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Aum Shinrikyo's Nuclear and Chemical Weapons Development Efforts

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Abstract

This article details the terrorist activities of the Japanese cult, Aum Shinrikyo, from the perspective of its complex engineering efforts aimed at producing nuclear and chemical weapons. The experience of this millenarian organization illustrates that even violent non-state actors with considerable wealth and resources at their disposal face numerous obstacles to realizing their destructive aspirations. Specifically, Aum's attempts at complex engineering were stymied by a combination of unchecked fantastical thinking, self-imposed ideological constraints, and a capricious leadership. The chapter highlights each of these mechanisms, as well as the specific ways in which they constrained the decision-making process and the implementation of the complex engineering tasks associated with their unconventional weapons development.

Disclaimer

Editor's Note: This article forms part of a series of related case studies collected in this Special Issue and should be viewed in the context of the broader phenomenon of complex engineering by violent non-state actors. Readers are advised to consult the introductory and concluding papers for a full explanation and comparative analysis of the cases.

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Introduction

Aum Shinrikyo, an apocalyptic-millenarian cult headquartered in Japan, made headlines in March 1995 by conducting one of the most notorious terrorist attacks using an unconventional agent,¹ during which five Aum members released sarin nerve agent in five subway lines in Tokyo, killing twelve, injuring several hundred, and forcing around six thousand people to seek medical attention.² Prior to the attack, the group attempted at least ten chemical agent and ten biological agent attacks between 1990 and 1995.³ While Aum Shinrikyo actually engaged in the development of biological and chemical weapons, the group actively sought a nuclear weapons program. Indeed, in the early 1990s, Aum Shinrikyo moved to acquire nuclear materials and construct nuclear weapons.⁴ When the construction of nuclear weapons proved unattainable, Aum members abandoned their nuclear aspirations and focused on their chemical and biological programs.⁵ This article focuses on the evolution of Aum Shinrikyo, from its inception as a failed political entity to its eventual place in history as one of the most notorious terrorist groups, with specific attention paid to its complex engineering efforts, especially the chemical and nuclear weapons programs.

Decision

Aum Shinrikyo's efforts to develop chemical and nuclear weapons are owed largely to the morbid curiosity, penchant for fantastical thinking, and apocalyptic ideology espoused by its leadership, while its financial resources enabled the group to pursue the requisite complex engineering required.⁶ Secondary factors included the group's expanding size and influence, protected status as a religious organization (preventing intervention by

¹ Adam Dolnick, "Aum Shinrikyo's Path to Innovation," in Maria Rasmussen and Mohamed Hafez, *Terrorist Innovations in Weapons of Mass Effect: Preconditions, Causes, and Predictive Indicators*, Report ASCO 2010-019 (Defense Threat Reduction Agency [Advanced Systems and Concepts Office], 2010): 17, 126.

² Ibid., 126.; Holly Fletcher, "Aum Shinrikyo," *Council on Foreign Relations*, June 19, 2012, available at: <http://www.cfr.org/japan/aum-shinrikyo/p9238>.

³ David Kaplan, "Aum Shinrikyo," in Jonathan Tucker's *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons* (Cambridge, MA: MIT Press, 2000), 207.

⁴ Sara Daly, John Parachini, and William Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor," *RAND Corporation*, 2005, 12, available at: http://www.rand.org/content/dam/rand/pubs/documented_briefings/2005/RAND_DB458.pdf.

⁵ Ibid., 8.

⁶ Rasmussen, Maria and Mohamed Hafez, *Terrorist Innovations in Weapons of Mass Effect: Preconditions, Causes, and Predictive Indicators*, Report ASCO 2010-019, (Defense Threat Reduction Agency [Advanced Systems and Concepts Office], 2010): 18.

Japanese authorities), and a desire to eliminate perceived enemies.⁷ Aum Shinrikyo is considered by some to be the first violent non-state actor (VNSA) with “the means, capabilities, intentions and finances to develop and deploy a sophisticated weapon of mass destruction.”⁸

Aum members adhered to a millenarian ideology espoused by their leader, Chizuo Matsumoto, who later took the name Shoko Asahara. Asahara espoused a belief that salvation can only be brought about through “final conflict and eradicating the enemy,” in which Aum would play a pivotal role.⁹ The group’s stated ideology was a syncretic blend of Buddhism and several other religions, with millenarian tropes that focused on persistent nuclear threats to Japan and the nation’s psychological devastation from the atomic bombs dropped on Hiroshima and Nagasaki.¹⁰ Specifically, he prophesied the coming of a nuclear war that would result in Armageddon, where Aum Shinrikyo’s members would constitute the sole survivors.¹¹

Following its poor showing in Japan’s 1990 parliamentary elections, Aum Shinrikyo’s agenda shifted from doomsday survival to doomsday initiation, with the goal of bringing about the apocalypse.¹² Asahara accused the Japanese government of deliberately altering election results, and sought to overthrow the Japanese government (and other perceived enemies, including the United States) using weapons of mass destruction (WMD).¹³ Asahara demonstrated a fetish-like affinity for unconventional weapons with high destructive potential. The extent of his obsession was manifest in the fact that he wrote odes about the chemical agent sarin.¹⁴ Furthermore, according to a

⁷ Kaplan, “Aum Shinrikyo,” in Jonathan Tucker’s *Toxic Terror*, 208.

