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DEFENSE INTELLIGENCE AGENCY

SCIENTIFIC AND TECHNOLOGICAL BASE OF SELECTED FOREIGN COUNTRIES

VOLUME I

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SCIENTIFIC AND TECHNOLOGICAL BASE
OF
SELECTED FOREIGN COUNTRIES
VOLUME I

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PREFACE

~~(C)~~ The object of this study is to define, describe and assess the scientific and technological capabilities of Argentina, Non Responsive [redacted] in order to determine nuclear weapons development potential of these countries. Scientific and technology profiles were developed for each country through detailed study and analysis of scientific manpower, education, research and development management, facilities, resources allocations, and political motivations as applied to nuclear programs. These profiles were used to assess current nuclear weapon potentials and establish future areas of emphasis in the subject nations.

(b)(3):50 USC 3024(i),(b)(6)

(U) [redacted] The document is the first of a series of reports being prepared for DIA on the S&T capabilities of selected countries.

(U) Constructive criticism, comments, or suggested changes are encouraged and should be forwarded to the Defense Intelligence Agency (b)(3):10 USC 424 [redacted] Washington, D.C. 20301.

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PART I - ARGENTINA

Argentina has the capabilities and resources to produce a nuclear weapon. However, a weapons program is receiving very low priority as a goal of the Argentine government and the scientific community. Primary emphasis is being given to development of independent nuclear facilities which will produce one-third of Argentina's electrical power by 1985. Argentina has political problems, difficulty in retention and motivation of capable scientists, and a need for major support from foreign firms for nuclear know-how. The Argentine education system is capable of developing sizable numbers of qualified S&T personnel, and they will, no doubt, constitute the base for future nuclear programs and possible weapons development in five to ten years.

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PART I

ARGENTINA

1. Research & Development Manpower

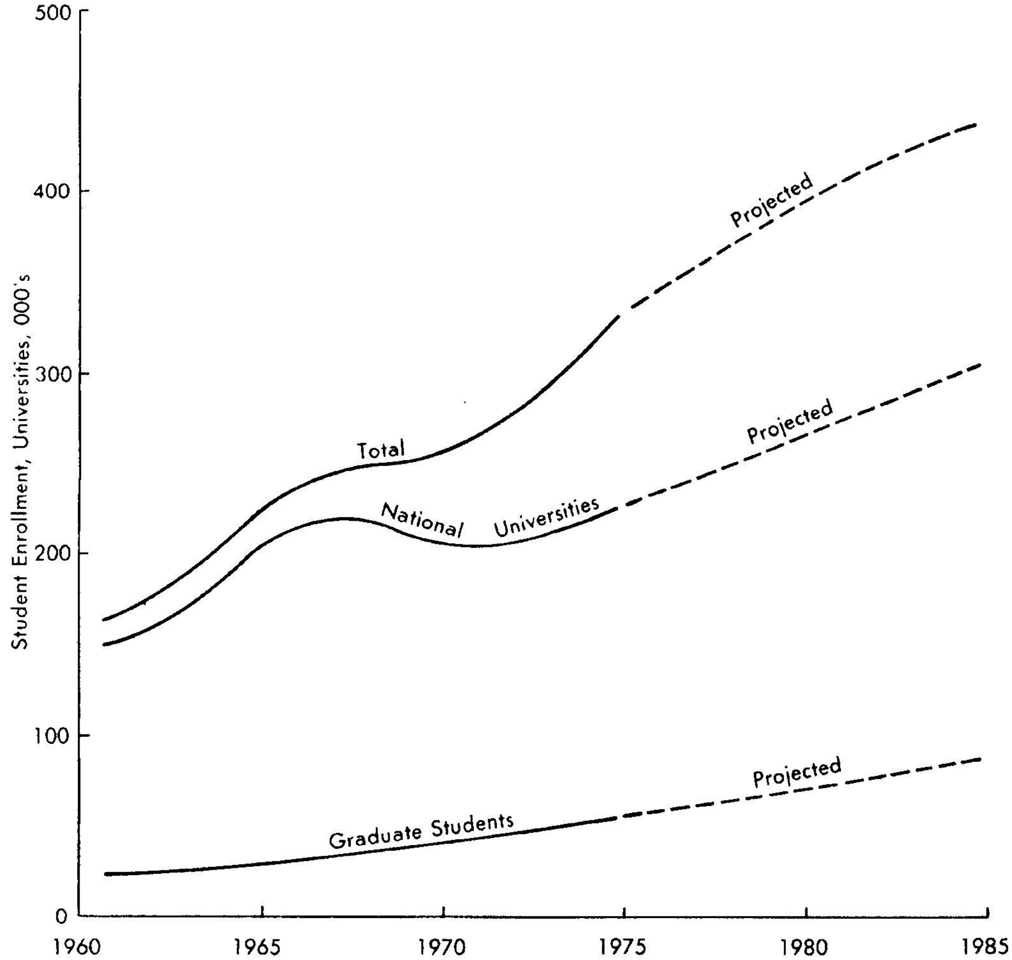
A. Scientific and Technological Education

Argentina has one of the highest literacy rates in the world (over 90% in 1960). Since 1868, different governments of the republic have placed such a premium upon education and schooling that today the nation maintains a very good system of free schools. Currently, higher education in the country maintains the highest proportion of students enrolled and the highest teacher/student ratio of any country in Latin America. Therefore, it is not surprising that in the fields of natural science and engineering Argentine universities produce sizable numbers of technicians and researchers who will contribute substantially to the country's technological development.

In overall enrollments the universities have grown at a rate two and one-half times the rate of population growth of 20 to 24 year olds. It is expected that the rapid surge in enrollments in the last five years will level off as the government becomes more conservative about the number of private universities it accredits. Private universities in general had a 671% increase in enrollments in the 1960's, but are not likely to show such growth in the next decade. Provincial universities, however, which emphasize studies in agriculture, teacher education and veterinary medicine, are likely to see more growth than the national universities. (See Graph 1).

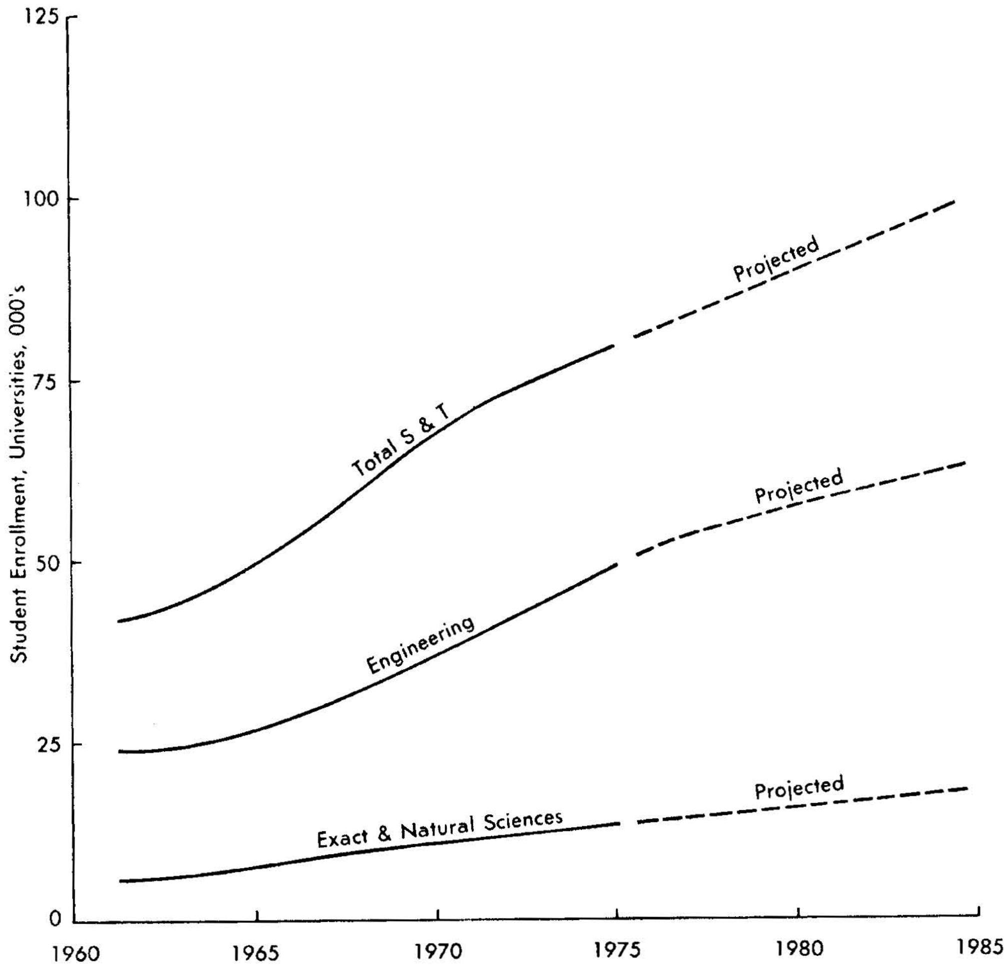
Argentine universities are placing more emphasis each year on training engineers, laboratory researchers and technicians. In the decade of the 1960's, enrollment in engineering in the universities increased 72% and enrollment in the exact and natural sciences increased 52% (see Graph 2). This growth does not keep pace with the increased enrollment in humanities and social sciences, but interest in these fields is not falling off. Each year an increasing number of graduates with first and advanced degrees are eligible to enter the science and technology work force (see Graph 3).

