Tel Aviv and Pretoria's Nuclear Tango

ArunVishwanathan [1]

Abstract

The coming together of Israel and South Africa on nuclear, missile and military fields; though puzzling can be understood if the entire geo-political situation the countries found themselves in. Both states were international pariahs and to top it off felt that they were surrounded by hostile neighbours.

This article tracks cooperation between Israel and South Africa from the 1950s when South Africa began supplying uranium to Israel. Thereafter the bonhomie expanded to training of each other's scientific personnel. Israel and South Africa also collaborated in the missile field with declassified documents released from South African archives pointing to Tel Aviv offering to sell its Jericho-2 nuclear capable missiles to Pretoria as well as Pretoria allowing Israel to test its longer range missiles from the Overberg test range. In addition, the bilateral cooperation also extended to testing of Israeli nuclear weapons in South Africa as brought to light by the 1977 aborted preparations and the subsequent 1979 nuclear test picked up by the American Vela satellites.

Keywords: South Africa, Israel, Nuclear Programme, 1979 Vela test.

---

1. Assistant Professor, International Strategic and Security Studies, National Institute of Advanced Studies, Bangalore
E-mail: arun_summerhill@yahoo.com

Tel Aviv and Pretoria: Examining Connections

Ali Mazrui writing in *Alternatives: Global, Local, Political* draws similarities between Israel and South African policies which drew them closer and set the stage for cooperation in military and nuclear fields. In the article, Mazrui highlights four areas namely *"situational similarity between South Africa and Israel, normative congruence between Zionism and the ideology of apartheid, the trend towards economic cooperation between Israel and South Africa, and prospects for greater military consultation"* which form the bedrock of cooperation between the two countries. (Mazrui, 1983, 74) Explaining the 'normative congruence' between Zionism and apartheid Mazrui writes:

"An example of similarities in approach lies in the strategies of ethnic preponderance pursued by both states. The dream of apartheid is to eventually create a 'white' heartland by pursuing a 'homelands' policy that would strip South African citizenship from those belonging to a Bantustan. Similarly, the logic of creating a Jewish state in Palestine has required that the great majority of citizens be Jewish. This has been achieved through discriminatory immigration practices (Israel's Law of Return) and by brutal intimidation of the Arab Palestinian population." (Mazrui, 1983, 73)

Internationally, isolated countries it can be argued would take much greater risks to achieve capabilities they feel would safeguard their interests. The case of North Korea's pursuit of nuclear weapons despite its precarious economic situation is a shining example of such risk taking. It is possible that the international scenario played a critical role in bringing these two 'pariah' nations closer. Being outlier states could have pushed the two countries to take decisions that they otherwise - in the normal course of things - would not take. Apart from this, it is also important to understand the importance that security challenges had on the nuclear pursuits of both Israel and South Africa.

Given the value and power attached to possession of a nuclear weapon, it is one of the most important bargaining chips that a

country could hope to possess, especially in face of hostile neighbours. The Israeli and South African fear of invasion by their neighbours and further political isolation could have compounded the desire of these two nations to possess nuclear weapons at any cost.

Dr. Ernst David Bergmann, one of the prime architects of the Israeli nuclear programme during a visit to South Africa in 1968 spoke of such shared fears and the possibility of cooperation between the two countries. Dr. Bergmann said:

"Neither of us has neighbours to whom we can speak and to whom we are going to be able to speak in the near future. If we are in this position of isolation, perhaps it might be best for both countries to speak to each other." (Polakow-Suransky, 2010, 118-119)

Given its perceived security threats, Israel early into its independence decided to develop a strong deterrent which it felt was required to survive as a nation given that it was surrounded by states hostile to its very existence. In order to put in place a deterrent, Israel went ahead with the setting up of the Department of Isotope Research in the Weizmann Institute in 1948 followed by the establishment of a Research and Planning Branch within the Israeli Ministry of Defense and a special unit of the Israel Defence Forces (IDF) Science Corps to scout for possible sources of uranium in the Negev Desert. (Barnaby, 1989, 4-5; Aftergood and Kristensen, 2007; Pry, 1984, 5) In order to train its manpower in the nuclear field, Israel sent its most promising students beginning in 1949 to Switzerland, Holland, Britain and United States. Also, in order to break its reliance on the United States, Israel began to turn to Norway and France. Using the technological advances at its disposal and some adroit diplomacy, Israel managed to secure French commitment for the 24 MWth Dimona nuclear reactor from France and heavy water from Norway.[1]