⁸ James Forest, “Framework for Analyzing the Future Threat of WMD Terrorism,” *Journal of Strategic Security* 5: 55 (2012), available at: <http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1193&context=jss>.

⁹ Sara, Daly, John Parachini and William Rosenau, “Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor,” *RAND Corporation*, 2005, 5, available at: http://www.rand.org/content/dam/rand/pubs/documented_briefings/2005/RAND_DB458.pdf.

¹⁰ *Ibid.*, 8.

¹¹ *Ibid.*, 6.

¹² Philipp C. Bleek, “Revisiting Aum Shinrikyo: New Insights into the Most Extensive Non-State Biological Weapons Program to Date,” *Nuclear Threat Initiative*, 2011, available at: <http://www.nti.org/analysis/articles/revisiting-aum-shinrikyo-new-insights-most-extensive-non-state-biological-weapons-program-date-1/>.

¹³ Anthony T. Tu, “Aum Shinrikyo’s Chemical and Biological Weapons,” *Archives of Toxicology, Kinetics and Xenobiotic Metabolism* 7: 3 (Autumn 1999): 49.

¹⁴ Gary Ackerman, “More Bang for the Buck’: Examining the Determinants of Terrorist Adoption of New Weapons Technologies” (PhD thesis, King’s College London, 2014), 12-13, available at:

https://kclpure.kcl.ac.uk/portal/files/32901277/2014_Ackerman_Gary_0715371_ethesis.pdf; Gary Ackerman, “Motivations for Engaging in Nuclear Terrorism,” *Ffp Threat*

2005 RAND report, “Asahara’s obsession with nuclear weapons formed the foundation for all of his actions related to these weapons.”¹⁵ Not only did he try to develop his own nuclear weapons, he sought to provoke a U.S. nuclear attack on Japan in order to “precipitate Armageddon,” and he went about doing so by targeting a U.S. military base, rival organizations, and the general public¹⁶

Asahara’s charisma inspired unctuous behavior on the part of members, resulting in his uncontested monopoly on decision-making.¹⁷ He ordered Aum members to carry out the 1995 attack on the Tokyo subway system.¹⁸ He refused to tolerate dissension or opposition to his arcane agenda and often killed, or attempted to kill, those who opposed him.¹⁹ Asahara’s uninhibited leadership style lent itself to hasty decision-making that involved minimal contemplation on his part. Shoko Egawa, a journalist who studied the group since its inception, claimed that Asahara was prone towards making “impulsive” and “shortsighted” decisions.²⁰

Compliance with Asahara’s decisions was facilitated via several mechanisms, each of which suppressed active opposition by individuals in the group. Sycophantic members believed that supporting his decisions, regardless of their logical or ethical qualities, was a means to acquire greater status within the organization.²¹ Egawa noted that while many cult members harbored doubts about the probity of their actions, they acted under the belief that Asahara’s vision transcended their own worldly concerns.²² According to

Convergence Publications, Fund for Peace (FFP), Jan 25, 2008, 6, available at: http://mercury.ethz.ch/serviceengine/Files/ISN/46247/ipublicationdocument_singledocument/11ef4937-b842-435e-98cd-4c651cecc508/en/Motivations+for+Engaging+in+Nuclear+Terrorism.pdf; Rasmussen and Hafez, *Terrorist Innovations in Weapons of Mass Effect*, 18.

¹⁵Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor;" Dolnik, Adam, *Understanding Terrorist Innovation: Technology, tactics, and global trends*, (Oxon, UK: Routledge, 2007), 159.

¹⁶Milton Leitenberg, Responses to Aum-related inquiries via email. 10 October 2015.

¹⁷Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

¹⁸“Japan Cult Member Sentenced to Death,” *CBS News*, July 28, 2000, available at: <http://www.cbsnews.com/news/japan-cult-member-sentenced-to-death/>; Lebra, Takie Sugiyama, *The Japanese Self in Cultural Logic* (Honolulu, HI: University of Hawaii Press, 2004), 49, available at: <https://books.google.com/books?isbn=0824828402>

¹⁹Rasmussen and Hafez, *Terrorist Innovations in Weapons of Mass Effect*, 17.

