸⁶ 'About us,' undated, Space and Upper Atmosphere Commission, <http://suparco.gov.pk/webroot/pages/functions.asp>, accessed 15 August 2016.

³⁸⁷ Federal Public Service Commission, 'Circular,' 2 December 2013, <http://fpsc.gov.pk/icms/admin/documents/forms/grant%20of%20age%20relaxation-04-12-2013.pdf>, accessed 2 September 2016

³⁸⁸ Image source: <http://isnet.org.pk/pages/activities-2015-02.asp>.

³⁸⁹ Central Intelligence Agency, '(EST PUB DATE) BALLISTIC MISSILES IN (DELETED) PAKISTAN (DELETED),' 1 June 1990, <https://www.cia.gov/library/readingroom/document/est-pub-date-ballistic-missiles-deleted-pakistan-deleted>, accessed 15 August 2016.

³⁹⁰ 'Pakistan tests nuclear capable Hatf II missile,' *Dawn*, 15 February 2013, <http://www.dawn.com/news/786253/pakistan-tests-nuclear-capable-hatf-ii-missile>, accessed 15 August 2016.

³⁹¹ United States Department of State, 'China's Record on Controlling Missile-Related Exports,' 12 October 2008, O8STATE105132_a, https://wikileaks.org/plusd/cables/O8STATE105132_a.html, accessed 15 August 2016.



Figure 37. Abdali/Hatf-II missile, developed by SUPARCO.³⁹²

Key personnel

As of 2015, Major General Qaiser Anees Khurram was chairman of SUPARCO, according to the organisation's website.³⁹³

Involvement in proliferation/procurement

SUPARCO has been involved in attempted procurements of complete missile systems from China, although not since the early 1990s. In June 1991, the US State Department designated SUPARCO on the grounds that it had 'engaged in missile technology proliferation activities', almost certainly relating to the transfer of M-11 missile systems from China.³⁹⁴

SUPARCO has been involved in multiple instances of procurements of controlled dual-use goods, including cases where procurements have been made in violation of export control laws. These cases have included:

- In 2009, a US man supplied carbon fibre (Tenax-E HTS40 F13 12K 800 tex) and microwave laminate (RT/duroid 5870 High Frequency Laminates) to SUPARCO without the required export licences. He later pleaded guilty to violations of US export controls.³⁹⁵

³⁹² Image source: <http://defence.pk/threads/pakistan-missile-milestones-ranges.235978/>.

³⁹³ 'About us,' undated, Space and Upper Atmosphere Commission, <http://suparco.gov.pk/webroot/pages/history.asp>, accessed 15 August 2016.

³⁹⁴ 'Imposition of Missile Proliferation Sanctions Against Chinese and Pakistani Entities,' Federal Register (vol 56, no 137), 17 July 1991, pp.25-26, cited in Cameron Binkley, 'Pakistan's Missile Development: The Sword of Islam?' p.83, in Potter and Jencks, eds., *The International Missile Bazaar* (Boulder: Westview Press, 1994)

³⁹⁵ U.S Attorney's Office, Northern District of Illinois, 'Bolingbrook Man Pleads Guilty to Illegally Exporting Carbon Fiber and Other Controlled Items to Pakistan,' 2 October 2014, <https://www.fbi.gov/contact-us/field-offices/chicago/news/press-releases/bolingbrook-man-pleads-guilty-to-illegally-exporting-carbon-fiber-and-other-controlled-items-to-pakistan>, accessed 15 August 2016.

- In 2007, SUPARCO attempted to procure unsymmetrical dimethylhydrazine (UDMH), an MTCR-controlled chemical used as an advanced liquid missile propellant, from a company in China (Xinshidai Company), according to a US cable.³⁹⁶
- In 2007, the University of Massachusetts at Lowell (UML) supplied SUPARCO with antennae, cables and an atmospheric testing device without required export licences. UML later paid a substantial fine to the US government.³⁹⁷
- In April 1996, SUPARCO was the listed consignee on a shipment of 10 tonnes of ammonium perchlorate that was detained in Hong Kong en route to Pakistan from the DPRK.³⁹⁸ Ammonium perchlorate is used as a key ingredient in some solid rocket propellants. The shipment originated with North Korea's Lyongaksan Corporation (also known as Korea Ryonbong General Corporation), 'a defence conglomerate specializing in acquisition for DPRK defence industries and support to that country's military-related sales.'³⁹⁹ In March 1996, another shipment of ammonium perchlorate to SUPARCO from the DPRK was detained in Taiwan.⁴⁰⁰

SUPARCO has been seen in trade data procuring dual-use goods from abroad since at least 2013. Notable recent procurements include missile-related equipment and components from Chinese state-owned entities including China Great Wall Industry Corporation and the China Academy of Aerospace Electronics Technology.