A number of Argentine students have enrolled in foreign universities, although specific information concerning fields of study and past history of numbers involved are not available. A study is underway and should be completed within two months. In 1971 there were 1,828 students enrolled in foreign universities, including the United States (760), West Germany (117), Spain (154), Uruguay (211), Israel (72), United Kingdom (71), Italy (76), France (75), Canada (65) and Belgium (64).



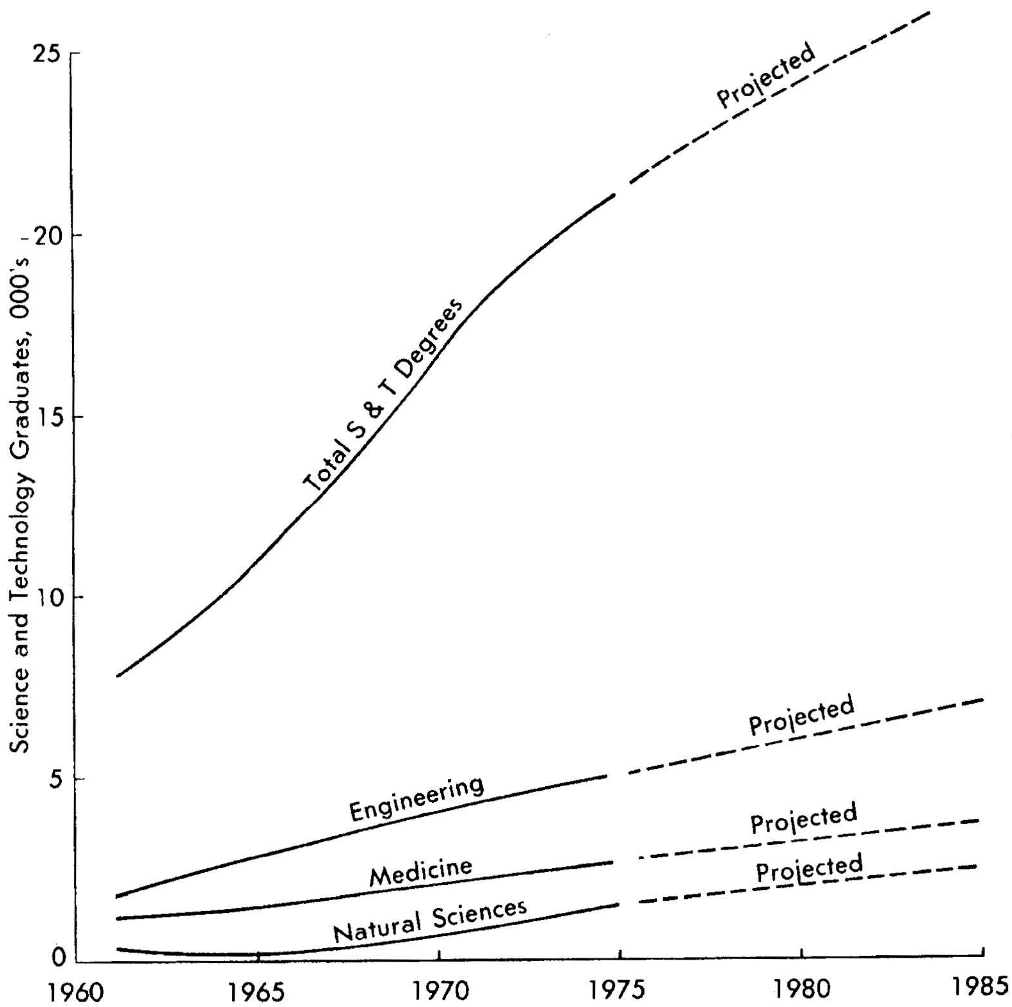
Argentina Student Enrollment vs. Year

Graph 1



Student Enrollment by Specialization vs. Year

Graph 2



S & T Graduates vs. Year

Graph 3

B. Leading Universities and Colleges in S&T Fields

The great majority of Argentine students in higher education are enrolled in public universities, which house much of the research effort in the technical and natural sciences. These public universities are spread about the country and the offerings of each are sufficiently diverse so that no student will have to travel far to pursue his chosen field.

The establishment of private unviersities was authorized by 1958 legislation which recognized several institutions already in existence and encouraged the founding of others. By 1967 the government had recognized thirteen such institutions, all but three of which were affiliated with the Roman Catholic Church; at that time, private universities had a total enrollment of some 17,000. The government requires stringent financial and academic standards, but also authorizes government subsidies "when in the national interest." In late 1969 there were sixteen recognized private universities and eight others having provisional authorization to operate.

Below is a list of the leading universities in Argentina, all of them public national universities:

University of Buenos Aires

Year	Total Students	Total Faculties	Total Staff (Instructors and Professors)
1961	68,322	11	1,853
1965	90,251	13	2,118
1970	78,461	13	2,178
1973	88,628	13	9,100

Special facilities for study of agronomy, biochemistry, experimental physics. Natural sicence, medical, engineering and agronomy faculties study application of radio isotopes and nuclear physics. Also, CNIE funds the Centro Nacional de Radiacion Cosmica, which is a group from the physics faculty conducting cosmic ray research. University library has 110 million volumes.

National University of Cordoba

Year	Students	Faculties	Staff
1961	19,509	13	841
1965	23,546	14	872
1970	27,266	15	1,110

Although one of the largest universities, Cordoba is mainly concerned with the humanities and social sciences. Library has 125,000 volumes.

National University of Cuyo

Year	Students	Faculties	Staff
1961	4,681	12	654
1965	5,744	12	605
1970	6,873	13	769
1973	7,579		844

Confers degrees of doctor of physics and doctor of nuclear physics. The CNEA (Atomic Energy Commission) and the university have agreed to have the physics faculty form the School of Atomic Physics at Bauloche. Also, research done in petroleum engineering. Library has 131,000 volumes.

National University of LaPlata

Year	Students	Faculties	Staff
1961	25,035	14	941
1965	33,761	15	1,204
1970	28,594	15	1,249
1973	22,000	15	1,209

Faculties of engineering, exact and natural sciences, nuclear chemistry and spectroscopy. (Beta spectroscope and 100 channel analyzer) CNIE (National Space Agency) supports ionosphere research, solid state physics and theory of rocket propulsion systems.

National University of the Litorel

Year	Students	Faculties	Staff
1961	20,269	14	876
1965	24,105	15	951
1970	7,831	9	367
1973	15,330		1,406

Research in natural science and medicine: electronics, metallurgy, radiochemistry, mineral processing, chemical engineering and biochemistry.

National University of the Northeast

Year	Students	Faculties	Staff
1961	4,247	8	258
1965	8,139	8	360
1970	7,767	10	448
1973	6,879		445

Mainly offers varied natural science courses for first degree.

National University of Rosario

Year	Students	Faculties	Staff
1970	15,862	11	708
1973	15,974		2,053

Separated from Litoral in 1969. Not too much scientific research, except in biochemistry.

National University of the South

Year	Students	Faculties	Staff
1961	3,470	8	129
1965	6,195	10	214
1970	5,251	13	389

Faculties of engineering, chemistry, and mathematics and physics.

National University of Tucuman

Year	Students	Faculties	Staff
1961	6,773	15	429
1965	3,505	15	480
1970	10,157	15	592
1973	11,489		1,756

Natural and exact science faculties emphasize courses in biochemistry and physics. Also has faculties of engineering and of natural science at Salta.

National Technical University

Year	Students	Faculties	Staff
1961	3,256	9	600
1965	6,191	11	734
1970	11,094	11	1,013
1973	9,805		893

Spread over the country, various campuses have offerings in engineering, chemistry and telecommunications.

National University of Comahue

Founded in 1971, has faculties of engineering and physics and natural sciences. 1973 enrollment: 2,100 students, 360 instructors and professors.

C. Leading Scientists and Engineers

While much of the research being done by Argentine scientists involves medical projects or biochemistry, there are a number of people deeply involved in nuclear physics. It would be impossible to note all those publishing recent research in Argentina, but persons who are in prominent leadership positions are listed below together with the foremost leaders in other scientific fields.

Baez, Juan N. - researcher in laboratory of radioisotopes, National University of Litoral

Bariagne, Dr. Jorge E. - in Center of Radiology, Buenos Aires.

Barrio, D. A. - President of the Argentine Association of Natural Science.

Bello, Dr. Jose Luis - Director of Nuclear Department, Coasiu S.A.

Bosch, Carlos Frederico - 1974 President of CNIE (see Section 2B).

Bulla, Professor Ricardo - in Center of Radiology, Buenos Aires.