²⁰Yumi Wijers-Hasegawa, “Aum Shinrikyo plagued by guru’s whims, journalist says,” *The Japan Times*, 2003, available at: <http://www.japantimes.co.jp/news/2003/04/25/national/aum-shinrikyo-plagued-by-gurus-whims-journalist-says/#.VhgkdPIVhBc>.

²¹Reader, Ian, *Religious Violence in Contemporary Japan: The Case of Aum Shinrikyo* (Honolulu: University of Hawaii Press, 2000), 150.

²²Yumi Wijers-Hasegawa, “Aum Shinrikyo plagued by guru’s whims, journalist says.”

prominent Aum member Toshiyasu Ouchi, where reticence towards certain activities lingered, individual members expected one another to vocalize objections.²³ In this way, each member was able to displace any moral burden associated with unsavory actions, and shift it to others. Both of these dynamics effectively curtailed the willingness of Aum members to vocalize opposition, and limited their role in the decision-making process. In addition to the aforementioned mechanisms, physical coercion and threats of violence were frequently used to cow opposition to Asahara's decisions.

Asahara's monopoly on decision-making authority did not preclude input by the high-ranking members of his inner circle, especially those heading "ministries" that oversaw the organization's activities.²⁴ While the ultimate decision to pursue a particular weapon fell to Asahara, he exchanged ideas on weapons and strategies with the heads of Aum's biological, chemical, and nuclear programs, often in the context of informal conversation.²⁵ Changes in the demographic and social backgrounds of the Aum leadership played a crucial role in determining the types of ideas featured in the group's decision-making process. According to a report developed by the Center for a New American Security, the shift from a predominantly female leadership in the late 1980s to the predominantly male leadership of the early 90s entailed movement towards the development of unconventional weapons, in line with the technological fetishism of the new cohort.²⁶ These members sought to curry favor with Asahara by promoting ideas that comported with his technological fetishism and favorability towards schemes inspired by science fiction.²⁷ These intra-group dynamics illustrate how members of the leadership aside from Asahara were able to influence the decision-making process by framing particular engineering tasks in ways that appealed to Asahara, such as pursuing technology on the basis that it was perceived as "advanced." The decision to engage in the "in-house" production of weapons of mass destruction came only after the group faced numerous setbacks in its attempts to acquire such weapons abroad. These setbacks, and the ultimate

²³ Richard Danzig, Marc Sageman, Terrance Leighton, Lloyd Hough, Hidemi Yuki, Rui Kotani and Zachary M. Hosford, "Aum Shinrikyo: Insights Into How Terrorists Develop Biological and Chemical Weapons (2nd Edition)," *Center for a New American Security*, 2012, 14, available at: http://www.cnas.org/files/documents/publications/CNAS_AumShinrikyo_SecondEdition_English.pdf.

²⁴ Gavin Cameron, "Multi-track Microproliferation: Lessons from Aum Shinrikyo and Al Qaida," *Studies in Conflict and Terrorism* 22 (1999): 283, available at: [doi:10.1080/105761099265658](https://doi.org/10.1080/105761099265658).

²⁵ Marc Sageman, Telephone Interview. October 27, 2015.

²⁶ Danzig, et al., "Aum Shinrikyo."

²⁷ Marc Sageman, Telephone Interview. October 27, 2015.

shift to intra-group development, will be addressed in detail within the context of a broader discussion concerning the group's weapons programs.

In support of his apocalyptic cause, Asahara expressed a willingness to engage in new complex engineering tasks that presented a high risk of failure.²⁸ The group's ability to tolerate greater amounts of risk can be at least partially attributed to its vast financial resources—possessing more than 1 billion USD in assets at its peak—which provided it with the leeway to pursue a new avenue to achieve its engineering goals even when the previous avenue did not pan out or initial attempts failed. Indeed, the group was able to attempt at least 20 attacks with biological and chemical agents prior to 1995.²⁹ A trial and error approach was thus far more feasible for Aum than groups with more limited resources. Its high risk tolerance was also the result of its obsession with “futuristic technologies” such as WMDs,³⁰ which it was prepared to pursue despite the daunting technical obstacles their development presented. Furthermore, the group risked discovery of its illicit operations by state authorities by making large-scale purchases and circumventing basic national regulations and protocols. For example, Hayakawa Kiyohide, Aum's construction minister, and Yoshihiro Inoue, its intelligence minister, oversaw and coordinated the ill-conceived purchase of a 500-acre sheep farm in Western Australia to mine uranium and test chemical weapons.³¹ During the early phases of the operation, several sect members were penalized for taking mining equipment onto a plane bound for Australia, which indicates the relaxed attitude members held in regard to avoiding entanglements with authorities.³²

As the group neared a viable and effective chemical weapon, Asahara engaged in less risky behavior. In 1994, Aum members were implicated in a sarin incident in Matsumoto City. Afterwards, Asahara, fearing a police raid on his compounds, ordered Aum members to cease the production of sarin and to destroy all evidence of the substance.³³ The organization also sought to

²⁸Rasmussen and Hafez, *Terrorist Innovations in Weapons of Mass Effect*, 17.; Bleek, "Revisiting Aum Shinrikyo."

