

CHAPTER 8

TECHNICAL OPERATIONS AND RESEARCH



8. TECHNICAL OPERATIONS AND RESEARCH

8.1 OVERVIEW

A number of miscellaneous technical operations and research are undertaken by specialized agencies in the Kingdom. Those covered in this chapter embrace activities associated with the transfer and development of science and technology, the operation of meteorological and environmental protection services, mapping and the development of, and application of, product standards and specifications.

8.2 SCIENCE AND TECHNOLOGY

8.2.1 Overview

8.2.1.1 Saudi Arabia's general attitude toward science and technology is based upon a traditional respect for knowledge and appreciation of the human effort expended in its accumulation and development. The Kingdom has always appreciated the contribution that science and technology can make to social and economic development. Accordingly, the objectives of the national science and technology policy are two-fold. First, their concern is the transformation of society's material conditions through the selection, transfer and management of advanced technology while simultaneously preserving cultural values; and second, in the development of the Kingdom's natural and human resources their focus is on reducing the economy's dependence on foreign manpower and on depletable hydrocarbon resources.

8.2.1.2 It was recognized in the Second Plan that the successful implementation of this policy required the concerted efforts of a central organization. The Plan proposed to establish a council for science and technology. In 1397 the Saudi Arabian National Center for Science and Technology (SANCST) was established as an independent body administratively attached to the office of the Prime Minister.

8.2.1.3 Besides the formulation of a national science and technology policy SANCST also has the responsibility for promoting and coordinating scientific research in accordance with the Kingdom's social and economic development requirements, and evaluating the acquisition of foreign technology, while at the same time developing the scientific and technological potential

of the country. Initially one of the most important aspects of SANCST's work will be its contribution to the alleviation of the present shortage of Saudi manpower through the promotion of labor saving technology in the Kingdom's commercial and industrial enterprises. SANCST is organized into four directorates, each administering a separate area of the Center's responsibility: Science and Technology, Infrastructure, Scientific Research, Scientific and Technological Manpower, and National Research Institutes.

8.2.1.4 In discharging its responsibilities SANCST coordinates its activities with many government and private sector agencies including: the Universities, the Ministry of Agriculture and Water, the Civil Service Bureau, Petromin, and the electricity corporations.

8.2.2 Present Conditions

8.2.2.1 The activities of SANCST can be divided into two categories: those performed by the individual directorates and those performed under the auspices of international agreements.

8.2.2.2 Within the first group, concerned with scientific information, grants for applied research and the establishment of advisory working groups, work began on establishing a national science and technology information system. Two studies were completed in 1398 to determine the existing nature of the Kingdom's scientific information and resource base and a contract was awarded for the design and establishment of a national science data base.

8.2.2.3 A grants program commenced in 1398. From a total of 79 applications to date, 32 grants have been awarded for applied research programs. The average size of grant is half a million Saudi Riyals and the average length of project is two years.

8.2.2.4 After an initial survey to determine the interests of individuals, nineteen areas have been identified in which specialized working groups are to be funded.

8.2.2.5 In terms of internationally sponsored programs SANCST has four active projects:

- (1) Under a technical agreement with the United States of America five major areas for solar research and development have been identified. These are the availability of solar energy, thermal processes, storage and fuel production, generation of electricity and the evaluation of other related energy sources.
- (2) A program office has been established in Washington, D.C., which will, among other things, develop plans for identifying major research elements and the personnel and equipment to implement research programs.

- (3) SANCST has entered into a project agreement with the Canadian National Research Council for a national observatory project. The project will specify the software and configuration and detail of the optomechanical part of the 'seeing monitor' and will test critical components.
- (4) Two projects in the field of single cell protein manufacture and agriculture are to be implemented as a result of a technical agreement signed with the Republic of China.

8.2.3 Objectives and Policies

8.2.3.1 Objectives. There are two principal Third Plan objectives:

- (1) To transform the material conditions of society by the application and incorporation of science and technology;
- (2) To develop the Kingdom's natural and human resources thereby reducing the dependence on oil reserves and on foreign labor.

8.2.3.2 Policies. To achieve these objectives the following policies will be adopted:

- (1) Determine scientific and technological objectives consistent with the National Plan;
- (2) Organize and deploy the necessary infrastructure and equipment;
- (3) Identify and adopt technology to meet the requirements of the economy;
- (4) Monitor and evaluate research programs;
- (5) Monitor the development, transfer and application of science and technology.