---

1. The French needed Israeli support because they themselves wanted to have atomic independence and produce plutonium to power their reactors. In order for this to happen they needed to know the method developed by

On the other hand, South African motives to procure nuclear weapons were mainly influenced by Cold War dynamics. The major security threats against which South African leaders thought a nuclear deterrent would be useful were an *"attack by Soviet-backed Angolan and Cuban troops on the Angolan-Namibian border, or a Soviet-backed invasion of South Africa from Mozambique."* (Liberman, 2004, 61; Polakow-Suransky, 2010, 78-87)

Another motivation for procurement of nuclear weapons is put forth in a three-page memorandum written in March 1975 by the South African Defence Forces (SADF) Chief of Staff, Lt. General Raymond Fullarton Armstrong addressed to the Commandant-General of the SADF Admiral Hugo Hendrik Biermann. The memorandum quoted by Peter Liberman in *The Non-proliferation Review* describes the deterrent potential of nuclear weapons but strangely enough goes forth and describes the utility of such weapons against terrorist attack. (Liberman, 2004, 77-79)

The date of the inception of the Israeli-South African cooperation in the nuclear field is unclear. There are differing accounts which add to this confusion. The nature and extent of the nuclear, military and military cooperation ranged from sale of uranium oxide and tritium, development and testing of missiles, training of scientific personnel and provision of nuclear test facilities. These are detailed below.

Nuclear Fuel Exchange

The nuclear cooperation between Israel and South Africa began in the

---

the Israelis for the processing of low-grade uranium ores such as phosphates (which Israel found in the Negev desert) into fissile material. The French also needed the Dostrovsky method of producing heavy water that was proving to be more economic than the Norwegian electrolytic one. Though the Israelis did not find the method very useful themselves given their limited need of heavy water, they subsequently used the method to produce heavy oxygen of which they are among the leading exporters in the world.

1950's with the supply of uranium by South Africa to Israel in exchange for Israeli nuclear technology. (Raj, 1981, 115) Relations between the two countries became very close in April 1976, when the South African Prime Minister John Vorster visited Israel and signed military, scientific and technical agreements. Thereafter, rough South African diamonds began to be sold in exchange for Israeli arms.

Most of the uranium which was supplied at this time by South Africa was going into the Soreq reactor. The reactor given that it a 'swimming pool' type reactor needed enriched uranium to function. Israel was dependent on the United States for the enriched uranium, which Tel Aviv found to be a very uncomfortable position to be in. To overcome this fix, Israel initiated probes to find alternative sources of fuel. According to a declassified CIA, Department of Military Intelligence report, South Africa proved to be one such source and provided Israel with 10 tons of uranium in 1963. (US Central Intelligence Agency, 1983)

Another exchange which became public due to leaking of an in camera court judgment was the 1977 South African import of 30 grams of tritium from Israel while exporting 600 tons of uranium oxide. The fact that top South African officials were in the know of the exchange was made clear by the judgment which mentioned that the deal was orchestrated by intelligence chief General Hendrik Van den Bergh, South African Minister of Mines Fanie Botha with approval of South African PM John Vorster and chief of the Atomic Energy Board Dr. AJ Roux. (Liberman, 2004, 54)

Reports again began surfacing in the 1980's that said that South Africa was supplying Israel and Taiwan with weapons-grade uranium. (Miller, 1981) It is not a matter of sheer coincidence that all the three countries that were involved in such cooperation were 'pariah' nations in diplomatic parlance, meaning that they were politically and diplomatically isolated. It is very much possible that it is this very isolation that has made these nations seek refuge in one another and seek the ultimate protective potential.

Exchange of Trained Personnel

For every nuclear programme to be successful it is essential to have properly trained personnel, without whom the possibility of having an independent nuclear programme remains a distant dream. Properly trained personnel are required for the task of designing and safely operating nuclear systems apart from designing and manufacturing delivery systems.

Israel realized the importance of having trained personnel very early in its existence and thus sent its brightest students to the United States to study. However it also realized that relying completely on the United States would be utter foolishness, as the U.S. could not be expected to part with complete information regarding its nuclear programme to the Israeli students because doing so would clash with American national interests.

The Israelis were thus caught in a very unenviable situation, wherein they had to seek the assistance of the U.S. to further its programme but at the same time could not afford to remain solely dependent on it. This was the main reason that made the Israelis turn to the South Africans for cooperation in training each other's scientific personnel.