²⁹Rasmussen and Hafez, *Terrorist Innovations in Weapons of Mass Effect*, 18.

³⁰Hoffman, Bruce, *Inside Terrorism*, (New York: Columbia University Press, 2006), 123.

³¹Danzig, et al., "Aum Shinrikyo;" Daly, Parachini and Rosenau, "Aum Shinrikyo;" Hoffman, *Inside Terrorism*; Senate Government Affairs Permanent Subcommittee on Investigations, "Global Proliferation of Weapons of Mass Destruction: A Case Study on the Aum Shinrikyo," (1995), Federation of American Scientists, available at: http://www.fas.org/irp/congress/1995_rpt/aum/index.html.

³²Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

³³Anthony T. Tu, "Aum Shinrikyo's Chemical and Biological Weapons," *Archives of Toxicology, Kinetics and Xenobiotic Metabolism* 7: 3 (Autumn 1999): 51-52.

protect its members from the dangerous agents that they were deploying, which indicates an interest in reducing risk.

Implementation

Aum Shinrikyo engaged in a prolonged effort to achieve its complex engineering goals. Its biological, chemical, and nuclear weapons programs began in earnest in 1990 and continued through 1995, culminating in the group's notorious Tokyo Subway attack. The progression of Aum's weapons programs can be conceptualized as three chronologically distinct periods. The first period is characterized by the group's loss in the 1990 Japanese parliamentary elections and its subsequent decision to pursue chemical and biological weapons programs. The second follows the group's short-lived attempt to obtain nuclear weapons, followed by the resumption of its chemical and biological weapons programs. In the final phase, Aum continued its two most successful weapons programs, chemical and biological, and finally achieved the lethal results it sought.

The first demonstrated attempt to acquire weapons occurred in 1988, when Aum Shinrikyo attempted to buy chemical munitions from what it believed to be a U.S.-based weapons supplier, but was later revealed to be a front for the U.S. Customs Service.³⁴ Had the supplier been genuine, Aum would have attained more than 250 tons of sarin.³⁵ While this attempt was unsuccessful, the group would later turn to its own scientists to develop chemical weapons, with lethal results.

In 1990, Aum Shinrikyo's defeat in Japan's parliamentary elections humiliated the group and, already harboring millenarian beliefs, Asahara predicted that the apocalypse would engulf Japan.³⁶ The group subsequently initiated its complex weapons programs in order to destabilize the Japanese government.³⁷ These programs boasted a hierarchical structure containing various ministries headed by trusted members, each of who managed his or her own unit and reported directly to Asahara.³⁸ However, while members

³⁴ Amy E. Smithson, "Rethinking the Lessons of Tokyo," in *Ataxia: The Chemical and Biological Terrorism Threat and the US Response* (Washington, DC: Henry L. Stimson Center, 2000), 81.

³⁵ *Ibid.*

³⁶ *Ibid.*, 74.

³⁷ Tu, "Aum Shinrikyo's Chemical and Biological Weapons," 49.

³⁸ Cameron, "Multi-track Microproliferation."

shared a mutual fascination with weapons of mass destruction, few actually engaged in developing advanced technological capabilities.³⁹

Seiichi Endo's Ministry of Health and Masami Tsuchiya's Chemical Arms Unit primarily managed Aum Shinrikyo's biological weapons program,⁴⁰ which began in the spring of 1990 with the initial production of botulism toxin.⁴¹ It was in 1990 that the group perpetrated its boldest 'apocalyptic' campaign⁴² dispersing botulism toxin in Tokyo that went largely unnoticed as the strain was ineffectual, resulting in no casualties.⁴³ What set this series of attacks apart from the rest of Aum's attacks was its wide array of targets, including U.S. Naval bases, the Narita International Airport, the Japanese Kokkai (National Assembly), and the Imperial Palace.⁴⁴ Furthermore, Asahara instructed Aum members to flee from Japan's mainland to Ishigaki island.⁴⁵

The birth of the chemical weapons program followed shortly thereafter, beginning in the summer and focusing on chlorine and VX gases.⁴⁶ The initial production phase was short-lived, though, as the October apprehension of three leaders for "fraudulent land purchases" temporarily halted its biological and chemical weapons programs.⁴⁷