8.2.4 Third Development Plan Programs

The programs of SANCST can be divided into two broad categories: those concerned with research and those concerned with supporting research:

8.2.4.1 Research Programs. A comprehensive survey of the distribution and character of the arid ecosystem will be undertaken to provide the basis for a detailed analysis of selected ecosystems and the development of holistic models to facilitate the analysis of implementing alternative land use patterns.

A study of the energy use pattern is planned which will recommend a policy of conservation and evaluate potential alternative energy sources.

Concerning the National Observatory, potential sites will be identified and assessed and recommendations will be made to the Council of Ministers regarding the magnitude of the program.

8.2.4.2 Supporting Research Programs. As part of the Kingdom's overall policy SANCST will appraise national needs in science and technology; identify priority areas; facilitate the adoption of appropriate technology; and encourage greater efficiency for manpower through the transfer of labor saving technology.

Attention will be given to increasing the availability of and access to scientific and technological information. As a result SANCST will establish a number of new data centers; provide for the standardization and maximum utilization of Saudi Arabian libraries; and participate in Arabic language related data processing, library information and research and development activities. Training will be given in scientific library techniques.

To provide specialized technical support to experimental research at universities and research institutes SANCST plans, in association with the Specifications and Standards Organization, to make well equipped modern research facilities available within the Kingdom; provide for instrument design, development, maintenance and calibration; conduct training services and make research facilities available to the private sector.

Important aspects of the SANCST support role will be the continuation of the grants program for applied research and the establishing of working groups to achieve and assist in development of national science and technology policy.

To create an environment which will enhance public interest and understanding of science and technology SANCST will develop a program to utilize mobile vans and publish newsletters and magazines for the dissemination of information; promote the translation to

Arabic of scientific materials; and publish books in Arabic on simple and advanced maintenance and related topics. In addition SANCST will encourage younger elements of society by promoting the formation of science clubs in educational establishments.

To ensure that adequate staff are available to meet SANCST's manpower requirements, without unnecessary encroachment on the staff of existing universities and other research establishments, scholarships will be offered to develop the scientific capabilities within the Kingdom.

A new headquarters building is planned to accommodate management and administrative staff.

8.3. METEOROLOGY AND ENVIRONMENTAL PROTECTION

8.3.1 Overview

8.3.1.1 The agency which takes primary responsibility in the Kingdom for development of meteorological and environmental protection services is the Meteorological Department of the Ministry of Defense and Aviation redesignated in 1399 as the Meteorological and Environmental Protection Administration (MEPA). MEPA collaborates with the World Meteorological Organization and International Civil Aviation Organization, and its affiliated regional units and sub-committees, to develop new functions and to upgrade and maintain standards useful in developing sound meteorological procedures and advisory services in the Kingdom and the Gulf Region. Cooperation with neighboring countries is active and Saudi Arabia is assisting Yemen through a foreign aid program to develop meteorological and environmental service programs.

8.3.1.2 The Ministry of Agriculture and Water (MOAW) collects climatological data at experimental farms within the cultivated areas, measures precipitation and stream flow at over 500 hydrographic monitoring stations, and provides agronomic support to MEPA where needed for collaborative work. MEPA develops selected agro-meteorological stations outside the cultivated areas. There is a permanent coordination committee to recommend on recording, processing, and publication of agro-meteorological data, determination of criteria for weather forecasts and warnings for the benefit of agriculturalists.

8.3.1.3 In the Hajj areas the Ministry of Health periodically requires information, from MEPA on the monitoring of human environmental hazards, particularly in the areas of water and air pollution. The Ministry of Health, however, has responsibility for implementing corrective measures and implementing or sharing enforcement activities with the appropriate enforcement agencies.

8.3.1.4 Meteorological and environmental services are thus a part of the various inputs to economic operations, socio-economic development and life saving efforts which are actually reported by other sectors.

8.3.1.5 Prior to the First Five Year Plan, limited services in meteorology and climatic observation were available. Two forecasting offices of the Meteorological Department of the Ministry of Defense and Aviation functioned mainly as aeronautical meteorological services. Agro-meteorological services data were gathered by the research department of the Ministry of Agriculture and Water at experimental farms in cultivated areas at scattered locations and by the water resources (hydrology) department. Fortunately, the need for technical and professional manpower and the lack of in-country institutional facilities to supply newly trained personnel and to develop and provide modern services to a number of sectors through a central meteorological service was recognized early. Between 1380 and 1395 more than 175 persons were trained abroad.