The South Africans gladly accepted the Israeli offer as it was facing international political isolation due to its apartheid policies. According to Mordechai Vanunu - a former Israeli at Dimona one of the few individuals who has publicly spoken about the Israeli nuclear programme and faced subsequent incarceration – employees from Dimona had been to South African and South African nuclear scientists had visited Dimona. (Cohen, 2003, 81,200, 306) Technicians from Israel are also believed to have worked at the Overberg testing area for many years. This was important because of the fact that Overberg Testing Range (OTR) which was similar in its lay out to the Israeli test facility at Palmachin provided the Israeli technicians with the facilities to acquire the technological expertise required to build

nuclear weapons and in particular design, test and operate its missile systems.

Cooperation and Transfer of Missiles and Technology

On the other hand the OTR also proved to be a right stage for exchange of nuclear/missile technology between the two nations. As early as 1975, Israel had offered the Jericho missile to South Africa. The March 1975 Armstrong memorandum cited earlier, recommends the acquisition of the *Jericho* weapon system and goes on to state that the nuclear warheads for the missile could either be 'acquired elsewhere' or built indigenously. (Liberman, 2004, 47)

Peter Liberman, writing in *The Nonproliferation Review* cites a former South African Navy Commodore Dieter Felix Gerhardt, who mentions a secret agreement signed between the Israelis and the South Africans in November 1974. The agreement was more of a mutual defence pact which outlined wide ranging strategic cooperation. The November 1974 agreement, Gerhardt mentions, included the *"supply of Jericho-1 missiles, the joint development of longer range ballistic missiles and supply of nuclear warheads by Israel to armupto eight Jericho missiles."* (Liberman, 2004, 49-50; Polakow-Suransky, 2010, 81-83) Peter Liberman mentions that in addition to possible cooperation in the missile domain, Pretoria *"relied heavily on Israeli technology for its nuclear delivery systems."* (Liberman, 2004, 55) Pretoria's primary delivery platform – an air-to-surface glide bomb H-2 - used several Israeli technologies.

U.S. Intelligence and State Department officials have accepted such a possibility to be likely; while acknowledging a growing exchange of nuclear technology and materials, such officials remain sceptical of any cooperation aimed at development of nuclear weapons and effective delivery systems. (Miller, 1981) Any such scepticism was blown to smithereens when on July 5, 1989 the South African version of *Jericho*-2 was launched at the Overberg range. An

important benefit for the Israelis of gaining access to the South African test range was that Tel Aviv could test missiles of a considerable longer range than was feasible from Israel.

Soon after July 1989 launch of *Jericho*-2, there were numerous reports indicating Israeli assistance to South Africa in developing long-range missiles. Although Israeli Prime Minister Yitzhak Shamir issued a blanket denial of the news reports about any such cooperation, the Defense Ministry statement left open the possibility that some missile cooperation was continuing under an old contract. The Israeli Defence Ministry statement said, *"the defence establishment strictly abides by the inner Cabinet decision of March 18, 1987 according to which no new contracts will be signed between Israel and South Africa in the defense realm."* But, more importantly the Ministry declined to discuss continuing work on contracts that existed before 1987. (Gordon, 1989)

Even after such a statement from the Defense Ministry and an outright denial by the Prime Minister an important piece of evidence that makes any Israeli denial fall flat is the fact that the rocket plume of the South African missile bore a striking resemblance to that of Israel's Jericho missile. This led to speculations that the South African missile was a derivative, or another version of the Israeli Jericho missile. (Spector, 1990, 163) U.S. Administration officials also say that the equipment seen at the South African missile test resembles equipment used by Israelis in their own missile test. The Soviets were particularly concerned about the range of the Jericho follow on which was said to be 900 miles. Even if it were to remain unchanged the missile could reach Soviet cities of Baku, Tbilisi and possibly Odessa. (Spector, 1990, 164) Following the 1989 test, Soviet foreign ministry spokesman Gennady Gerasimov indicted that Moscow considered the missile to be a threat and a *"source of destabilization far exceeding the boundaries of the Middle East."* (Spector, 1990, 164)