Aum Shinrikyo's WMD pursuits would reemerge in 1992 when its efforts to acquire nuclear weapons capabilities began in earnest through the group's international networks and activities in Russia and the United States, through which the group intended to procure information and materials.⁴⁸ During visits to Russia, Aum leaders consulted Russian scientists in order to obtain laser and nuclear technologies. The group was also believed by some to have shown interest in purchasing fissile materials from Russia.⁴⁹ Through its network, Aum Shinrikyo successfully recruited over 300 scientists and engineers—including employees at the Kurchatov Institute, the premier

³⁹ Marc Sageman, Telephone Interview. October 27, 2015.; Milton Leitenberg, Responses to Aum-related inquiries via email. 10 October 2015.

⁴⁰ Cameron, "Multi-track Microproliferation;" Milton Leitenberg, Responses to Aum-related inquiries via email. 10 October 2015.

⁴¹ Kaplan, "Aum Shinrikyo," in Jonathan Tucker's *Toxic Terror*, 213.

⁴² March Sageman, telephone interview. October 28, 2015.

⁴³ Danzig, et al., "Aum Shinrikyo," 18, 19.

⁴⁴ Monterey Institute of International Studies, "Chronology of Aum Shinrikyo's CBW Activities," 2001.

⁴⁵ *Ibid.*

⁴⁶ Danzig, Sageman, Leighton, Hough, Yuki, Kotani and Hosford, "Aum Shinrikyo," 18.

⁴⁷ *Ibid.*

⁴⁸ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁴⁹ Busch, Nathan E., *No End in Sight: The Continuing Menace of Nuclear Proliferation* (University Press of Kentucky, 2004), 11.

nuclear facility in Russia—who were either attracted to the apocalyptic ideology or lured with financial incentives.⁵⁰ Aum Shinrikyo's Russian contacts enabled group members to access black market materials and hardware.⁵¹ At this time, Shoko Asahara met Nikolay Basov, a Nobel Prize winner for research on laser technology focusing on the “practical applications for the laser, particularly how it can be used for thermonuclear fusion, which would allow controlled generation of nuclear power.”⁵² Unconfirmed reports have even claimed that one of Aum Shinrikyo's senior leaders, Hayakawa Kiyohide, may have purchased a nuclear warhead for 15 million USD through the Russian advanced weapons market,⁵³ although this is highly unlikely.

When attempts to purchase a nuclear weapon floundered, the group shifted its efforts to building its own nuclear weapon. Kiyohide Hayakawa's Ministry of Construction heavily influenced Aum Shinrikyo's nuclear and chemical weapons programs, and was responsible for producing the sarin used in the 1995 attack on the Tokyo subway system.⁵⁴ He also exercised purchasing authority primarily on behalf of Aum Shinrikyo's nuclear program; and Hideo Murai's Ministry of Science and Technology was vital for producing weapons.⁵⁵ Hayakawa personally traveled to Australia to help the organization acquire a 500,000-acre sheep farm called Banjawarn Station to serve as a front company for mining uranium and testing chemical weapons.⁵⁶

In 1993, Aum Shinrikyo continued its biological weapons program, maintained its research into acquiring nuclear weapon capabilities, and

⁵⁰ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor;" Senate Government Affairs Permanent Subcommittee on Investigations, "Global Proliferation of Weapons of Mass Destruction: A Case Study on the Aum Shinrikyo," (1995), Federation of American Scientists, available at:

http://www.fas.org/irp/congress/1995_rpt/aum/index.html.

⁵¹ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁵² Senate Government Affairs Permanent Subcommittee on Investigations, "Global Proliferation of Weapons of Mass Destruction: A Case Study on the Aum Shinrikyo;" Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor;" Olga Prodan, "Prominent Russians: Nikolay Basov," *RussiaPedia*, available at: <http://russiapedia.rt.com/prominent-russians/science-and-technology/nikolay-basov/>.

⁵³ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁵⁴ "Japan Cult Member Sentenced to Death;" Lebra, *The Japanese Self in Cultural Logic*.

⁵⁵ Cameron, "Multi-track Microproliferation;" Milton Leitenberg, Responses to Aum-related inquiries via email. 10 October 2015.