8.3.2 Present Conditions

8.3.2.1 Major accomplishments during the Second Plan period included improvements of facilities and the organization of programs for measurement and analysis of meteorological factors. The quality of information supplied to the military, civil aviation, and other agencies has been upgraded to match basic standards of the World Meteorological Organization (WMO) in areas where activities have been developed.

8.3.2.2 The number of surface observation stations was increased from 20 to 21. Improvements were made to six existing upper air sounding stations, and six additional stations were constructed to provide daily profiles of wind speed, direction and temperature. Three automatic observation stations in the Empty Quarter were constructed and equipment installed, and the stations are operating satisfactorily on isotopic power supplies in the harsh environment. A

satellite ground receiving station has been newly constructed at Dhahran for the purpose of receiving international weather satellite data covering the Gulf Region, and is fully operational. A staged upgrading of personnel, equipment and other weather service facilities at Tabuk and at Khamis Mushait has been completed, and local forecasting capabilities have been established at both stations. Riyadh and Medina weather service stations were improved to basic service levels.

8.3.2.3 Data have been accumulated and analyzed for a climate atlas for the Kingdom. Studies have been made of the feasibility of establishing a National Meteorological Center, which will facilitate services and stimulate international exchange programs and the conduct of research. Studies of the requirements for a marine meteorology program have been completed, and implementation of the program to provide services for the Navy and shipping will begin in 1400.

8.3.2.4 Four automatic weather stations at Mecca, Muna, Taif, and Al Kharj have been installed as a part of the weather observation network. These stations can be interrogated by the radio telemetry from the new Jeddah airport communications center and by land lines. MEPA is constructing 17 automatic surface weather observation stations to be interrogated by radio telemetry via satellite. Some of these stations will be equipped with marine meteorology sensors and others with air quality monitoring equipment. A storm detection radar installation at Taif has been completed which provides severe weather warning services to air operations and civil authorities. Two more units, at Jeddah and Medina, are in the process of completion.

8.3.2.5 The initial warning service is operational. A study of cloud seeding has been completed and has indicated positive results. A weather information dissemination system was established to give civil and domestic users accurate current weather information. Information is regularly furnished for pilot briefings, publications, and broadcasts by local sources, in weather reports, and in weather forecasts. More than 230 staff members have received formal training in maintenance and operation of meteorological equipment. Another 25 administrative and financial service personnel have received training in skills to support the meteorological and environmental protection operations. More than 100 personnel received formal training in technical areas of the Directorate's operations.

8.3.2.6 The accomplishments made during the Second Plan period were of major significance in providing the basic infrastructure for organizing meteorological and climatological services.

8.3.3 Objectives and Policies.

8.3.3.1 Objectives. The working objectives for the Third Plan period are, in brief:

- (1) To upgrade the ability to provide accurate, timely weather information and forecasts to meet the increasing requirements of military and civil aviation and marine navigation and safety, ground transport, agriculture, fisheries, and domestic users;
- (2) To upgrade the climate observation and information resources and to complement efforts to develop agricultural production and expansion, water resources, and resource reclamation efforts that are strongly affected by climatic factors;
- (3) To provide and develop a comprehensive environmental service by determining and promulgating standards for ambient air and water quality; to establish a comprehensive monitoring and surveillance of the air, water and solid waste disposal practices of the Kingdom; and to implement a broad public education program on the environment;
- (4) To maximize developmental training opportunities and to upgrade and diversify the experience and skills of Saudi personnel.

8.3.3.2 Policies. To achieve these objectives, the following policies will be implemented:

- (1) Acquire a comprehensive data base about the environment;
- (2) Provide an effective information dissemination system;
- (3) Develop skills required for performance of programmed duties and functions;
- (4) Cooperate with regional and international environmental programs;
- (5) Maintain national environmental standards and conduct research on important environmental problems.

8.3.4 Third Development Plan Programs

Four principle programs will be undertaken during the Plan period. These are:

8.3.4.1 Expansion and Improvement of Meteorological and Climatological Services. This program includes facilities and observation stations and the development of a climate station. A marine meteorological observation network will be established. In addition to a program of meteorological research and expansion of the meteorological observation and communication facilities, a network of air pollution monitoring stations, 214 climatic stations, 26 automatic stations (nine in remote areas) and 12 upper air stations will be established. The network of surface observation stations will also be increased from 21 to 26. Vital forecasting stations will be established in Jeddah, Riyadh, Tabuk and Dhahran with other forecasting stations planned for Medina, Taif and Abha. Construction and operation of manned stations in Moya and Dawadimi will also be undertaken. A project will be undertaken to update and mechanize meteorological and environmental forecasting.