Key facilities

SUPARCO's headquarters are located in Karachi (see figure below).

³⁹⁶ United States Department of State, 'China's Record on Controlling Missile-Related Exports,' 12 October 2008, 08STATE105132_a, https://wikileaks.org/plusd/cables/08STATE105132_a.html, accessed 15 August 2016.

³⁹⁷ See 'Order relating to University of Massachusetts at Lowell,' 12 March 2013, https://efoia.bis.doc.gov/index.php/component/docman/doc_download/837-e-2306?Itemid=, accessed 15 August 2016.

³⁹⁸ Michelle Chin and Glenn Schloss, 'CUSTOMS RAID UNCOVERS HUGE HAUL OF ROCKET FUEL,' *South China Morning Post*, 18 September 1996 (via Factiva).

³⁹⁹ Re United Nations Security Council, Resolution 1718 (2006), S/RES/1718, 14 October 2006, http://www.un.org/ga/search/view_doc.asp?symbol=S/RES/1718%20%282006%29.

⁴⁰⁰ Michelle Chin and Glenn Schloss, 'CUSTOMS RAID UNCOVERS HUGE HAUL OF ROCKET FUEL,' *South China Morning Post*, 18 September 1996 (via Factiva).



Figure 38. SUPARCO headquarters, Karachi⁴⁰¹

SUPARCO maintains several other facilities, including a rocket and propellant production plant in Karachi that was built in the 1960s with French assistance.⁴⁰² SUPARCO has also established a rocket launch site and monitoring facility⁴⁰³ at Sonmiani (see figure below), just north-west of Karachi.⁴⁰⁴

⁴⁰¹ Image by Athar Agha, via Panoramio (<https://ssl.panoramio.com/photo/90769385>).

⁴⁰² Tariq Mustafa, 'SUPARCO - The formative years (1961 - 1967),' *The Friday Times*, March 30 - April 05, 2012, Vol. XXIV, No. 7, <http://www.thefridaytimes.com/beta3/tft/article.php?issue=20120330&page=22>, accessed 15 August 2016.

⁴⁰³ 'Space and Atmospheric Sciences,' <http://suparco.gov.pk/pages/space-weather-monitoring.asp>

⁴⁰⁴ Tariq Mustafa, 'SUPARCO - The formative years (1961 - 1967),' *The Friday Times*, March 30 - April 05, 2012, Vol. XXIV, No. 7, <http://www.thefridaytimes.com/beta3/tft/article.php?issue=20120330&page=22>, accessed 15 August 2016.

SUPARCO headquarters, Karachi



Image © 2016 DigitalGlobe

Image from Google Earth/DigitalGlobe
24.948093°, 67.137598° (16 February 2016)