⁵⁶ Richelson, Jeffrey, *Defusing Armageddon: Inside NEST, America's Secret Nuclear Bomb Squad* (W. W. Norton & Company, 2009), 124, available at: <https://books.google.com/books?isbn=0393065154>; Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

resumed its chemical weapons program.⁵⁷ In addition to internal support, Aum Shinrikyo made efforts to incorporate technical expertise from outside the group in its attempts to acquire and build chemical, biological, nuclear, seismological, plasma, and laser weapons.⁵⁸ Group members utilized the Internet to gather information on nuclear facilities in Russia, Ukraine, China, and South Korea.⁵⁹ The group also established a network consisting of scientists and front companies. Across its transnational network, Aum Shinrikyo consisted of more than 40,000 members, with approximately 10,000 in Japan, 30,000 in Russia, and several dozen in the United States.⁶⁰ Furthermore, the group utilized front companies, such as Clarity Investments, Maha Posya, Bell Enoch, and Hasegawa Chemicals, in order to obtain weapons, laboratory and industrial equipment, chemical ingredients, and precursor chemicals.⁶¹ This gave it the opportunity to leverage vast human resources and access multiple networks.

Group members believed that the enlisted technical experts would enable them to acquire chemical, biological, and nuclear weapons; however, none of the recruits possessed expertise in nuclear physics.⁶² The majority of Aum members with scientific backgrounds were alienated individuals with substandard levels of professional accomplishment.⁶³ A 2005 RAND report implies that these scientists' expertise in medicine, biochemistry, biology, and genetic engineering and lack of knowledge about nuclear weapons design was the primary reason for the group's shift towards chemical and biological weapons.⁶⁴ Furthermore, the group's indoctrination methods yielded inefficiency and paranoia due to sleep deprivation and narcotics, which interfered with its biological and perhaps other weapons programs.⁶⁵

⁵⁷ Danzig, et al., "Aum Shinrikyo;" Kaplan, "Aum Shinrikyo," in Jonathan Tucker's *Toxic Terror*, 213.

⁵⁸ Dolnik, *Understanding Terrorist Innovation*, 8; Cameron, "Multi-track Microproliferation."

⁵⁹ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁶⁰ Kaplan, "Aum Shinrikyo," in Jonathan Tucker's *Toxic Terror*, 212.

⁶¹ *Ibid.*, 215.; Senate Government Affairs Permanent Subcommittee on Investigations, "Global Proliferation of Weapons of Mass Destruction: A Case Study on the Aum Shinrikyo;" Amy E. Smithson, "Rethinking the Lessons of Tokyo," in *Ataxia: The Chemical and Biological Terrorism Threat and the US Response*, (Washington, DC: Henry L. Stimson Center, 2000), 81.

⁶² Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁶³ William Rosenau, "Aum Shinrikyo's Biological Weapons Program: Why Did it Fail?," *Studies in Conflict & Terrorism* 24 (2001), 296, available at: [doi:10.1080/10576100120887](https://doi.org/10.1080/10576100120887).

⁶⁴ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor;" Cameron, "Multi-track Microproliferation."

⁶⁵ Rosenau, "Aum Shinrikyo's Biological Weapons Program: Why Did it Fail?"

Despite its desire to acquire advanced technological capabilities with the expertise of numerous scientists and engineers, Aum Shinrikyo faced numerous obstacles to obtaining its unconventional arsenal, eventually resulting in the abandonment of its nuclear weapons program. One source describes Aum Shinrikyo's experience as "a story of evolution."⁶⁶ When initially pursuing a nuclear weapon, Aum considered its Russian network to be the most likely to succeed, though ultimately this avenue did not yield positive results.⁶⁷ Not willing to abandon its nuclear aspirations, the group attempted to lay the foundation for its own nuclear program in Australia, yet failed again.⁶⁸ In May of 1993, a large explosion occurred near the farm in Australia that remains unexplained, but may be attributed to Aum's nuclear program.⁶⁹ If, indeed, the explosion was related to its nuclear program, a possible explanation for the subsequent abandonment of the farm is that Aum may have realized that nuclear technologies fell outside of their capabilities, or at least were unattainable because Asahara's 1995 timeframe for nuclear Armageddon proved too short for group members to successfully construct a nuclear weapon. Even if unrelated to its nuclear research, Aum Shinrikyo may have reasonably left the farm in order to avoid interdiction by law enforcement authorities. As a result, the group more effectively utilized its resources by focusing on chemical attacks, which had shown the most promise to date.⁷⁰

The farm in Australia may have also served as a testing ground for Aum's chemical weapons program. When Australian authorities examined the farm once Aum had abandoned it, they discovered the remains of 29 sheep and Japanese-language documentation that led the authorities to believe the reason for the deaths of the livestock was for unidentified experimentation.⁷¹ While the tests to identify sarin were not necessarily conclusive, as a byproduct of sarin breaking down in the environment is also related to the natural decomposition of the sheep,⁷² the timeline does suggest that Aum Shinrikyo had used the sheep to confirm the lethality of their chemical weapon.

⁶⁶ Danzig, et al., "Aum Shinrikyo."