Casas, Prof. - Head, 1969 group constructing new spectrometrics and studying isotopes Zargoza, University Spain L. H. Casas pub. for NCEA 1971.

Castellanes, Dr. Telosio - President of National Academy of Sciences of Cordoba.

Castellano, Dr. Enrique - secretary of Commission Especial de Fisica Atomia y Radioisotopes at LaPlata National University in 1970. Dean of Exact Sciences at LaPlata.

Cicordo, Vincente H. - director of CNICT (see Section 2B).

Del Carriel, Salvador M. - President of INTI (see Section 2B).

Devooght, Jacques - Engineer (1932). Ed: University of Brussels. Interested in nuclear reactor physics and reactor theory; Mossbauer spectrocopy.

Espanol, Dr. A. - Professor of Nuclear Engineering, University of Buenos Aires.

Ganiba, Dante Walter - Technical Director of Tecnitron S.A., Buenos Aires.

Hovesay, Bernardo A. - 1958 created CNICT (see Section 3B). Nobel Prize in Medicine.

Iraologortia, Rear Admiral Pedro E. - 1974 President of CNEA (see Section 2B).

Kowalenoski, Valdemar J. - Professor of Experimental Physics, University of Buenos Aires.

Leloir, Luis Federico - Nobel prize-winning 1970 chemist (body's metabolism of sugar) now at Biochemical Research Institute near Bariloshe.

Madero, Dr. Carlos Castro - Professor of Nuclear Physics, University of Buenos Aires.

Magallanes, Raul A. - Dean of Exact Physical and Natural Sciences at National University of Cordoba.

Maissa, Pedro A. - Director of the Center of Radiology, Buenos Aires.

Malliman, Dr. Carlos - Director of the Bariloche Foundation, Computer Think Tank.

Mayo, Santos Ph. D. (Physics) - Ed. National University of LaPlata. Instructor Physics, LaPlata 1950-55. Research Association in Nuclear Physics AEC 53-7, 59-. Guest Physicist Brookhaven National Laboratory 1957-8. Nuclear Interests: nuclear physics, nuclear reactions at intermediate energies, circular accelerations technology. Synchrocyclotron Lab in B. A. (1969).

Navarrine, Dr. Eduardo A. - in Center of Radiology, Buenos Aires.

Nussis, Nicolas - 1970 Director of and researcher in laboratory of radioisotopes, Litoral National University.

Ortiz, Eduardo L. - Director of Commission of Scientific Documentation.

Papadopolous, Celso C. - Energy Manager, CNEA. Has supervised the operation of the Ezeiza semi-industrial radiation plant (see Section 2B).

Perez de Urso Rafad - Advisor to Laboratory of Radioisoptopes, National University of Litoral.

Quihillalt, Oscar Armando - 1970 Chairman of CNEA.

Rolleri, Dr. Edgardo - Dean of Natural Science, LaPlata National University.

Sabato, Jorge A. - Technical Manager in CNEA in 1970.

Sivori, Enrique - President of Comision Especial de Fiscia Atomica y Radioisotopes at LaPlata National University in 1970.

Stipanic, Dr. Pedro N. - Manager of Raw Materials, CNEA; a strong advocate of the importance of earth sciences in the development of nuclear energy in Argentina.

Tabanera, Teofilo - research in space. Formerly of faculty at LaPlata National University.

Taquini, Dr. Alberto C. - President of Argentine Association for the Progress of Science.

Tendler, R. - works for CNEA, Buenos Aires labs, on manganese diffusion in zirconium.

Ursino, Augusto - advisor to laboratory of radioisotopes, University of Litoral.

Wainstein, Dr. Cecilio - director of Physics Department and faculty of mathematics and physics at LaPlata National University. Member Comision Especial de Fiscia Atomica y Radioisotopes.

Westerkamp, Jose F. - Professor of Experimental Physics, University of Buenos Aires.

Zerbo, Dr. Osvaldo E. - in Center of Radiology, Buenos Aires.

D. Exchange Programs

Argentine governments have always emphasized independence from foreign influence and have encouraged development of their own scientists and technology whenever possible. Therefore, involvement of foreign scientists in research and development in Argentina has been minimal. A German firm, Siemens, built a nuclear power plant at Atucha and supplied technicians to train Argentine technicians. Similarly, Canadian and Italian firms, Atomic Energy of Canada Limited and Italimpianti, will train Argentines in the use of the reactor they are building jointly. In May, 1974, India and Argentina signed an agreement which provided for the exchange of scientists for "peaceful nuclear research." Nuclear energy researchers are receiving training in the U. S., Great Britain, France and West Germany; and the French Atomic Energy Commission is providing personnel to advise Argentines on the exploitation of uranium in the Sierra Pintada District of Mendoza Province where about half of Argentina's uranium reserves are said to be located. Beyond this, most programs have involved the purchase of technology, exchange of information or financial assistance to be discussed in Section 5.

E. Total Scientists and Engineers

Argentina is experiencing some difficulty in maintaining a large enough working force of scientists, engineers and technicians to fulfill the ambitious research and development goals of recent governments. In one year, 1970-71, the numbers of scientists and engineers dropped from one million to three hundred thousand while the number of technicians increased from one million seven hundred thousand to one million nine hundred thousand. This "brain drain" has not been felt as much in research and development as in other areas, and the great number of part-time researchers and technicians brings the "full-time equivalent" figures for 1971 down to 90,000 scientists and engineers and 980,000 technicians. Of these, very few are actually engaged in research and development (as shown in Table I).

Table I

S&T Personnel in Research and Development

	Total	Scientists and Engineers	Technicians
1969	14,532	5,454 (38.0%)	5,885
1970	22,500	6,500 (28.9%)	9,800

Total S&T personnel in research and development are affected by numerous part-time employees and professionals who are actually doing work in fields other than scientific research (see Table II).

Table II

Number of Scientists in Research and Development by Field (1969)

	Total	Nat. Sci.	Engin. & Tech.	Med.	Agri.	Soc. Sci. & Law	Human, Ed. & the Arts
Full-Time	5,454	2,290	711	1,027	867	402	121
Part-Time	5,373	963	963	2,411	290	826	131
Full-Time Equivalent	4,452	1,688	1,688	911	627	448	134

A further analysis for 1969 shows a mere 1,165 scientists and engineers actually working on some integrated research and development projects (see Table III).

In spite of the educational opportunities and training facilities offered by Argentina's universities and the increasing number of graduates with the qualifications to do scientific research, the numbers of personnel involved in full-time research remain low. Argentine scientists cite emigration because of limited opportunities, low salaries and political interference as the explanation for this condition, and these matters will be discussed in Sections 2 and 3.

Table III

Number of Scientists, Engineers and Technicians in R&D
By Sector of Performance and Type of Personnel (1969)

1. Total		= 14,140*
Scientists and Engineers		= 4,355
Technicians		= 5,885
Auxiliary Personnel		= 3,900
2. Productive Sector*		
A. Integrated Research and Development	(31.6%)	= 4,471
S&E		= 1,165
Technicians		= 2,072
Auxiliary Personnel		= 1,243
B. Non-Integrated Research and Development	(5.5%)	= 781
S&E		= 246
Technicians		= 258
Auxiliary Personnel		= 277
3. Higher Education*	(39.2%)	= 5,546
S&E		= 2,422
Technicians		= 1,963
Auxiliary Personnel		= 1,161
4. General Services*	(23.6%)	= 3,342
S&E		= 522
Technicians		= 1,592
Auxiliary Personnel		= 1,228

*Sectors do not include 97 scientists and engineers, 212 technicians and 83 auxiliary personnel for which sectors could not be determined.

2. R&D Facilities, Institutions

A. Total Numbers and Growth Trends

Since the number of scientists involved in integrated research is low, Argentina must rely upon the more independent scientific research being conducted in the large universities as a source of technological development. In 1969, an estimated 65% of all research and development projects were being done in the universities (another 24% were being funded by the private sector).

In the past decade the number of these university research centers has been growing as the government has been placing more and more emphasis on higher technical education. In 1969 there were 38 universities in Argentina, 14 of them public; and in 1971 there were 41, 16 of them public. In addition, a number of long-standing institutions are receiving more and more governmental support for the development of special equipment and research capability. These data are summarized in Tables IV and V.

Table IV

Facilities for Advanced Degree Preparation

	Establishments					Professors				
Year	Total	National	Provincial	Private	Municipal	Total	National	Provincial	Private	Municipal
1961	141	49	56	22	14	3,438	1,716	994	559	169
1965	176	55	70	41	10	4,234	1,809	1,097	1,212	116
1970	215	51	88	70	6	6,473	1,966	2,113	2,318	91

Table V

Higher Education Facilities

	Universities				Faculties				Teachers/Professors			
Year	Total	Nat.	Prov.	Prvt.	Total	Nat.	Prov.	Prvt.	Total	Nat.	Prov.	Prvt.
1961	18	9	1	8	145	104	2	39	7,793	6,581	40	1,172
1965	26	9	4	13	198	113	12	73	11,167	7,538	253	3,376
1970	42	14	4	24	280	125	18	137	16,004	8,823	642	6,539

B. Leading R&D Facilities/Institutions

Following is a list of the most important facilities and institutes for research and development in Argentina, some of which have administerial responsibilities.