SUPARCO production facility, Karachi

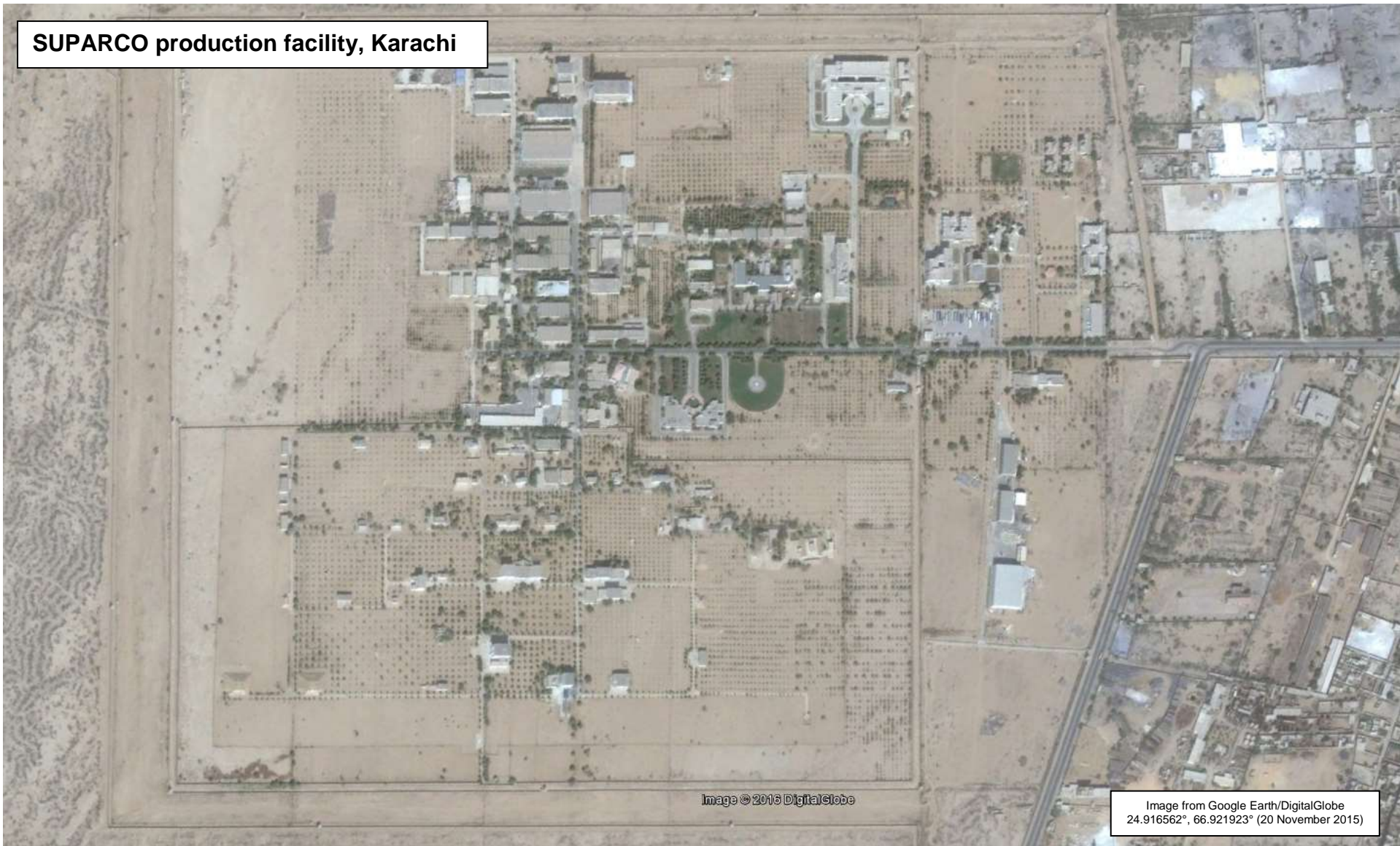


Image © 2016 DigitalGlobe

Image from Google Earth/DigitalGlobe
24.916562°, 66.921923° (20 November 2015)

SUPARCO launch site, Sonmiani



Image © 2015 DigitalGlobe

Image from Google Earth/DigitalGlobe
25.353356°, 66.665721° (26 January 2015)

International footprint

SUPARCO is involved in a range of bilateral, regional and multilateral space efforts, including with major international organisations.⁴⁰⁵ These efforts are civil in nature, although some may involve diversion of sensitive foreign expertise or technology to Pakistan-based missile-related activities.

Space and Upper Atmosphere Commission (SUPARCO)				
Reports to	Strategic Plans Division			
Also known as	SUPARCO			
Current head	Major General Qaiser Anees Khurram ⁴⁰⁶			
Address	Sector 28, Gulzar-e-Hijiri, Off University Road, P.O. Box 8402, Karachi 75270; ⁴⁰⁷ SUPARCO Road, P. O. Box No. 8402, Karachi 75270 ⁴⁰⁸			
Contact details	Karachi Office: 92 21 34690765 Lahore Office: 92 42 35293040-50 Islamabad Office: 92 51 9075100 Peshawar Office: 92 91 5837195 Multan Office: 92 61 9210136 Fax: 92 21 34644928, 92 21 34694941 ⁴⁰⁹			
Designated by	Japan	BIS		
	Y	Y		

⁴⁰⁵ See 'International Cooperation,' undated, Space and Upper Atmosphere Commission, <http://suparco.gov.pk/webroot/pages/cooperation.asp>, accessed 15 August 2016.

⁴⁰⁶ 'About us,' undated, Space and Upper Atmosphere Commission, <http://suparco.gov.pk/webroot/pages/history.asp>, accessed 15 August 2016.

⁴⁰⁷ 'Addition of Certain Persons to the Entity List; Removal of Person From the Entity List Based on Removal Request; and Implementation of Entity List Annual Review Changes,' 19 September 2012, <https://www.federalregister.gov/articles/2012/09/19/2012-22952/addition-of-certain-persons-to-the-entity-list-removal-of-person-from-the-entity-list-based-on>, accessed 15 August 2016.

⁴⁰⁸ 'Contact us,' undated, Space and Upper Atmosphere Commission, <http://suparco.gov.pk/webroot/pages/contact-us.asp>, accessed 15 August 2016.