⁶⁷ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁶⁸ *Ibid*, 12.

⁶⁹ Hoffman, *Inside Terrorism*, 124.

⁷⁰ Danzig, et al., "Aum Shinrikyo."

⁷¹ Smithson, "Rethinking the Lessons of Tokyo."

⁷² Danzig, et al., "Aum Shinrikyo."

In the fall of 1993, Aum was able to generate 20 grams of sarin at the Krishitigalva Prefab.⁷³ Possibly due to the efficacy of the agent, Asahara ordered increased production, requiring a new facility. In response, the cult constructed the \$30 million USD⁷⁴ Satyan 7 facility which was equipped with three laboratories, a computer control center, and five reactors, all of which was made from corrosion-resistant Hastelloy, ideal for the production of chemical weapons.⁷⁵ Once completed, Aum's sarin production increased significantly. From its opening in October to November, 600g of sarin were produced and December would see a total of 3kg of sarin produced at the 90 percent purity level.⁷⁶ However, the limited chemistry background of Kazuyoshi Takagawa led to sub-optimal results, with Takagawa employing only three of the five steps used by his predecessor, Tsuchiya, to produce sarin.⁷⁷

Furthermore, group members resumed their targeted attacks in Japan, utilizing botulinum toxin, bacillus anthracis, and sarin, though all were unsuccessful.⁷⁸ The year 1994 saw a series of attacks against individuals that Aum's leadership considered a threat, including the incident at Matsumoto, which targeted judges involved in a legal case concerning Aum. The group released sarin and, while the judges survived the attack, eight people in total died with an additional 200 injured.⁷⁹ Possibly influenced by the efficacy of the chemical attacks, Aum members sold the Australia property in 1994 and focused on chemical and biological weapons.⁸⁰

One year later, Aum Shinrikyo's active pursuit of chemical and biological weapons came to an end. In March, the group perpetrated its most infamous attack when five members released sarin on five subway lines in Tokyo.⁸¹ Aum members dispersed the sarin throughout the subways using a method that proved ineffective—they punctured holes in plastic bags filled with sarin.⁸² In order to ensure their own safety and avoid the effects of sarin,

⁷³ Smithson, "Rethinking the Lessons of Tokyo," 81.

⁷⁴ Danzig, et al., "Aum Shinrikyo."

⁷⁵ Smithson, "Rethinking the Lessons of Tokyo," 82.

⁷⁶ Danzig, et al., "Aum Shinrikyo."

⁷⁷ Ibid., 31.

⁷⁸ Ibid., 20.

⁷⁹ Ibid., 21.

⁸⁰ Senate Government Affairs Permanent Subcommittee on Investigations, "Global Proliferation of Weapons of Mass Destruction: A Case Study on the Aum Shinrikyo;" Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁸¹ Rasmussen and Hafez, *Terrorist Innovations in Weapons of Mass Effect*; Fletcher, "Aum Shinrikyo."

⁸² Cameron, "Multi-track Microproliferation."

members carried atropine and pyridine-2-aldoxime-methylchloride as a precaution.⁸³ Some sources even indicate that Aum Shinrikyo intentionally produced a less pure version of sarin for the attack in order to elude detection during its development, and possibly to ensure the safety of the group members carrying out the attack.⁸⁴ However, Seiichi Endo provided Tsuchiya with only four days to prepare sarin for the attack, and ultimately made use of an incorrect organic base during production.⁸⁵ The attack still failed to yield Asahara's intended results either due to the low concentration of sarin or the unconventional dispersal method. Aum members later carried out an attack in May, as they unsuccessfully attempted to disperse hydrogen cyanide during the Children's Day holiday.⁸⁶ Ultimately, on December 15, the Japanese Prime Minister ordered the disbandment of Aum and seized all of its assets.⁸⁷

The aforementioned timeline yields two key observations regarding Aum Shinrikyo's pursuit of complex technologies. First, the organization's fascination with technology inspired members to pursue multiple, novel weapons programs, largely as a means of appeasing Asahara and achieving higher status within the cult.⁸⁸ While the group's chemical and biological weapons programs were the most well-known, it had shown interest in a myriad of technologies, including nuclear, seismological, plasma, and laser weapons as well.⁸⁹ Despite a substantial war chest, all of these initiatives ended in failure save for the chemical weapons program, and even its successes were few.⁹⁰

Analysis

Aum Shinrikyo took up complex engineering tasks concerning nuclear, biological, and chemical weapons due to its apocalyptic ideology and the Aum leadership's obsession with high-tech and unconventional weapons.⁹¹ Asahara, in particular, expressed a techno-fetishist affinity towards WMDs,

⁸³ Brackett, D. W, *Holy Terror: Armageddon in Tokyo* (New York: Weatherhill, 1996), 129; Kaplan, David E., and Andrew Marshall, *The Cult at the End of the World* (New York: Crown, 1996), 243.