In late 1989, a major investigation by an American television news

team reported that the two countries were collaborating on the development of long-range missiles. (Spector, 1990, 165) The NBC report which was aired on October 25, 1989 on "NBC Nightly News" stated that Israel had provided missile technology to South Africa in return for a supply of enriched uranium for nuclear weapons and access to long-range missile testing facilities at Overberg in the mainland and at Prince Edwards Islands in the Antarctic. The Israeli Defence Ministry statement said that there is no truth to the report carried by the NBC network on the so-called relations with South Africa in the nuclear realm. (Gordon, 1989, 10) But, when asked if Israel had ever received enriched Uranium from South Africa, a senior Israeli Defense Minister said simply "No comment." The South African Ambassador to Israel, Johan Fiyun, told Israeli radio that he had *"no information or knowledge about such operations between Israel and South Africa"*. He also stated, *"these are allegations that have been made over a number of years."* (Gordon, 1989)

The October 25, 1989 NBC report also raked up the issue of the illegal transfer of U.S. technology regarding ballistic weapons to the South Africans. The Israeli political establishment took this very seriously as the numerous denials of the above report very clearly show.[1] On October 29, during a Cabinet meeting Defense Minister Yitzhak Rabin said *"there has been no transfer of defense technology – certainly not American technology – from Israel to South Africa. No technology whatsoever was transferred – not American and not such that was fully or partly financed by the US."*(FBIS-NES-89-208, 1989, 36)

The next day, 30 October, 1989 the Israeli Cabinet Secretary reiterated what had been said by Rabin the earlier day, *"As far as the U.S. technology, the defense establishments did not transfer from Israel to*

1. The force with which the whole Israeli establishment came down on the NBC Report makes one thing amply clear, that is, the Israeli government regardless of which party is in power will not antagonize, jeopardize their relationship with U.S. This was one risk the Israelis were just not willing to take.

any other country U.S. technology or systems that include U.S. components without permission of the U.S. authorities. This applies to any foreign country including South Africa, so all allegations that NBC reports, that U.S. Lavi technologies were transferred, allegedly to South Africa are baseless." (FBIS-NES-89-208, 1989, 36)

In 1993, President F.W. de Klerk declared that *"at no time did South Africa acquire nuclear weapons technology or materials from another country, nor has it provided to any other country, or cooperated with another country in this regard."* (deKlerk, 1993)

Despite such denials by Israeli and South African leaders there is enough evidence, in the form of declassified documents, media leaks, resemblance in missile signatures and accounts by former officials involved in various aspects of the nuclear cooperation, which point to wide ranging cooperation between the two countries on nuclear and missile related issues.

Provision of Nuclear Test facilities

One of the main reasons why the Israeli-South African cooperation is of continued interest to scholars and policy makers is the provision of nuclear test facilities by South Africa to Israel. Testing nuclear weapons is a crucial aspect of validating one's designs and also ensuring that one's nuclear deterrent is seen as being credible by one's adversaries. However, given Israel's geographical limitations, Israel could not have tested its nuclear weapons on its soil. It was therefore imperative that Israel test its nuclear weapons outside the region. The South African provision of test facilities for an Israeli test has to be viewed in this context.

There have been two major instances in which South Africa has provided Israel with test facilities. Before going on it would be imperative to place out the fact that as early as 1966, South Africa offered Israel a nuclear testing site on or off the South African coast. It however seems as if the Israelis uncharacteristically did not take any

definitive decision on the matter. (Raj, 1981, 115) The South African Prime Minster John Vorster renewed the offer during his 1976 visit to Israel. It seems by this time, Israel too was looking to diversify its partners and as subsequent events in 1977 and 1979 show, Israel seems to have taken up the renewed offer.

Preparation for the test had begun as early as 1974 when South Africa began construction of a nuclear test site at the Vastrap military base in the Kalahari Desert. Three test shafts were drilled. One of them hit unfavourable geological conditions and flooded, but the other two were completed. Pretoria did not bury the monitoring equipment, power generators and associated facilities because, firstly it did not anticipate that its activities would be observed and secondly, it would have been too expensive to go completely underground. J.W.de Villiers, a weapons designer who later became President and then Chairman of the Board of the Atomic Energy Commission (AEC), corroborated this fact. (Beri, 1998; Horton III, 1999)

In August 1977 South Africa was carrying out preparatory work at the nuclear test site in the Kalahari Desert under the garb of an artillery test range. On July 30, 1977, a Soviet satellite passing over South Africa spotted the distinctive configuration of a nuclear test site in the Kalahari Desert and subsequently made four more passes on August 6. Moscow immediately alerted Washington, which redirected its satellites to independently confirm this information. It was the American satellite SR–71 that finally confirmed the information to be true. (Polakow-Suransky, 2010, 111-113)