⁴⁰⁹ 'Contact us,' undated, Space and Upper Atmosphere Commission, <http://suparco.gov.pk/webroot/pages/contact-us.asp>, accessed 15 August 2016.

Peoples Steel Mills (PSM) is an alloy and specialty steel producer, established in 1968 and one of Pakistan's largest industrial companies. PSM has been an historic supplier of specialty metals to Pakistan's nuclear programme and defence industries, although the extent of its ongoing involvement with these programmes is unclear.⁴¹⁰

Because of its mounting debts, PSM is currently inactive and has not produced steel since June of 2015, according to Reuters.⁴¹¹ However, trade data reviewed by Project Alpha suggests that PSM continues to procure equipment from abroad.

PSM may be under the control of SPD. A 2016 SPD study recommended that PSM be transferred to SPD control,⁴¹² and at least one news article has since stated that PSM is now under SPD.⁴¹³



Figure 39. Peoples Steel Mills logo⁴¹⁴

Key personnel

PSM's current leadership is not known.

Involvement in proliferation/procurement

PSM has played an historic role in providing material to Pakistan's centrifuge programme. AQ Khan took over PSM in 1994, and used it to manufacture specialised metals including maraging steel for

⁴¹⁰ See eg 'Locally-produced gun delivered to HIT for tanks,' *Dawn*, 17 April 2011, <http://www.dawn.com/news/621771/locally-produced-gun-delivered-to-hit-for-tanks>, accessed 5 September 2016.

⁴¹¹ 'Slumbering Pakistani steel giant shows why state sell-offs are stalled,' *Reuters*, 16 February 2016 (via Factiva).

⁴¹² See 'HMC won't be allocated funds,' *Business Recorder*, 25 June 2016 (via Factiva).

⁴¹³ See Shahid-ur-Rehman Khan, 'Pakistan's indigenous nuclear power plant capability gets big boost,' *Japan Economic Newswire*, 22 June 2016 (via Factiva).

⁴¹⁴ 'Peoples Steel Mills Ltd,' Peoples Steel Mills, file dated October 2011, <http://www.psmltd.com/images/brochure1.pdf>, accessed 5 September 2016.

KRL's uranium enrichment operations at Kahuta.⁴¹⁵ During the 1990s, PSM also served as a front company for overseas purchases for Pakistan's centrifuge programme.⁴¹⁶ As of 2011, PSM was still collaborating with KRL on metallurgical testing, according to a presentation by the Wisconsin Project on Nuclear Arms Control.⁴¹⁷

In the past five years, PSM has been seen procuring raw materials for steel production as well as parts for vacuum furnaces.

International footprint

In addition to its foreign procurements, Peoples Steel Mills maintains business engagements with various foreign entities. For example, in 2015, Austrian certification authority TÜV Austria provided an ISO 9001 certification to PSM, according to Pakistani news reporting.⁴¹⁸

Peoples Steel Mills				
Reports to	Possibly SPD			
Also known as	PSM			
Current head	?			
Address	Javedan Nagar, Manghopir Road, Karachi 75890, Pakistan. ⁴¹⁹			
Contact details	Tel 92 21 6770115, 92 21 6770126, fax 92 21 677 0112, email marketing@psmltd.com ⁴²⁰			
Designated by	Japan	BIS		
	Y	Y		

⁴¹⁵ Adrian Levy and Catherine Scott-Clark, *Deception: Pakistan, the United States, and the Secret Trade in Nuclear Weapons* (New York: Walker and Company, 2007), pp.447-8.

⁴¹⁶ Albright, *Peddling Peril*, p.144.

⁴¹⁷ Presented at the 2016 Workshop on Analysis of Trade Data and Related Open Source Information for Non-Proliferation and Strategic Security, 27- 28 June 2016, Vienna.

⁴¹⁸ 'TUV Austria awards certification to Steel Mills,' *The Nation*, 10 August 2015, accessed <http://nation.com.pk/business/10-Aug-2015/tuv-austria-awards-certification-to-steel-mills>, accessed 6 September 2016.

⁴¹⁹ Department of Commerce, 'India and Pakistan Sanctions and Other Measures,' 15 CFR Parts 742 and 744, <https://www.gpo.gov/fdsys/pkg/FR-1998-11-19/pdf/98-30877.pdf>.

⁴²⁰ 'Peoples Steel Mills Ltd,' Peoples Steel Mills, file dated October 2011, <http://www.psmltd.com/images/brochure1.pdf>, accessed 5 September 2016.

Ministry of Defence Production

The Ministry of Defence Production (MODP) oversees procurement and indigenous production for Pakistan's armed forces.⁴²¹ It has authority over three autonomous military production entities, two of which have been involved in or possibly involved in work for Pakistan's strategic programmes – the Pakistan Aeronautical Complex and the Pakistan Ordnance Factories. The third entity overseen by MODP, Heavy Industries Taxila, is not known to be involved in strategic work.