Comision Nacional de Energia Atomica: Perhaps the most ambitious of all Argentina's institutions, the CNEA has an increasing number of research facilities and has been involved in intensive efforts to achieve nuclear independence for Argentina. Founded in 1950, and placed under direct authority of the President, the commission developed what is today the most advanced and comprehensive nuclear energy program in Latin America. In 1958 it supervised the creation of Latin America's first reactor, and last year began operating the continent's first nuclear power plant, at Atucha, 100 km northwest of Buenos Aires. Its major divisions of Raw Materials, Energy, Technology, Radiological Protection and Security, General Services, Research, and Administration, are involved in a variety of activities geared toward speedy development of nuclear facilities.

The raw materials division handles ore prospecting, extraction and chemical processing. It has branches in the cities of Salta, Cordoba, Mendoza and Sarmiento. Its main laboratories are in Buenos Aires; its Cordoba plant produces commercial concentrates on a semi-industrial scale.

The CNEA has announced plans to build a heavy water plant but its schedule is uncertain at this time. The raw materials division has also reassembled a pilot scale reprocessing plant at the Ezeiza Nuclear Center which had been dismantled some years previously. It is used to process the "RA-3" research reactor fuel. The U. S. AEC scientific representative in Buenos Aires was recently shown a model for a waste disposal facility, which is apparently to be located at the same site. The facility is to include two underground storage tanks complete with cooling coils and above ground heat exchangers. As with the heavy water plant, foreign technological assistance would be required for Argentina to construct a large scale reprocessing facility for power reactor fuel. CNEA experience in working with plutonium is very limited, although they have already been successful at producing refined uranium at the Eziera site.

The technology division is especially active in metallurgy. Its Servicio de Asistencia Tecnica a la Industria (SATI) was organized to provide services to industry. The metallurgy department has assisted in various international cooperative projects with European and U. S. scientists; it carries out research projects with the help of national and foreign grants and contracts.

The energy division is responsible for the design, construction and operation of CNEA's research reactors and for the supervision of the construction of the power plant at Atucha. The research reactors presently in operation are:

RA-1 Reactor at Constituyentes, Buenos Aires: This is a 15 KWt modified argonaut research and training reactor which was designed and built by the CNEA.

RA-3 Reactor at the Ezeiza Atomic Center near Buenos Aires: This is a 5 MWt tank-type research reactor designed and built by the CNEA. It achieved criticality on May 18, 1967. An AEC reactor grant of $350,000 was committed for this project in 1962. In addition to the reactor grant, the U. S. donated through the IAEA about $45,330 worth of special nuclear material for use as fuel in the reactor.

RA-0 Reactor at the University of Cordoba achieved criticality in 1973 at its present location and has a power of 0.5 watts. It uses 20% enriched fuel and was formerly located at Constituyentes.

RA-4 Reactor at National University of Rosario uses 20% enriched fuel and has a power of 0.1 watt. It achieved criticality in 1973.

RA-2 Reactor at Buenos Aires: First operated in 1966. Not currently in operation.

RA-1 and 3 are producing Argentina's stockpile of plutonium. According to a recent CNEA report, RA-3, the largest, is to be fitted with a "fertile blanket" for making plutonium to be used in fast reactor studies. The small stockpile is kept in vaults at Ezeira and supervised under safeguard accounting controls by the International Atomic Energy Agency.

A major portion of the research conducted with these reactors is devoted to applications of radioisotopes in medicine, biology and agriculture. However, the dependence of these reactors upon enriched uranium from the United States has stimulated a great amount of research in metallurgy, which has led to development of independent fuel fabrication and reprocessing capabilities for CNEA.

Attachment to the natural uranium reactors has not diminished in the CNEA, because a ten-year plan now calls for the construction of a second and a third reactor of that type, bringing Argentina's total nuclear capability to 2,000 MW(e).

Atomic Energy of Canada Ltd. and Italimpianti will supply a 600-MWe Candu natural uranium reactor for the Rio Tercero plant reportedly at a cost of some $250 million. Rio Tercero, approximately 420 miles northwest of Buenos Aires, will be Argentina's second nuclear power unit. Ceremonies marking the start of construction were held on June 25, 1974, and the reactor is scheduled to be completed in 1978.

Plans for a third nuclear power plant have been announced by the Economic Ministry, probably to be located at Atucha. It is expected to be supplied mostly by Canada, although the Argentines are looking into the possibility of India bidding on the job.

An ambitious projection by CNEA's energy division sets its 1980 capacity at 1,900 MW, 1985 at 5,000, 1990 at 10,000, and 2000 at 30,000 MW, which would be 30% of Argentina's generating capacity. However, if the same pattern of delays (it took six years to build Atucha 1) in construction are experienced in the next decade as in the one past, these estimates may need some revising.

CNEA has various other facilities for research leading to the use of radiation and radioisotopes. One of its programs has been in cooperation with the U. N. Food and Agriculture Organization and the International Atomic Energy Agency. The research division maintains some thirty laboratories in Buenos Aires and in the Centro Atomico de Bariloche. The facilities include the 30 MeV Synchrocyclotron. CNEA programs in physics, biology and especially chemistry and radiobiology are concentrated here. Its Instituto de Fisica Balseiro, also at Bariloche, trains selected graduate and undergraduate students. This research and training center has a wide range of equipment which includes a particle accelerator; a metallurgical laboratory; physical, medical, biological and chemical research facilities; and an electronics department. The Center's research programs include low-termperature physics, metal physics, ion beam physics and electro-mechanics.

National Institute of Physics Research for the Production of Energy: established to work primarily on plasma physics research and controlled thermonuclear fusion. The new institute is not formally tied to the CNEA but is to coordinate its plans with the CNEA.

Consejo Nacional de Investigaciones Cientificas y Tecnicas (CNICT): The Consejo Nacional de Investigaciones Cientificas y Tecnicas, essentially a coordinating agency, maintains two institutes, one for limnology and one for radioastronomy, the latter in cooperation with other institutions. It has also established the Centro Nacional de Radiacion Cosmica in cooperation with the University of Buenos Aires and other scientific organizations.

The council has actively concerned itself with science information and had created the Centro de Documentacion Cientifica. The center has well-equipped quarters in the council's building at Rivadavia 1917, close to the national Congress. Its most important contribution to date has been the massive Catalogo colectivo de publicaciones periodicas existentes en bibliotecas cientificas y tecnicas argentinas (1962), a volume consisting of 1,754 pages listing 25,646 titles and 5,915 references to them.

Thanks to its excellent reprography facilities, the center can supply at cost copies of any article requested. Priority is given to scholars attached to the council, but other scholars are also served. There is a translation section which for a fee makes translations of articles which appear in languages other than English, French, Portuguese and Italian.

The center has a small library, which is open to qualified scholars, although at present it does not have a proper reading room. The collection consists of reference works and index services.

Comision Nacional de Investigaciones Espaciales (CNIE)

Among the fields in which it has been active are cosmic ray research, ionosphere research, satellite movements, solid state physics and the theory of rocket propulsion systems. There is a rocket-launching station at Chamical in the province of La Rioja and another at Mar Chiquita near Mar del Plata.

In May 1969 the first stage of a two-stage Castor rocket carrying a 110-pound payload to a height of 333 miles was successfully launched, Several rates have made successful flights in Argentine missles, and it is planned to send up a monkey in the Castor. Argentina is the only Latin American country which designs and builds its own missiles. Argentina has fired space-probing rockets from Antartic bases. The only other countries to have done this are the United States, France and Russia.

The commission has a library with a small number of books and journals; it receives no abstracts. The library consists almost entirely of technical reports from NASA and other similar agencies. The commission does not publish a journal, but it issues occasional technical reports.

Instituto de Desarrollo Economico y Social (IDES): located in Buenos Aires, founded 1961. President Oscar Altimar. Published Desarrollo Economico and Revista de Clencias Sociales. Concerned mainly with economic development.

Instituto Nacionalde Tecnologia Agropecuaria (INTA): located in Buenos Aires, founded 1956. Concerned mainly with agricultural research and programs for development.

Bariloche Foundation: located in a hunting lodge 1100 road miles from Buenos Aires. Large computer center and think tank.

Biochemical Research Institute: Staff of 30 includes Nobel Prize winning chemist Luis F. Leloir, who has written on the body's metabolism of sugars. Government funding is low, but having worked together twenty-five years, these scientists are reluctant to go to other nations where they would be paid higher and have better facilities than an old schoolhouse.

Instituto Nacionalde Tecorologiu de Industrial (INTI): founded 1957. Library with 8,000 volumes, 2,500 maps. Publishes Contribuciones Tecnicas and Bolet in Tecnico.

Comision Especial de Fisica Atomica y Radioisotopes (CEFAR): Founded 1970 at La Plata National University.

Centro de Radioonicologia - Buenos Aires.

Tecnitron S.A.: Buenos Aires. Manufactures nuclear instruments: sealer, rate meters, pulse analyzers, scanners, well counters, Geiger Muller counters, scintillatior counters, etc.