8.3.4.2 Establishment and Development of Environmental Protection Support Services. Initial projects will include the development of standards for air, water and marine ecology, and standards for solid waste disposal practices. An environmental modeling group to simulate air pollution problems is to be established. An oil spill emergency response plan is to be developed. Studies of the ozone-hydrocarbon relationships, environmental effects of the pilgrimage periods, agro-meteorological data uses, and basic meteorological research will be carried out as a basis for future policy actions. Four special purpose environmental stations are to be established, together with satellite receiving and processing facilities in Jeddah and an air pollution station in Jubail. Cloud studies will be continued throughout the Plan period. A program for supporting the Bedouin environment in land utilization will be introduced.

8.3.4.3 Operation and Maintenance Program. High priority will be given to the operation and maintenance of technical equipment throughout the Plan.

8.3.4.4 Training Program. Training programs will be established to provide training for new observers, forecasters and environmental protection technicians, and additional ongoing training for existing staff forecasters and observers. Training will be provided for up to about 545 meteorological and environmental personnel during the Plan.

8.3.4.5 Cooperation with those other departments responsible for climatological, and hydrological data collection, recording and publishing will be continued and strengthened.

8.4 AERIAL SURVEY AND MAPPING

8.4.1 Overview

The Aerial Survey and Mapping Department (ASMD) is an autonomous department within the Ministry of Petroleum and Minerals which provides comprehensive mapping services for the Kingdom's public and private sectors. The work of the department is continuous with constant updating required.

8.4.2 Present Conditions

8.4.2.1 Most of the targets set for the Second Development Plan were completed. A total of 6000 kilometers of the national geodetic network was covered and a land connection system in the Rub' al Khali was completed. Survey networks were set up for 30 towns and villages and 2260 traverse stations maintained. The initial work for the topographic mapping of about 70% of the Kingdom's areas was completed, and preparation of hydrographic maps of the Kingdom's west coast was completed. In addition final studies of the requirements for the information system were presented; the construction and equipment of the new computer and data bank center was completed in 1400.

8.4.3 Objectives and Policies

8.4.3.1 Objectives. Two primary objectives apply:

- (1) To provide comprehensive mapping services for the Kingdom in response to the requirements of national development plans;
- (2) To increase the efficiency and capability of the department's work force.

8.4.3.2 Policies. To achieve these objectives the following policies will be implemented:

- (1) Expand and maintain the national geodetic network;

- (2) Continue photography work as required by the mapping programs;
- (3) Continue the preparation of topographic maps for national resource surveys, industry, agriculture, and infrastructure sectors;
- (4) Commence the modification of topographic maps to large scales e.g. 1: 24,000 scale;
- (5) Prepare and provide detailed thematic maps;
- (6) Maintain and operate the central information bank and computer center to provide centralized survey map and photography information and avoid duplication in survey and mapping work;
- (7) Expand and improve the manpower training program.

8.4.4 Third Development Plan Programs

Work will concentrate on the extension and maintenance of the geodetic network, aerial photography and subsequent preparation of map series for regions of the Kingdom. Map production will be based on preparatory work undertaken during the Second Development Plan as well as new planned survey and photography work. The dissemination of survey and mapping information will be improved with the operation of the new computer and information bank. The recruitment and expertise of Saudi staff will be increased with the construction and operation of a training center in Riyadh. The following five programs will be implemented.

8.4.4.1 Topographical Mapping. This is the largest program and will be continuous and include basic topographic map production, coastal surveys and mapping, thematic geographic map production and related aerial photography.

8.4.4.2 Geodetic Network. Under this program an adequate, first, second and third degree geodetic points network will be established and 1400 traverse and paving stations maintained.

8.4.4.3 Central Information Department. Using the new computer facilities all types of survey information will be classified and stored with provision for easy access for government and private sector users. The capability to undertake geodetic computer calculations will also be developed.

8.4.4.4 Equipment and Furnishing. This program includes continuous expenditure to provide mapping equipment for ortho - photography and printing and field survey equipment.

8.4.4.5 Training. The construction and operation of a technical training center will be undertaken in Riyadh. When fully operational up to 40 employees at any one time will be able to receive training.

8.5 STANDARDS AND SPECIFICATIONS

8.5.1 Overview

8.5.1.1 The Specifications and Standards Organization (SASO) was created by Royal Decree number M/10 dated 3/3/1392. Its general function is to develop and promulgate standards; approve standards of other organizations; apply rules of quality marks and certificates of conformity; and participate in Arab and other international organizations relating to specifications and standards for products. The decree stipulates that Saudi standards are obligatory through the Kingdom unless an exception is agreed to by the SASO Board of Directors. SASO is part of the Ministry of Commerce.