The discovery led to an international furore with demarches being issued by the Americans, French and the Germans which included threats to break off of diplomatic relations as well as cessation of trade relations. In wake of the discovery, the French cancelled the contract for building the Koerberg nuclear power plants at Cape Town. (Liberman, 2004, 53, 65, 69, 70; Polakow-Suransky, 2010, 111-112) In response, Prime Minster Vorster abandoned the test site,

promised not to carry out any nuclear tests, asked the Atomic Energy board to cancel the PNE programme and made assurances about the peaceful nature of the South African nuclear programme. (Liberman, 2004, 53, 69, 70)

The Soviet and American actions which forced the South Africans to abandon work at the Kalahari test range also had an unintended consequence which was to push Pretoria towards making clandestine efforts at acquiring a deliverable nuclear deterrent. This resulted in the nuclear weapons programme shifting from the scientists at the AEC who were pushing for a crude, bulky gun-type device, to the Armscor and the SADF who were in favour of a miniaturized deliverable design. (Polakow-Suransky, 2010, 113) Given that South Africa was not advanced enough in its nuclear weapons programme at that point in time, there continue to be suspicions that the preparations underway at the Kalahari range in August 1977 were to carry out a nuclear test reportedly of an Israeli device. (Director of Central Intelligence, 1979, 11)

The 1979 Vela Test

The most important and oft repeated instance of Israeli and South African cooperation in the nuclear weapon testing domain occurred in September 1979. On September 22, 1979, American VELA satellites' photodiode sensors called *bhangmeters* registered a double-peaked signature, characteristic of a nuclear explosion off the coast of southern Africa.[1]

While detecting a nuclear explosion, both the *bhangmeters* would record the light pattern in a characteristic manner known as the

1. Launched following the 1963 Partial Test Ban Treaty (PTBT), the Vela satellites were a constellation of satellites which were launched with the objective of identifying clandestine nuclear explosions. The two photodiode sensors on board the Vela satellites were called 'bhangmeters.' Interestingly, the Indian intoxicant is also called *bhang*.

'double hump' and the recording by both the sensors would result in a precise match. However, during the September 1979 test, the records of both the *bhangmeters* did not match. This technicality was used by the Carter administration and a section of the experts to make the claim that the sensors did not record a test but some other event like a meteoroid hitting the satellite sensors which caused the double peak.

In order to gather additional evidence to assess whether the September 22, 1979 event was a nuclear explosion or not, the Carter administration used various alternative means at its disposal. Firstly, the US analysed data collected by the satellites belonging to the Defence Support Program (DSP). It sought an analysis from the Ionosperic Observatory at Arecibo regarding any ionospheric movement that could have resulted from an atmospheric test. It also sent aircraft fitted with special sensors to collect air samples which might have radioactive particles from the test site. In addition, it also roped in the Naval Research Laboratory (NRL) to analyse the data collected by naval ships and assess as to whether a test occurred or not. (Wiess, 2011, 2-3)

The analysis resulted in a mixed verdict. The DSP sensors did not notice a test but analysts after going through the entire data concluded that this could have been because the event did not take place in the field of view of the DSP satellites. However, after analysis of all the available test data, the scientist at the Los Alamos Scientific Laboratory, Henry G. Horak concluded that *"both the bhangmeters were operating normally"* and *"there was strong evidence that a nuclear explosion had actually produced the Vela alert 747."* (Horak, 1980, 7,10)

Further, the analysts at the Ionospheric Observatory did notice changes in the ionosphere which could indicate an atmospheric test. (Albright, 1994, 42) The special aircraft did not pick up any radioactive debris which might point to an atomic test. However, the NRL analysis of the data given by ships and other vessels of the Navy

stated that a test had taken place. Leonard Weiss quotes Alan Berman, former scientific director of Naval Research Laboratory who states *"pulses of underwater sound detected by Navy sensors at two locations following the blast were the strongest corroborative evidence that a nuclear explosion had taken place."* Berman describes the evidence as being strong enough to make a case in its own right. (Wiess, 2011, 7)