Academie Nacional de Ciencias de Buenos Aires: founded 1937, 29 members.

Academie Nacional de Ciencias Exactus, Fisicas y Naturales: founded 1874, 30 members. Publishes Anales, Revista Darwinia, Memoria.

Academie Nacional de Ciencias de Cordoba: founded 1868; 35 members. Publishes Actus, Boletin Miscelanea.

Asociacion Argentin de Ciencias Naturoles: founded 1911; 350 members. Publishes Physica.

Asociacion Argentina para el Progreso de las Cienciao: publishes Cieneiae Investigacion.

Comision de Document acion Cientifica, Buenos Aires. Founded 1959. Library has 5,500 volumes, including 1,200 periodicals.

Sociedad Cientifica Argentina: founded 1872. Library has 46,300 volumes, 702 members. Publishes Anales.

Physical Science Societies;	Library	Members
Friends of Astronomy (f. 1929)	4,000	1,000 - observatory
Biochemical Association (f. 1934)		1,500
Physics Association (f. 1944)		
Chemical Association (f. 1912)	10,000	2,000
Association of Mining & Geology (f. 1929)	160	
Argentine Centre of Engineering (1895)	18,000	6,200

Argentine Chemical Industry: There are 17 chemical companies in Argentina which maintain research facilities. Most deal in synthethics, resins, dyes, and acids. About half are foreign-owned.

C. Areas of S&T and R&D Emphasis

The main emphasis in Argentine scientific research, until 1970, has been in the fields of biology, biochemistry and their application to medicine. While those engaged in nuclear projects have made significant achievements by Latin American standards, it should be noted that the data discussed in preceding pages show that nuclear physics and nuclear engineering are not the chosen fields of most Argentine scientists and technicians.

A survey of works published by the CNEA between 1971 and 1974 shows that about two-thirds are studies of the application of radiology to biochemistry and medicine. There are a few recent studies in the nuclear development area which should be noted. Kaufmann (1973) analyzed costs of reprocessing, storage and transportation of irradiated fields in Argentina and suggested five ways for economical treatment of fuel elements. Buienson, et al (1973) studied the effect of radioactive fallout attributed to Pacific explosions 1966-1970 on people and on milk. But most irradiation work has concerned effects on viruses, etc., neutron activation of soils to stimulate plant growth, or straight atomic theory.

Of recent importance is interest in methods of uranium recovery. Marinkeff (1973) described an aerial radiometric prospecting technique, and Stipaniere (1973) has lectured often at various congresses about the importance of developing a sound earth science program for the nuclear independence of South America.

Nevertheless, Argentina has had to rely upon foreign research for its nuclear technology from the beginning. While Argentine scientists devised CNEA's first research reactors and fabricated the fuel, the power plant designs came from elsewhere. Most Argentine scientists had other interests, and followed people like Luis Leloir, Nobel prizewinning biochemist, toward research not connected with development of a nuclear technology.

The institution of various commissions and agencies connected wtih nuclear science shows that the government has hopes of developing a nuclear program, but the emigration of young scientists from the country, the interest of those who stay in biochemistry and medicine, and the perpetuation of a great number of older, "non-nuclear" research institutions show that the Argentine science community does not, as a whole, complement the government's interest in nuclear development.

3. Research & Development Organization & Management

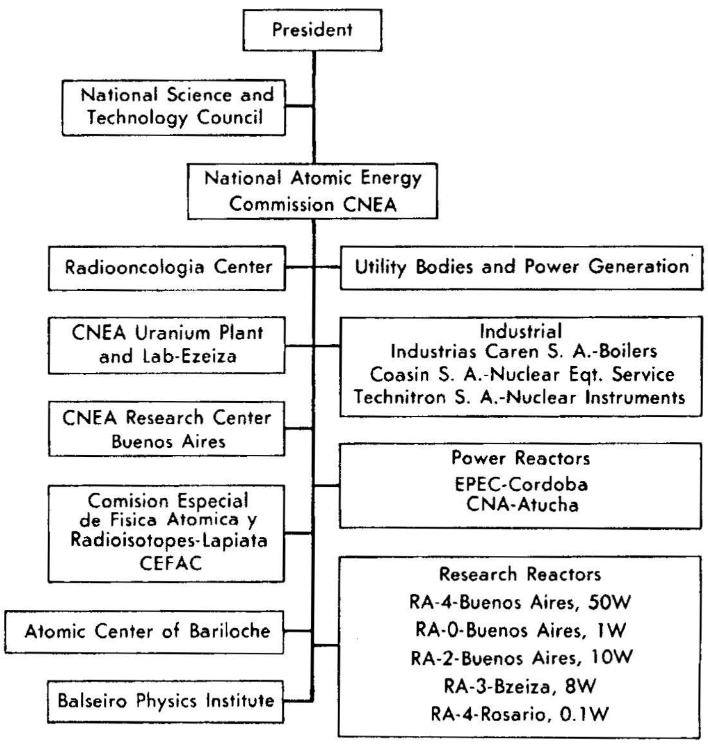
A. R&D Structure

The greatest concentration of research activity in Argentina is in the biological, biochemical and biomedical fields, although there is moderate activity in meterology, astronomy and oceanography. The amount of research undertaken by industry in Argentina is insignificant, in part because many companies and subsidiaries of foreign firms which perform their research and development work in other countries.

Nearly all research and development activity is carved out in universities and government organizations, and a large percentage of scientific and technical work is controlled, planned and funded by the government. Chart I illustrates Argentina's organization for nuclear development programs.

Chart 1

Argentine Nuclear Development Organization



The various institutes and development commissions are coordinated by the Minister of the Interior; in the cases of the universities and the development commissions, the Minister of the Treasury and Finance has an influential role in determining the amount of funding each institution will receive.

The Universities

The universities are now in a state of uncertainty, as a result of the government's failure fully to implement plans for major reform. The first major change, known as the Cordoba reform because it stemmed from a campaign by the students there, was begun in 1918 and was a landmark for both Argentina and the other nations of Latin America, most of which adopted it. Under its provisions, students, alumni, and faculty made up a tripartite university government, which was autonomous for all practical purposes. Student delegates provided the means whereby students could vote on course content, the assignment of professors and the selection of rectors. The changes brought the involvement of students in national politics--a role they have been reluctant to relinquish. Although some needed changes were made and some improvements achieved, progress toward more effective education was not as rapid as originally planned. Later, the involvement of the Peron government in education did not bring either an influx of lower class students, to whom the universities had for the first time been opned. It did, however, lead to an expansion of politically oriented student organizations and a shift leftward in the ideology of university youth.

One of Ongania's first moves after assuming power was to take over the national universities and end the tripartite government. Political activity in the universities was banned. Students could have a voice--one elected representative--but no vote in the governing council. The most telling blow to the students, especially to the professionals who jealously maintained their status as students by enrolling in courses without ever passing or completing them, was the requirement that students had to pass at least one course per year to maintain status. Ongania's move against the universities was badly handled; violence broke out at the National University of Buenos

Aires, and the resulting harsh repression of student demonstrators gave rise to widespread criticism of the regime. About 15% of the Buenos Aires professors resigned, and many either emigrated, took other teaching posts, or left teaching entirely. Many Communist professors, reportedly under party orders, kept their jobs, thus frustrating the government's aim of purging the universities of party members.

Consejo Nacional de Ciencia y Tecnica (CNCT):

Since its creation in 1958, the supreme scientific body in Argentina had been the Consejo Nacional de Investigaciones Cientificas y Tecnicas (CNICT). Despite statements that it would concern itself with national science policy, it was evident that the aim of CNCT was to create a science council which would be directly under the military dictatorship and that the result would be to downgrade the CNICT.

The CNCT is attached directly to the Presidency of the Republic and its secretary has the rank of secretary of state. Its committee consists of the ministers and secretaries of state and the commanders in chief of the three branches of the Armed Forces. The council will coordinate its work with that of the national security council (thus tying it directly to the Armed Forces) and to the national development council (thus ensuring that it will encourage applied rather than pure science). Since it controls the national science budget, its power is effective.

Among the organizations which will come within its purview, in addition to the universities, are the: CNICT, Comision Nacional de Energia Atomica, Instituto Nacional de Tecnologia Agropecuaria, Instituto Nacional de Tecnologia Industrial, Instituto Nacional de Geologia y Minas, Instituto Nacional de Microbiologia, Instituto de Investigaciones Aeronauticas y Espaciales, Academia Nacional de Medicina, Academia Nacional de Ciencias, and Academia Nacional de Ciencias Exactas, Fisicas y Naturales.

New Physics Institute:

A National Institute of Physics Research for the Production of Energy has been established to work primarily on plasma physics research and controlled thermonuclear fusion. The new institute is not formally tied to the CNEA, but is to coordinate its plans with CNEA.