MODP> Pakistan Aeronautical Complex (PAC) Kamra

The Pakistan Aeronautical Complex's (PAC) stated mission is to produce and support weapons systems for the Pakistan Air Force (PAF).⁴²² It maintains all PAF's operational assets, and conducts repair, refurbishment, and overhaul services of aircraft and aircraft systems.⁴²³

This role possibly includes work relating to nuclear weapons delivery systems. PAC's declared capabilities and stated role would make it a suitable hub for modification work on Pakistan's fighter aircraft to make them capable of delivering air-dropped nuclear weapons. However, this has not been confirmed, and PAC does not state that it plays any mission in Pakistan's strategic programmes.



Figure 40. PAC logo⁴²⁴

PAC is operated by the PAF and commanded by a PAF officer, but functions under the Ministry of Defence Production.⁴²⁵

⁴²¹ 'Yearbook 2014-15,' Ministry of Defence Production, <http://202.83.164.29/modp/userfiles1/file/Year%20Book%202014-15.pdf>, accessed 15 September 2016.

⁴²² Pakistan Air Force, 'Pakistan Aeronautical Complex (promotional video),' YouTube, 27 August 2013, https://www.youtube.com/watch?v=17P_zKJ86pY, accessed 6 September 2016.

⁴²³ 'Introduction,' Pakistan Aeronautical Complex, undated, <http://www.pac.org.pk/introduction>, accessed 6 September 2016.

⁴²⁴ Pakistan Aeronautical Complex, undated, <http://www.pac.org.pk/>, accessed 6 September 2016.

⁴²⁵ See 'Organizations,' Ministry of Defence Production, undated, <http://www.modp.gov.pk/>, accessed 28 September 2016.

Key personnel

As of July 2016, Air Vice Marshal Nadeem Tariq is in command of PAC.⁴²⁶

Involvement in proliferation/procurement

PAC has been seen in trade data conducting several hundred imports of goods relevant to its aircraft refurbishment and production work. This includes imports from major multinational suppliers including US aircraft manufacturer Pratt & Whitney.⁴²⁷

Subsidiaries and affiliates

PAC has four main complexes, according to the company's website:⁴²⁸

- **Aircraft Manufacturing Factory (AMF)**, producer of the Mushshak trainer aircraft, K-8 jet trainer, JF-17 Thunder fighter aircraft and Falco UAV.
- **Aircraft Rebuild Factory (ARF)**, involved in overhauling aircraft for A-5III, FT- 5, Y-12, K-8 and F-7 aircraft variants
- **Avionics Production Facility (APF)**, developer and producer of airborne radar and other avionics systems.
- **Mirage Rebuild Factory (MRF)**, involved in overhauling French-origin Mirage aircraft

These facilities are located at the main PAC site in Kamra, Pakistan (see figure below).

⁴²⁶ 'News,' Pakistan Aeronautical Complex, <http://www.pac.org.pk/news>, accessed 6 September 2016.

⁴²⁷ Trade data sourced by Project Alpha.

⁴²⁸ Pakistan Aeronautical Complex, undated, <http://www.pac.org.pk/>, accessed 6 September 2016.