The Vela test and Israel's probable involvement in the test would have caused an enormous amount of headache for President Carter and his re-election bid. The Carter administration was caught in a unique 'Catch-22' situation. On one hand due to the impending ratification of the SALT II Treaty by the Senate, the administration had every reason to point out that the American capability to detect any clandestine nuclear test by the Soviets was working perfectly. In fact, the American Secretary of State, Cyrus Vance himself pointed to the fact that the satellites worked well. Given that the Carter administration had been unable to secure ratification of the SALT Treaty partly due to the perception in the Senate that it could not be verified, the American Secretary of State Cyrus Vance was quit to drive home the point that *"Within a period of an hour or so, the information picked up from the satellite had been reported back and we knew about it. So, the equipment we had, worked perfectly."* (Walters, 1987, 43)

On the other hand, there were suspicions of Israel's involvement in the test as it was believed that South Africa had not advanced enough on its own right to conduct a nuclear test. This fact was alluded to by a report by the Director of the Central Intelligence Agency (CIA) in the Interagency Intelligence Memorandu which was prepared at the request of the National Security Council. The report entitled "The 22 September 1979 Event," considers the possibility of a secret test by South Africa, a secret test by Israel and a test clandestinely conducted by both countries working in tandem. (Director of Central Intelligence Agency, 1979, 5-6)

President Carter had invested significant political capital and

effort into brokering the Camp David Accords between Egypt and Israel. This was also going to be an important plank of President Carter's re-election campaign. Also, the State Department under the Carter Administration had come down quite heavily on Pakistan for its nuclear enrichment and reprocessing activities. Economic and military assistance to Pakistan had been cut as a result of such efforts. Now, if Israel was implicated in the Vela test, the US could not afford to turn a blind eye to it. (Wiess, 2011, 4) The Vela test came at a very inopportune time and could cost President Carter significant political capital. President Carter was already feeling the domestic heat due to the blowback of the Iranian hostage crisis; an Israeli nuclear test would have made the situation much worse.

Given the above, it was but natural for the White House to try to find some way by which it could wriggle out of the situation which was nothing but political *hara-kiri*. Thus, the White House decided to convene a panel of scientific experts to review the data which was available and assess whether the "double flash" was in fact a nuclear test or not. To this end, Frank Press, the President's science advisor and Director of the Office of Scientific and Technology Policy was put in charge of putting together such a panel. The panel consisted of Jack Ruina, an MIT professor as Chairman of the panel, and other distinguished scientists like Luis Alvarez, Richard Garwin, Wolfgang Panofsky, Richard Muller, Alan Peterson, William Donn, Riccardo Giacconi and F. William Sarles. (Office of Science and Technology Policy, 1980, 20) The Ruina panel's final report released in May 1980 concluded that the Vela signal was *"possibly a consequence of the impact of a small meteoroid on the satellite which reflected sunlight into the field of view of the bhangmeters"* but was *"probably not from a nuclear explosion."* (Office of Science and Technology Policy, 1980, 2) However, a Defence Intelligence Agency (DIA) study had calculated the *"probability of a single meteoroid causing the Vela signal was less than one in a hundred billion."* (Mansfield, 1980, 28)

One question which remained unanswered in all these reports is as to why the Vela satellites, which had detected the characteristic double peaked signature signalling a nuclear explosion forty-one times earlier, would fail or throw up a false positive in the case of the September 22, 1979 explosion. More interestingly, although the current set of Vela satellites had been in orbit since 1970, the sensors had been calibrated just one week prior to the sighting. One does not come across a satisfactory answer to this puzzling problem in any of the scientific and technical reports that were churned out in the aftermath of the September 22, 1979 event. (Richelson, 2006)

Conclusion

As can be seen from the above description, though there was a creeping suspicion amongst the American intelligence community about the complicity of Israel and South Africa in the conducting the September 1979 nuclear explosion off the South Atlantic. Though the Carter administration used the Ruina panel as a cover to counter the widespread belief of the event being a nuclear explosion. However, when seen in light of the widespread cooperation between Israel and South Africa in the years preceding the nuclear test - in the nuclear, military and missile fields - there is enough evidence pointing to the strong possibility of such cooperation. This assessment is further strengthened by the fact that South Africa at the time of the September 1979 event had not advanced sufficiently to carry out an independent nuclear explosion.