B. Decision-Making Practices

Below is a list of the major decision-making groups within the framework of the national science and technology community:

Comision Nacional de Energia Atomica (CNEA):

The organization and facilities of this commission have already been discussed in Part 2d. Founded in 1950 by an edict of President Peron, this agency has scored an impressive number of firsts. In 1958 the CNEA made Argentina the first Latin American nation to operate a research reactor; in 1968 it started Latin America's first and so far only chemical processing plant for reclaiming plutonium from spent reactor fuel; and in 1974 it built Latin America's first nuclear power plant.

It currently has a total staff of 2,200, 700 of which are researchers. Its chairman is chosen by the President, along with a five-man board with representatives of the Army, Navy, Air Force and civilian sectors. Its budget ($10 million in 1969, $18 million in 1972) comes from the federal government, sale of products (uranium to Israel, for example), contracts with private industry (Argentina's industry helped build the Atucha plant), and national and foreign grants.

Comision Nacional de Investigaciones (CNIE):

The Argentine nacional commission on space established in 1960 by Teofilo Tabanera. It is under the Ministry of Aeronautics and is thus subject to the control of the

Air Force, i.e. of the Armed Forces. This is anomalous, since the corresponding agencies in other countries are under the Presidency, as is NASA in the United States, or under the national research council, as in Brazil. In 1969 its budget was raised to $2.5 million annually.

The commission consists of about twenty members, representing different organizations. It is a planning and coordinating body rather than an operating agency, but it does carry on some research.

Consejo Nacional de Investigaciones Cientifias y Tecnicas (CNICT):

The Consejo Nacional de Investigaciones Cientificas y Tecnicas combines the functions of the U. S. National Academy of Sciences/National Research Council and of the National Science Foundation. It was created in 1958 by Bernardo A. Houssay, Argentina's most notable scientist, who was awarded the Nobel Prize in Medicine and who serves as the president of the council. There are nine committees for different branches of science, including social sciences, history, economics, philosophy, philology, and education, as well as the natural sciences and medicine to which the council devotes most of its attention. In addition there are six regional councils. The whole council is actively concerned with science information documentation and for that purpose has created the Centro de Documentacion Cientifica.

Academie Nacionale des Sciences and Academie Nacionale des Sciences Exactes, Physiques et Naturella:

Both advisory bodies to the Ministry of Education.

Corporacion de Empressas Nacionales:

This agency was founded in 1973 to control the activity of all state-owned companies and those where the State has a majority of shares. It administers bond issues and tax and treasury payments, centralizes the generation of external finance and controls private participation.

Secretaria del Consejo Nacional de Desarrollo (CONADE):

Founded in 1961, this State organization formulates national long-term development plans and integrates them into internal, external, economic, social and defense policies. It coordinates with Consejo Nacionale de Seguridad; evaluates regional development plans; checks existing organizations; and creates new organizations to carry out national plans. Reports are published for internal and public consumption.

Subsecretarie de Energia:

Concerned with energy and fuels, grain, meat and export boards.

The universities which the government operates are under the jurisdiction of the Minister of Education. This has been a tradition since 1949 when President Peron took measures to tighten governmental control over the often troublesome university community. At that time Peron required the universities to develop political ideology courses which would use textbooks designed to 'exalt the sentiment of the fatherland.' Dissenting teachers were dismissed by the government at first, but since then the government has been less concerned with using the authority it once claimed. The universities regained their autonomy until the crisis in 1966 which put General Ongania in power and brought stricter control by the government.

C. Leading Policy Makers

Below is a list of leading policy makers in the Argentine S&T effort. While these people would probably have the most influence in the development of any kind of nuclear program, power or weapons, they do not exert a powerful force upon the majority of the Argentine scientific community. Other leaders among the scientists themselves are noted in Section 2c.

Bosch, Carlos Federico. President of CNIE.

Cicardo, Vincente H. Director of CNICT research.

Gelbard, Jose. Minister of Treasury and Finance, formerly Juan Peron's chief advisor.

Housay, Bernardo A. President of CNICT.

Iraolagoitia, Pedro E. President of CNEA (appt. June 1973).

Mallman, Dr. Carlos: Director of Bariloche Foundation (computer think tank).

Peron, Sra Isabel Maria Estela Martinez. President of the Republic.

Sebato Jorge Alberto, Prof. (b. 1924): Director of G. Decker S.A., Buenos Aires 1952-1954; Head Metal. Div. CNEA, BA 1956; Participant Third Inter American Symposium on Peaceful Application of Nuclear Energy Rio de Janiero July, 1960.

Sivori, Enrique: President of CEFAR.

Taiano, Dr. Jorge Alberto: Minister of Culture and Education.

D. Political Climate for R&D

The political climate of Argentina is extremely difficult to understand. It is were simply a case of an autocratic regime, or an economy operating in a free marketplace, there would be no problem. It is not that simple, however. Instead, Argentina's political arena is the scene of intense and often violent contests for control of the reigns of power. The feuds are sparked by both issues and personalities. Labor groups, political activists, loyalists to one leader or another, military chieftains, and those jealous of local independence all vie for power in an atmosphere where kidnappings and assassinations are a way of life. At the same time, the society which surrounds this political circus seems at peace, friendly to visitors, confident, content, and reasonably successful at its efforts to develop its human and physical resources. As Arthur P. Whitaker has said, "Argentina is a maverick. It does not fit into any of the common categories of nations, such as 'underdeveloped' or 'developed'; and 'democratic' or 'authoritarian', and it does not even run true to any Latin American type."

Perhaps one way to explain the apparent ambivalence of Argentina's political culture is to suggest a source of unity for this society. Beneath all of the surface tension, there is in Argentina a sense of superiority, a feeling that this nation and its people are not only well endowed with potential for success, but also destined for leadership of South America. Since the overthrow of Spanish rule and subsequent defeat of British attempts at conquest in the early nineteenth century, Argentines have valued their independence and strength. Jose de San Martin's campaigns to liberate Chile and Peru in 1818 did much to encourage this feeling of strength as well as initiate a devotion among many later political leaders to a "continental mission" in which Argentina eventually would emerge as the "Colossus of the South."

During the nineteenth century and early twentieth century, there was a great deal of political upheaval. Efforts at centralization of federal power under the 1853 constitution were met with hostility from "the camp", the large outlying region of pastureland west of Buenos Aires. In the 1890's rebellion on the part of the urban middle class, led by socialists, was sparked by inflation, corruption and government indebtedness. A revolution in 1930 restored power to the landholding class which had suffered in the disturbances at the turn of the century, but they soon faced the discontent of the urban working class, which had grown large over the previous fifty years. Still, in spite of all this, the ideal of continental leadership remained strong, and none of the factions involved in these disputes opposed it.

A coup d'etat in 1943, led by army officers pushed Juan and Eva Peron into power as the undisputed dictators of the nation. Peron was able to harness the superiority sentiment amont Argentines, and he was an adept politician who could enlist great numbers in support of his personal leadership. His major aim was to organize an economic and social revolution that would convert Argentina into a powerful and self-sufficient modern state. His earliest actions reflected this purpose, but Peron met with economic difficulties which had much to do with his downfall and exile in 1955.

After his departure, the threat of civil war was constant, and eight times between 1955 and 1973 the government changed hands. After Hector J. Campora, a loyal Peronist, was elected President in March 1973, the government allowed Peron to come back and called the elections which returned him to power. Violence continued throughout late 1973 as animosity between elements of Peron's coalition grew more and more unhappy with each other's ideas about government. Peron turned against the left-wing faction of his movement and threatened to promote legislation banning their disruptive activities after a trade union leader was assassinated. Peron's death in July 1974 made matters worse, as the prosocialist faction went underground vowing to destroy the administration of Peron's widow and former vice-president. At one point, nuclear reactor guards were disarmed by these terrorists, but only weapons were taken without bloodshed.

It is hard to imagine, then, how technological development and scientific research, especially where none of it is sponsored by the government, can survive in such an atmosphere of political turmoil and university disruption. Yet, since the late 1800's, Argentina's education system has maintained high quality and since the 1950's, Argentina's scientists have been involved in advanced technological research and development. Little of the tumult seems to have impeded their steady progress. The reason, apparently, is that Argentines all seem to agree that leadership, through technological superiority is the direction they want to go in. Peron, in spite of his less popular economic policies, was able to appeal to that sentiment, and thus could lead a society which was virtually unleadable. Past experience would suggest that the political climate, being no more desperate now than it has been for the last century and a half, will continue to be non-interruptive to the country's technological development. Whether or not the government will be able to place more emphasis upon weapons development or social welfare is another question; for in that question the conflict over the route to continental leadership comes into play. Recently, a Peronist member of the Argentine

Congress proposed that Argentina develop an atomic bomb. Whether or not he is taken seriously within Sra. Peron's government is not known. Officially, the government favors nuclear development for peaceful purposes only, but it certainly is keeping its options open for weapons development.

Without pressure from the outside, Brazil, for example, it is unlikely that the government will give primary emphasis on development of a weapon and peaceful claims can be taken seriously. Argentines can see many roads to continental leadership and the promise of industrial growth which would inevitably result from the presence of nuclear power.