Pakistan Aeronautical Complex, Kamra

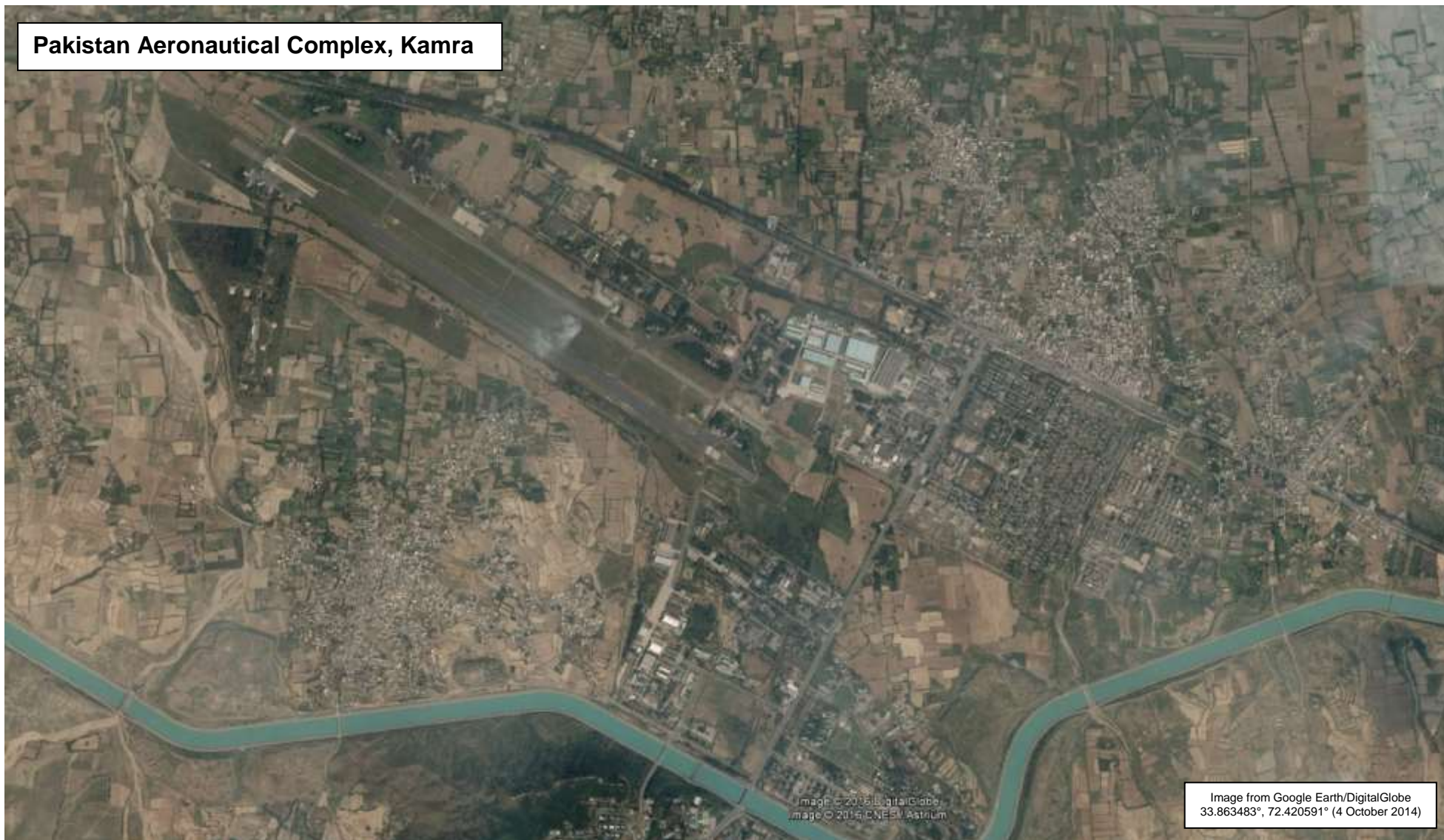


Image © 2015 DigitalGlobe
Image © 2016 CNES/Airbus

Image from Google Earth/DigitalGlobe
33.863483°, 72.420591° (4 October 2014)

International footprint

PAC advertises its international collaborations with a wide range of foreign companies, including Boeing, China's China National Aero-Technology Import & Export Corporation (CATIC), China Electronics Industries Corporation (CEIC) and China Electronics Technology Group (CETC), France's Dassault, UK company Rolls-Royce, and others.⁴²⁹

Pakistan Aeronautical Complex (PAC)				
Reports to	Pakistan Air Force			
Also known as	PAC Kamra			
Current head	Air Vice Marshal Nadeem Tariq			
Address	Pakistan Aeronautical Complex, Kamra, District Attock, Pakistan ⁴³⁰			
Contact details	?			
Designated by	Japan	BIS		
	N	N		

⁴²⁹ 'Collaboration,' Pakistan Aeronautical Complex, undated, <http://www.pac.org.pk/collaboration>, accessed 6 September 2016.

⁴³⁰ 'Contact,' Pakistan Aeronautical Complex, undated, <http://www.pac.org.pk/contact>, accessed 6 September 2016.

Pakistan Ordnance Factories (POF) is a major state-owned defence industrial development and manufacturing concern.

POF has historically been an important contributor to Pakistan's strategic programmes, but the extent of its ongoing involvement is difficult to verify. Until at least the end of the 1990s, POF produced at its Wah Cantonment facilities high explosives and precision-manufactured components for Pakistan's nuclear weapons, according to Khan.⁴³¹ Cloughley and Kelley assess that POF probably remains the contractor for integrating and producing Pakistan's nuclear weapons, although this cannot be verified.⁴³² They state that:

Non-nuclear components such as high explosives, electronics, firing and fuzing systems, and structural parts are likely to be produced at POF facilities in Wah Cantonment.⁴³³



Figure 41. POF logo⁴³⁴

Key personnel

Lt. General Omar Mahmood Hayat is chairman of POF's board, according to the POF website. POF's other senior personnel are also listed on the POF website.⁴³⁵

Subsidiaries and associated entities

POF has at least 11 known subsidiaries, some of which are possibly involved in development or production for Pakistan's strategic programmes.⁴³⁶ These are:

- Wah Industries Limited
- Wah Nobel Limited
- Hi Tech Plastic (PVT) Limited
- Wah Brass Mills (PVT) Limited

⁴³¹ Khan, *Eating Grass*, p.190.