The end of the apartheid began with F.W. de Klerk being elected state president in September 1989. This coincided with the process of dismantling of the South African nuclear programme. The process reached its logical conclusion with the South African cabinet accepting the proposal to disarm the six and half nuclear weapons it possessed under IAEA supervision. The South African nuclear weapons programme formally came to an end with Pretoria joining

the NPT as a non-nuclear weapon state on July 10, 1991. With both these developments, any possibility of further clandestine collaboration between Israel and South Africa ended; thus bringing down the curtains on the deep and wide ranging collaboration between the two countries in the nuclear, missile and military domains.

References

- Aftergood, Steven and Hans M. Kristensen (January 8, 2007) "Israel: Nuclear Weapons", *Federation of Atomic Scientists*, available at: http://www.fas.org/nuke/guide/israel/nuke/.
- Albright, David (July/August 1994) "The Flash in the Atlantic," *Bulletin of Atomic Scientists*.
- Barnaby, Frank (1989) *The Invisible Bomb: The Nuclear Arms Race in the Middle East*, London: I.B. Tauris and Company Ltd.
- Beri, Ruchita (October 1998) "South Africa's Nuclear Policy," *Strategic Analysis*, Vol XXII (7).
- Cohen, Yoel (2003) *Whistleblower of Dimona: Israel, Vanunu, and the Bomb*, New York: Holmes & Meier.
- de Klerk, F.W. (March 24, 1993) "Speech on the Nonproliferation Treaty to a Joint Session of Parliament", *Joint Publications Research Service, Proliferation Issues*.
- Director of Central Intelligence Agency (January 21, 1980) "The 22 September 1979 Event", available at: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB190/03.pdf.
- FBIS-NES-89-208 (October 30, 1989) *Israel*.
- Gordon, Michael (October 27, 1989) "U.S. sees Israeli help in Pretoria's Missile Work", *New York Times*.
- Horak, Henry G. (May 1980) "Vela Event Alert 747", *Los Alamos Scientific Laboratory"*, available at: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB190/07.pdf.
- Horton III, Lt. Col. Roy E. (August 1999) "Out of (South) Africa: Pretoria's Nuclear Weapons Experience", *USAF Institute for National*

Security Studies, Occasional Paper #27, available at: http://www.fas.org/nuke/guide/rsa/nuke/ocp27.htm
- Liberman, Peter (Summer 2004) "Israel and the South African Bomb," *The Non-proliferation Review*.
- Mansfield, John E. and Houston T. Hawkins (June 26, 1980) *The South Atlantic Mystery Flash: Nuclear or Not?*, Defence Intelligence Agency, available at: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB190/10.pdf.
- Mazrui, Ali A. (1983) "Zionism and Apartheid: Strange Bedfellows or Natural Allies?" *Alternatives: Global, Local, Political*, Vol. IX.
- Miller, Judith (June 28, 1981) "3 Nations Widening Nuclear Contacts", *New York Times*.
- Office of Science and Technology Policy (May 23, 1980) *Ad Hoc Panel Report on the September 22 Event*, available at: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB190/09.pdf.
- Polakow-Suransky, Sasha (2010) *The Unspoken Alliance: Israel's secret relationship with Apartheid South Africa*, Cape Town: Jacana Publishers.
- Pry, Peter (1984) *Israel's Nuclear Arsenal*, Boulder Colorado: Westview Press.
- Raj, Christopher S. (1981) "Israel and Nuclear Weapons: A Case of Clandestine Proliferation", in: K. Subramanyam Ed., *Nuclear Myth & Realities: India's Dilemma*, New Delhi: ABC Publishing House and IDSA.
- Richelson, Jeffrey T. (May 5, 2006) "The Vela Incident: Nuclear Test or Meteoroid?", *National Security Archive*, Electronic Briefing Book, No. 190, available at: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB190/index.htm.
- Spector, Leonard and Jacqueline R. Smith (1990) *Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990*, Carnegie Endowment for International Peace. Boulder: Colorado, Westview Press.
- US Central Intelligence Agency (March 30, 1983) Directorate of Intelligence, *New Information on South Africa's Nuclear Program and*

South African-Israeli Nuclear and Military Cooperation, partially declassified and released 27 April 1997, available at: http://www.nti.org/e_research/profiles/1611_1642.html
- Walters, Ronald U. (1987) *South Africa and the Bomb: Responsibility and Deterrence*, Washington: Lexington Books.
- Wiess, Leonard (July 30, 2011) "The 1979 South Atlantic Flash: The case for an Israeli Nuclear Test", Stanford University.