At the moment, it is not a desire for military superiority, nor fear of enemies which is the most influential factor in Argentine research and development. It is the constant turmoil, poor governmental support for Argentine scientists, and enticements of opportunities in other countries for young graduates. Those who stay are dedicated to their work and seem to continue in spite of the contests for political power.

4. Budget Figures

Expenditures on research and development reveal generally poor financial support for Argentine scientists. Total expenditures on R&D between 1968 and 1970, when the Atucha plant was just getting underway, was from 170,050 new pesos tononly 207,500 new pesos. The next year showed considerable improvement (see Table VI), but by then thousands of scientists had gone elsewhere and programs showed up instead of accelerating.

Table VI

Expenditures for Research and Development

Year	% of GNP	Per Capita	Annual Avg. Per R&D Scientists and Engineers
1970	0.3	8.9 New Pesos	31,900 NP
1971	2.6	26.1 New Pesos	51,000 NP

Table VII shows the breakdown of R&D expenditures for 1968.

Table VII

Expenditures on R&D (1968)

1. By Type of Activity

Total	Fundamental Research	Applied Research	Experimental Development
11,600,000 Old Peso	3,500,000 (30.2%)	5,650,000 (48.7%)	2,450,000 (21.1%)

2. By Sector of Performance

		Productive Sector			
	All	Integrated	Non-Integrated	Higher Ed.	General Services
Total	15,078,000	7,243,000	564,000	5,384,000	1,887,000
%	100	48	3.7	35.7	12.5
Current	11,346,000	5,221,000	435,000	4,204,000	1,486,000
%	100	46	3.8	37.1	13.1

The indifference of the Argentine government toward spending money on research and development projects is not reflected in trends in educational expenditures. Education expenditures have increased and maintained a stable portion of each budget, particularly higher education. (see Tables VIII and IX).

Table VIII

Expenditures on Education (New Pesos)

			Higher Education		
Year	Total Current Ed. Expenditures	% of Nat. Budget	Nat. Univ. % of Ed. Expend.	% of GNP	Exp. Per Pupil
1965	601,000,000	15.0	18.6	3.0	772
1967	1,028,000,000	15.0			
1970	1,827,000,000	14.0	21.0	1.9	1,455
1971	ca. 2,150,000,000	13.4	27.7	-	2,316

Table IX

University Budgets
(In millions of $)

Year	Buenos Aires	Cordoba	Cuyo	LaPlata	Litoral	Nordeste	Sur	Trevman	Tel.
1961	1,367	876	675	907	886	139	199	525	95
1965	6,448	2,872	2,178	3,080	2,867	589	801	2,010	761
1970	17,104	6,898	5,323	7,364	2,624	2,296	2,319	5,172	2,692

The national universities are becoming the main targets for increased funds from Argentine governments. Unfortunately, for Argentina's integrated technological development programs, this expenditure serves only to train scientists, not to put them to work in a productive capacity resulting in integrated research and development lacking government financial support.

5. Foreign Assistance in Science and Technology

A. Foreign Influence on Presence of Weapons Development

There is no evidence at present of any foreign assistance in the direct development of nuclear weapons.

B. Foreign Imports and Purchases of Technology

In the past Argentina has attempted to keep itself independent from the rest of the world. It has not allowed itself to accept more than limited economic and military aid from the United States, and its loans from the InterAmerican Development Bank and International Bank for Reconstruction and Development have been minimal. Nevertheless, in its quest for technological progress, it has imported some much needed machinery, vehicles, chemicals and raw materials (iron and steel) from the United States, Brazil and West Germany.

In terms of nuclear technology, these imports have been substantial, and the Argentine nuclear program is very dependent upon these imports. Since 1957, when Argentina became a member of the International Atomic Energy Agency, IAEA assistance has totaled over $1.5 million in the form of equipment, technical experts, and fellowships. When Argentine scientists (b)(1),Sec. 1.4(c),Sec. 1.4(d)

[redacted]

Cannot find info on line, no DOE or State review

The Atucha power plant built by Siemens of West Germany is the largest technological import so far. Constructed between 1968 and 1970 at a cost of $70 million, this reactor is now under the supervision of the CNEA. Future plans call for the purchase of at least one more power plant, a CANDU (Canadian Division Uranium) reactor, from Atomic Energy of Canada, Ltd., and Italimpianti at a cost of $250 million. The CNEA hopes that in the 1980's it will be able to purchase several reactors. This may be difficult if they plan to rely on Canadians, who are under heavy pressure since the Indian explosion to restrict sales of nuclear technology and to insist on safeguard agreements.

India and Argentina recently concluded a five-year agreement for cooperation in the peaceful uses of atomic energy which provides for the exchange of information reciprocity in training assignments and visits, and cooperation in the development of "specific projects of mutual interest". It provides for the sale or lease of material or equipment necessary to develop programs in the peaceful uses of atomic energy. No safeguards of any kind are included in the agreement. This may be an indication that Argentina will begin to look to India if Western nations fail to provide it with nuclear supplies.

C. Cooperative Programs and Agreements on Technology Exchange

Argentina's foreign policy has been influenced to a great extent by the sense of continental mission discussed in Section 3c. Therefore, any agreements or cooperative programs involving the country will reflect a desire for independence through technological and economic superiority. Such was the guiding notion when Argentina refused to sign the nuclear proliferation treaty of 1968 claiming that the treaty prohibited peaceful nuclear explosives in nations which did not have them already. However, recent comments cause one to wonder how interested Argentina is in getting help in nuclear weapons development. Hector A. Slebrizor, the minister-counselor of the Argentine embassy in Washington has said, "Our research has always dealt with nuclear power, nothing else. [To develop an explosive] you have to have a certain level of technology that we do not have. It is now impossible; though I can't tell you about the future."

In respect to this thrust toward economic and technological independence, Argentina's activities concerning nuclear development are clearly paradoxical. The CNEA sees its nuclear program as a means of maintaining autonomy in the world, and yet the more involved the country gets in nuclear technology, the more dependent it seems to become upon foreign research, foreign technology and foreign technical experts.

(b)(1),Sec. 1.4(c),Sec. 1.4(d)

[redacted]

No DOE review, cannot find in public domain.

(b)(1),Sec. 1.4(c),Sec. 1.4(d)

[redacted]

No US Army (Environmental Command) review, cannot locate info in public domain.

<u>Exhibit and Atoms for Peace Mission:</u> The first U. S. Atoms for Peace Mission to the American Republics visited Argentina in June 1956. The "Atoms at Work" exhibit was first shown in Latin America at Buenos Aires in 1960 and again at Cordoba in 1968.

Cooperation with West Germany:

In March 1969, Argentina and the Federal Republic of Germany concluded a five-year bilateral agreement for cooperation in scientific research and technical development. The agreement provides for cooperation in the fields of nuclear energy, oceanography, computer applications, meteorology, food preservation, and water supply. West Germany has also agreed to provide the Siemens AG-built 318 MWe heavy water moderated natural uranium reactor achieved criticality on January 13, 1974 (two years behind schedule). The USAEC provided the D_2O moderator for this reactor project. This, the first nuclear power plant in Latin America, is located at Atucha on the Parana River, about 100 kilometers northwest of Buenos Aires.

Cooperation with France:

France and Argentina signed a cooperative agreement on the peaceful uses of atomic energy in November, 1963. Recently U. S. Senator Ribicoff has charged that France is helping Argentina build a pilot plutonium plant which would give Argentina a potential for developing nuclear weapons.

Cooperation with Canada:

Canadian government spokeman Richard Gorham has said Canada has asked Argentina for assurances that nuclear reactor she will provide for power plant will not be used to produce an explosive device. He said Canada will cancel the deal if assurances are not given. He recalled India's explosion of nuclear device following similar arrangement with India on Canadian help, cites 1971 exchange between prime minister Pierre Elliott Trudeau and Prime Minister Indira Gandhi.

Cooperation with India:

Ten days after India concluded the testing of its first nuclear explosive on May 28, 1974, India and Argentina signed a five-year agreement for cooperation in the peaceful uses of atomic energy which provides for the exchange of information reciprocity in training assignments and visits, and cooperation in the development of "specific projects of mutual interest." India has suggested it might help Argentina develop its third nuclear power plant, which could give Argentina a substantial independent supply of plutonium for use in explosives.

Cooperation with Other Countries:

Argentina has a 20-year cooperative agreements with Euratom, signed in September 1962, and a 10-year agreement with Italy signed in February 1965. On July 20, 1966, the CNEA and the Spanish Atomic Energy Commission signed a bilateral agreement on the peaceful uses of atomic energy. Argentina also has concluded cooperative agreements with Bolivia, Brazil, Paraguay and Uruguay for exchange of nuclear information. However, Brazil and Argentina are seen more as competitots in the nuclear field than as partners.

Nuclear Safeguards in Argentina

In an effort to provide complete military denuclearization of Latin America, the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco) was drawn up in 1967. Requirements of this treaty resemble closely those of NPT in that each party is required to enter into negotiations and conclude a safeguards agreement with the IAEA. The Agency is to apply safeguards to each country's nuclear activities for the purposes of verifying compliance with Treaty obligations that nuclear material be used exclusively for peaceful purposes. The Treaty is administered by the Organization for the Prohibition of Nuclear Weapons in Latin America (OPANAL) headquartered in Mexico City. Lack of support by Argentina and Brazil has diluted the Treaty's effectiveness. Argentina signed the Treaty in 1967 but has all but ignored it from the outset. This lack of adherence is apparently a result of strong opposition to the Treaty by the military.