⁴³² Brian Cloughley and Robert Kelley, 'Pakistan adopts full-spectrum nuclear deterrent,' *Jane's Intelligence Review*, 26 May 2016.

⁴³³ Brian Cloughley and Robert Kelley, 'Pakistan adopts full-spectrum nuclear deterrent,' *Jane's Intelligence Review*, 26 May 2016.

⁴³⁴ Image source: <http://www.pof.gov.pk>.

⁴³⁵ 'Pakistan Ordnance Factories,' undated, <http://pof.gov.pk/>, accessed 2 September 2016.

⁴³⁶ 'Our factories,' Pakistan Ordnance Factories, undated, <http://pof.gov.pk/about.php>, accessed 2 September 2016.

- Attock Chemicals (PVT) Limited
- Nobel Energy Limited
- Wah Gezhoubu (PVT) Limited
- Packages Factory
- Shotgun Ammunition Factory
- Wah Clothing (PVT) Limited
- Sanjwal Solar Power (PVT) Limited

Involvement in proliferation/procurement

POF has been active in procuring dual-use goods over the past five years, particularly from the EU and US. This includes machine tools from firms in the UK, Switzerland and Singapore, and materials from China and Singapore.

Key facilities

POF maintains multiple facilities, including a headquarters at Wah Cantonment (see below) that was used in the 1990s as part of Pakistan's nuclear weapons programme. This site remains a key hub for POF manufacturing operations.