⁸⁴ Danzig, Sageman, Leighton, Hough, Yuki, Kotani and Hosford, "Aum Shinrikyo."

⁸⁵ *Ibid.*, 34.

⁸⁶ Hoffman, *Inside Terrorism*, 125.

⁸⁷ *Ibid.*, 126.

⁸⁸ March Sageman, telephone interview. October 27, 2015.

⁸⁹ Dolnik, *Understanding Terrorist Innovation*, 8; Cameron, "Multi-track Microproliferation."

⁹⁰ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁹¹ *Ibid.*; Dolnik, *Understanding Terrorist Innovation*; Rasmussen and Hafez, *Terrorist Innovations in Weapons of Mass Effect*, 18.

which led the group to pursue more advanced technological weapons.⁹² Ranking Aum members generally shared this obsession, resulting in a leadership with numerous ideas for achieving apocalyptic ends, but without efficacious plans or practical knowledge for bringing those ideas to fruition.⁹³ As a cult that grew quickly and incorporated over 300 scientists and engineers, Aum Shinrikyo developed a false sense of confidence in the coming of doomsday and in the group's ability to embark on a WMD development program.⁹⁴

The group did prove adept at responding to setbacks and adjusting its focus to maximize the likelihood of committing a successful attack. While Aum Shinrikyo failed to acquire a nuclear weapon, it successfully perpetrated chemical weapon attacks owing to its self-imposed short timeframe for action and protected status as a religious organization.⁹⁵ Because of the difficulties associated with acquiring nuclear materials and constructing a nuclear weapon, Aum Shinrikyo shifted focus to its chemical weapons development program; chemical agents also proved easier to acquire and assemble.⁹⁶ One of the key factors that enabled Aum Shinrikyo to continue its activities for several years and acquire innovative technology is that the Tokyo Metropolitan Government granted the group official religious corporation status in 1989, providing them with various privileges that include tax breaks and de facto immunity from oversight and prosecution.⁹⁷

Despite its aspirations, financial clout, and relative security from state meddling, Aum Shinrikyo was never able to develop its desired weapons of mass destruction.⁹⁸ Its chemical weapons program proved partially successful to the extent that the 1995 Tokyo subway attacks caused mass injuries, but the ideal of mass fatalities lay out of reach. While the group ultimately failed to approximate its ideal outcomes, the foregoing discussion has stressed the extent to which failure may have been contingent on the

⁹² Ackerman, "More Bank for the Buck": Examining the Determinants of Terrorist Adoption of New Weapons Technologies;" Gary Ackerman, "Motivations for Engaging in Nuclear Terrorism."

⁹³ Marc Sageman, Telephone Interview. October 27, 2015.

⁹⁴ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor;" Senate Government Affairs Permanent Subcommittee on Investigations, "Global Proliferation of Weapons of Mass Destruction: A Case Study on the Aum Shinrikyo."

⁹⁵ Daly, Parachini and Rosenau, "Aum Shinrikyo, Al Qaeda, and the Kinshasa Reactor."

⁹⁶ Ibid.

⁹⁷ Senate Government Affairs Permanent Subcommittee on Investigations, "Global Proliferation of Weapons of Mass Destruction: A Case Study on the Aum Shinrikyo;" Rasmussen and Hafez, *Terrorist Innovations in Weapons of Mass Effect*, 18.

⁹⁸ Dolnik, *Understanding Terrorist Innovation*, 47.

inability of Aum's "experts" to adequately perform the complex engineering tasks needed to attain organizational goals with the allotted time and available knowledge base. As noted, the group produced impure sarin, which some sources have claimed was unintentional, and due to the short timeframe with which they had to construct a weapon.⁹⁹ Another manifestation of basic technical shortcomings was Tsuchiya's use of an incorrect organic base during the rush to prepare sarin for the Tokyo subway attacks. Furthermore, Aum had difficulty acquiring an effective dispersal system in preparation for those attacks, thereby resorting to puncturing holes in plastic bags to ensure the delivery of sarin.¹⁰⁰ Reliance on individuals with little practical experience was also a major factor in the numerous technical shortcomings, as evident in Kazuyoshi Takagawa's failure to replicate the sarin manufacturing procedure used by Tsuchiya. Whether these failures owed more to eschatological timeframes or lack of practical experience with the relevant complex engineering tasks, the group's limited success highlights the difficulties associated with bringing apocalyptic goals to fruition.

⁹⁹ Cameron, "Multi-track Microproliferation."

¹⁰⁰ *Ibid.*, 294.