Involvement of Specific Organizations in Cooperative Agreements

CNEA

The CNEA has also worked with the United Nations Food and Agricultural Administration and the IAEA, whose publication it maintains at its library in Buenos Aires. The CNEA's metallurgy division has assisted in various cooperative projects with European and U. S. scientists. It held two Pan American Nuclear Metallurgy Courses (nine month duration) in 1962 and 1965, and has successfully sought grants

[redacted]

(b)(1),Sec. 1.4(c),Sec. 1.4(d)

Unable to find this info in public domain.

CNICT

The Consejo has received substantial help from U. S. foundations, especially from the Ford Foundation, which in 1964 made a grant of $550,000 for a three-year program to provide fellowships for advanced study abroad. Help has also come from the Rockefeller Foundation, [redacted] In addition the Consejo has been assisted by such European organizations as the Centre National de la Recherche Scientifique of Paris, the technical cooperation department of the French Ministry of Foreign Affairs, the Soviet Academy of Sciences, and the Deutsche Forschungsgemeinschaft of Germany. Under a UNESCO grant it has organized an information service for scientific translations into Spanish, the Centro Documentacion Cientifica.

(b)(1),Sec. 1.4
(c),Sec. 1.4(d)

Could not locate open source to confirm in public domain, no reviews.

CNIE

The national space commission has arranged agreements with the Science Services Administration at Boulder, Colorado, and the Smithsonian, which supply scientific literature and loan equipment, and with the Commission Nationale des Etudes Spaciales of France.

Additional International Aid and Involvement

Agreements and treaties which Argentina is involved in include the Investment Guarantee Agreement with the United States in 1961, Mutual Defense Agreement and Arbitration Treaty with the U. S., Pact of Conciliation and Non-agression with Brazil (1933), Agreements with Brazil on cultural exchange and economic and military defense, and a Treaty of Friendship and conciliation with Brazil.

A list of Ford Foundation grants is given in Table X.

Table X

Ford Foundation Grants

$ 650,000	to CNICT
550,000	for advanced education abroad and in Argentina
440,000	to Bariloche Foundation
25,500	to Argentine Chemical Association
250,000	for technical assistants to libraries
175,000	to Institute of International Education for Visiting Professors for Faculties of Exact and Natural Science, University of Buenos Aires
245,000	to Faculty of University of Buenos Aires for Science Library Experiment in Education T.V.
200,000	to CNEA for research
190,000	to University of Buenos Aires for Semi-conductors research
125,000	to Metallurgical Chamber of Argentine Manufacturing Industries for Research
$2,850,000	Total

6. Assessment

A. Overall Research and Development Capabilities

In terms of human and physical resources, Argentina has a great lead over other Latin American nations in scientific and technological research and development capabilities. The country's universities are capable of training sizable numbers of researchers and technicians in the natural sciences, engineering, and scientific technology. Other institutes and commissions provide facilities for productive research and development of new technology. Much of this research has concerned biochemistry and biomedicine, although there has been some significant work done in nuclear physics technology, particularly in respect to development of the nation's uranium reserves.

Argentina is now capable of producing nuclear power through the assistance of foreign firms in the building of large reactors, fuel fabrication plants, and provision of heavy water for reactor moderation. One reactor, the only large reactor in Latin America, is already producing at a capacity of 319 MWt(e). With the help of Canadian and Italian firms, a second power plant will be producing at a capacity of 600 MWt(e) in 1982.

The metallurgy and raw materials divisions of the CNEA have made great strides in uranium prospecting and extraction from abundant uranium reserves, which are estimated at 10,000 tons capable of being extracted at less than $10 per pound. Uranium production at the Ezeiza refinery has been running from 20 to 50 tons per year, and must be increased to 250-460 tons per year by 1977 and 800 tons per year by 1985 to support the needs of projected reactor building programs.

Argentina has resisted signing the Non-proliferation Treaty and moves by the Argentine Congress to authorize the development of peaceful nuclear explosives indicates the capability to develop a nuclear weapon. Whether this could be done without foreign assistance is another matter because Argentina has no heavy water plant (although one is planned), no large scale plutonium processing plant (although France may be helping with the construction of one), and no large reactor which Argentine scientists have built themselves. Foreign assistance has not been lacking and some of this aid could enhance the capability to produce an explosive device.

Financially, Argentina can support an ambitious research and development program, both in terms of university training and institutional research. While there have been complaints about the lack of support with public funds, modest support has continued. With a sizable middle class and a per capita income of $850 per year, Argentina cannot excuse a lack of technological development on the basis of poverty.

Argentine governments have proven their capability of negotiating deals with foreign firms and national governments. These agreements have included purchases of technology, exchange of personnel and information and acquisition of large grants of financial support for nuclear research and other fields.

B. Current and Projected Weaknesses

Weaknesses in Argentina's research and development effort are seen in the political climate, financial support, research facilities and training institutions and utilization of technological manpower. Continual political and social turmoil of the last twenty years has made overall progress slower than it should be. Administrative support has been haphazard and inadequate, funding has been erratic and facilities have been threatened as the government has changed hands numerous times. This has been distracting to scientists involved in the programs, and many have sought work in more stable environments. Financial support has been minimal and, for this reason, scientists and engineers have left for more profitable employment in other countries.

Many universities have no formal campuses, but house their activities in rented buildings in different cities. Scientific research institutions are similarly hindered, operating in older, remodelled buildings which are often not suitable for the work being done. While facilities are excellent by Latin American standards, they are not adequate to develop a degree of independence in nuclear power. This, together with financial problems, discourages young scientists and engineers from remaining in Argentina's S&T professional work force.

C. Present and Projected Areas of Emphasis

Nuclear development is not the highest priority in the area of scientific and technological development in Argentina. The national government enjoys the attention its nuclear program is acquiring, and it serves to enhance the prestige of Sra. Peron's shaky coalition at home, but the government will not put everything else aside to develop nuclear autonomy. Even,so, there is the question of the manpower to support such a program as Argentine scientists are more concerned with biochemical and biomedical research, or with finding better positions in other nations.

Numerous Argentine scientists have commented on the need for more work in agronomy and veterinary medicine, and these fields have received increased enrollments recently. There is increasing concern in the Argentine science community that research and development should meet the real needs of Argentine society, rather than some vision of an industrial society which exists only in Buenos Aires, while the rest of the country is far less developed.

Argentina's nuclear program will receive major support from foreign firms and governments to provide Argentina with a large supply of nuclear energy. Major efforts are in metallurgy (uranium extraction and refining) and heavy water production in keeping with the goal of autonomous nuclear facilities.

D. Indicators of Nuclear Weapons Development

John R. Redick, an expert in Latin American nuclear energy programs and nuclear proliferation stated: "The existence of civil nuclear programs does not necessarily imply the future development of nuclear weapons...The important point is that the unavoidable by product of the development of nuclear power production is a military potential. It is the promise of effective regional management (through the Treaty of Tlatelolco) as much as the nuclear weapons potential, that yields importance and significance to the Latin American situation."

There is little disagreement over whether or not Argentina has the capability to produce an atomic weapon. All the ingredients for development are either at hand or under construction. The country is well endowed with uranium oxide deposits, and three refining plants can produce refined natural uranium. A fuel fabrication plant currently under construction will have a planned output in 1978 of 300 tons per year, enough to provide reload fuel for Argentina's Atucha reactor and two additional natural uranium power reactors. The CNEA has announced plans to build a heavy water plant, even though Argentina is now buying heavy water from the United States. The reactors which Argentina is building and has built are natural uranium reactors which produce explosive grade plutonium. To reprocess the spent fuel and extract the plutonium, the CNEA is reassembling a pilot scale reprocessing plant at the Ezieza Nuclear Center which had been dismantled some years previously. It is based on the Purex process and is scheduled for operation in 1977.

Of course, ingredients, such as independent fuel supply, chemical reprocessing, natural uranium reactors, heavy water plants, do not necessarily signify intentions. It could be assumed that natural uranium reactors were chosen over cheaper enriched uranium reactors, which do not produce explosive grade plutonium on the basis of fuel considerations and to avoid becoming dependent upon the United States for fuel. Evidence such as Argentina's refusal to sign the NPT, the government's attempts to avoid agreements limited by safeguards when purchasing nuclear materials, and regional rivalry with Brazil does not indicate decisive effort to produce a nuclear weapon. The potential of natural uranium reactors for weapons may have played a part in the decision to choose the Seimens and CANDU models, but there are no indications of work on concentric shells, HE main charges, exploding bridge wires, or tritium hardware. It would take at least five years to develop weapon technology from the materials on hand, and the government may change its policy and actively foster such a program, but such a decision would not be likely to bring quick results.

The remainder of the document (73 pages) is not responsive to your request, and not provided.