Pakistan Ordnance Factories, Wah Cantonment

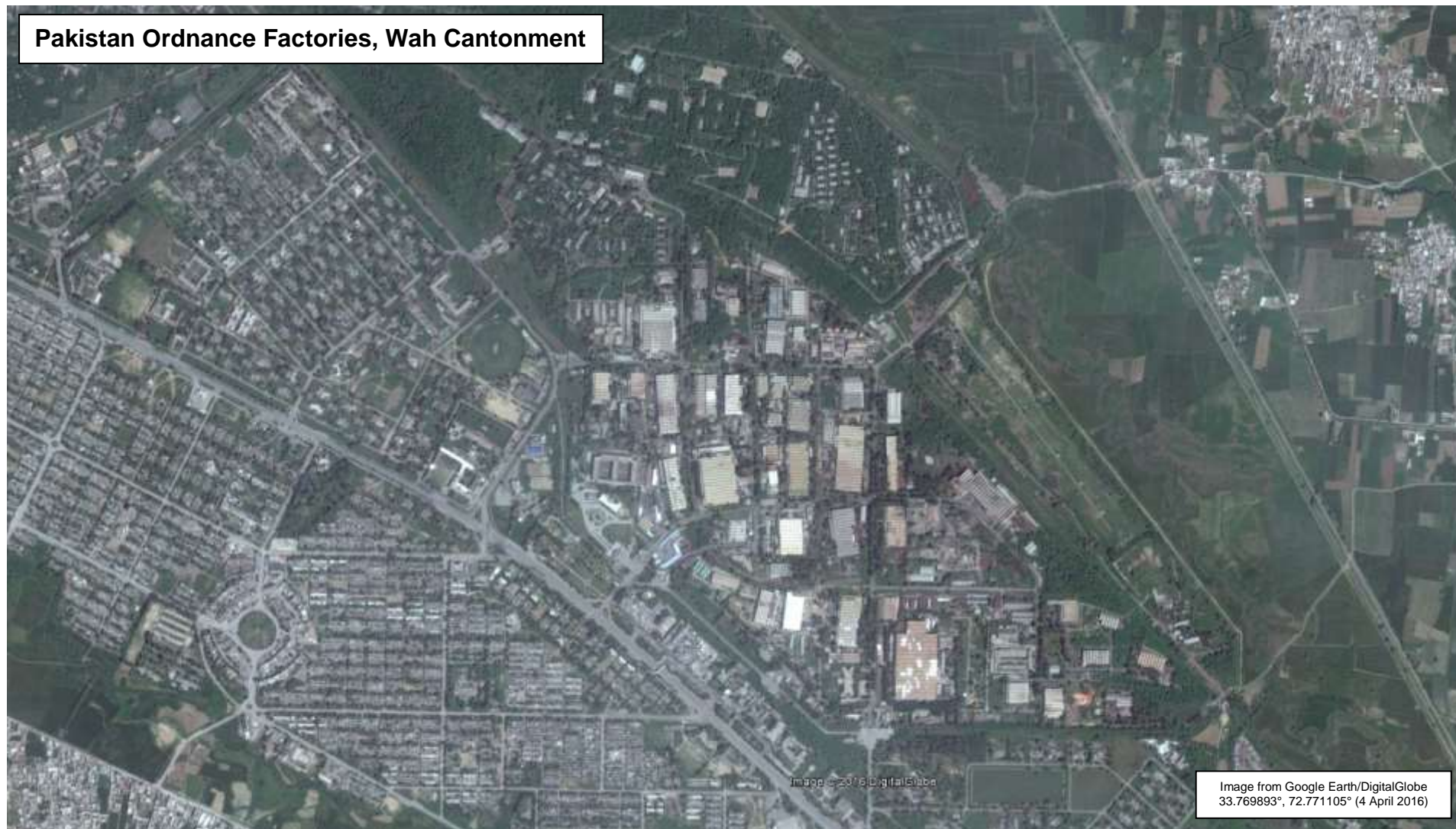


Image © 2016 DigitalGlobe

Image from Google Earth/DigitalGlobe
33.769893°, 72.771105° (4 April 2016)

International footprint

POF exports military goods and equipment to overseas clients, particularly in the Gulf Arab states and in Africa. In 2016, a POF spokesperson stated that the annual value of its foreign exports is now \$100m.⁴³⁷

Pakistan Ordnance Factories				
Reports to	Ministry of Defence Production			
Also known as	POF			
Current head	Lt. General Omar Mahmood Hayat			
Address	Wah Cantt, Pakistan; ⁴³⁸			
Contact details	Tel 92 51-9055000, 92 51-4514000; fax 9251-9271400, 9251-9314100 ⁴³⁹			
Designated by	Japan	BIS		
	Y	N		

⁴³⁷ 'PAKISTAN ORDNANCE FACTORIES EXPORTS HIT \$100M FOR CURRENT YEAR,' Quwa Defence and News Analysis Group, 23 August 2016, <http://quwa.org/2016/08/23/pakistan-ordnance-factories-exports-hit-100m-current-year/>, accessed 15 September 2016.

⁴³⁸ Trade data sourced by Project Alpha.

⁴³⁹ 'Government of Pakistan PAKISTAN ORDNANCE FACTORIES TENDER ENQUIRY,' Pakistan Ordnance Factories, August 2016, <http://pof.gov.pk/tenders/T.E.NO.0009-FP-PUR-BM-46.pdf>, accessed 2 September 2016.

4. Conclusion and Outlook

This report has aimed to make Pakistan's strategic industries less opaque to external scrutiny. It should be clear that there is a wealth of available information in open sources which can be used to dissect what are otherwise ostensibly covert or classified activities that are underway in the Pakistani nuclear and missile domains. Hopefully, further work will be completed to make even clearer the organisational structures, facilities, institutions, and operations of Pakistan's strategic programmes.

Pakistan finds itself in the difficult situation of wanting to expand its civil nuclear programme with outside assistance – and perhaps even to become a nuclear exporter – and yet does not want to accept the international rules associated with responsible non-proliferation behaviour. Islamabad has rejected the Nuclear Non-Proliferation Treaty and Fissile Material Cut-Off Treaty, and not signed the Comprehensive Test Ban Treaty. It continues to keep most of its nuclear fuel cycle off-limits to IAEA inspection. These refusals in themselves make Pakistan's push to join the NSG hard to accept.

Meanwhile, Pakistan continues its forty-year history of covert procurement for its nuclear weapon programme largely unabated. This study has shown that Islamabad continues to engage in deceptive procurement tactics aimed at defeating national export controls in countries across the world in order to build strategic capabilities at home. Pakistan has questions to answer about how it will reconcile these activities with its goals of joining the NSG – and most NSG members are likely to be sceptical of any response.

Islamabad has only a few allies in its quest to build strategic capabilities, albeit ones whose commitment is not wholly known. Our analysis shows that China continues to aid Pakistan's missile programmes through repeated sales of sensitive dual-use technology. If Beijing has intended for these exports to be clandestine, it has failed in its tradecraft. If Beijing is unaware of the extent that its state-owned enterprises are supplying Pakistan's missile industries, then it has failed in its oversight. Either way, Beijing will need to adjust its sales relationship with Pakistan in order to avoid international criticism.

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