8.5.1.2 SASO has two areas in which it operates to fulfill the responsibilities outlined in the Charter:

- (1) Research to develop specifications for products as required;
- (2) Metrology, which entails the calibration of equipment in the Kingdom.

8.5.2 Present Conditions

8.5.2.1 During the Second Plan SASO concentrated largely on the development and promulgation of standards. The concentration of effort has been in the areas deemed to be important to the nation's development, namely: foods, construction materials, and mechanical and electrical products.

8.5.2.2 The Second Development Plan target of 300 standard specifications was attained. The categorization of standards either approved or in process of approval is as follows:

	<u>Percent</u>
Food	25
Building and other Construction	19
Electrical	17
Mechanical	15
Petrochemical	10
Textiles	4
Metrology	10
Total	<u>100</u>

Another Second Plan target was to develop a system of quality marks for implementation during the Third Plan period. The lack of a laboratory has delayed the development of the specifications requisite to implementation of this program. SASO is overcoming this problem to some extent by working with the Ministry of Industry and Electricity to require industrial licensees to cooperate with SASO to ensure that appropriate quality control measures are adopted.

8.5.2.3 There are several organizations in the Kingdom engaged in the testing of products. This is an area where coordination is needed in order to avoid possible duplication of effort and/or to achieve specialization and the greatest return from the research effort expended.

8.5.3 Objectives and Policies

8.5.3.1 Objectives. During the coming period the policy will be to encourage standardization in the productive fields of industry, agriculture, and construction, in addition to commerce. General objectives are:

- (1) To establish standard operating procedures relating to specifications, methods of testing and calibration;
- (2) To unify terms, symbols, and units of measure;
- (3) To establish rules for quality control, and the issue of conformity certificates and quality marks;

- (4) To coordinate standardization practices in the Kingdom;
- (5) To propagate information concerning standardization;
- (6) To participate in international efforts directed towards achievement of standardization;
- (7) To increase training activities.

8.5.3.2 Policies. The foregoing will be accomplished by the following policy actions:

- (1) Stipulate that industrial licensees must consult with SASO relative to measures of quality control to ensure that acceptable product standards are maintained;
- (2) Take measures to enforce quality standards for imports. Inspection of goods will be made in the country of origin in those cases where this is appropriate;
- (3) Make special efforts to broaden the use of conformity certificates and quality marks;
- (4) Establish a calibration laboratory;
- (5) Establish a laboratory to determine qualities of various types of goods. The steps in this are as follows:
 - prepare standard specifications which relate to the needs of the Kingdom;
 - develop methods of examination of products;
 - study and research ways to overcome the obstacles to improve quality; ways to increase the use of local raw materials; and methods to improve quality control;
- (6) Disseminate information concerning specifications;

(7) Develop assistance programs from international organizations;

(8) Improve the organization.

8.5.4 Third Development Plan Programs

8.5.4.1 Standards Specification Program. Preparation of standard specifications for 400 products and the issuance of 300 specifications are targeted. The products will be selected according to the following criteria:

- (1) Products manufactured within the Kingdom;
- (2) Products relating to industrial safety and protection of the environment from industrial pollution;
- (3) Products relating to consumer protection;
- (4) Products which are widely used;
- (5) Products which are exported.

The schedule for the preparation of specifications will be revised each year to reflect the dynamic conditions that exist in the Kingdom. The currently expected categorization of products for which specifications will be issued are;

	<u>Number</u>
Foodstuffs	65
Building materials	55
Industrial safety and consumer protection	10
Mechanical products (method of testing)	40
Electrical applications and symbols	40
Chemical and petroleum products	30
Textiles	30
Metrology	30
Total	<u>300</u>

8.5.4.2 Certificates of Conformity and Quality Marks. The initial emphasis will be on conformity certificates with a limited number being awarded for products which are easy to

inspect. Quality marks are given to indicate that the products of a factory are always in accordance with the appropriate standard specifications.

8.5.4.3 Metrology Laboratory. Construction of a metrology laboratory and administration offices at Riyadh will begin and will be ready for operation at the beginning of the Fourth Plan period. The comprehensive program in the areas of testing, research, development and metrology will begin in leased facilities early in the Plan period.

8.5.4.4 Other Programs. Participation in international activities will continue, and all suitable means will be used to disseminate information concerning standards. Good quality trophies will be issued to companies meeting certain standards.

8.5.4.5 Training Program. A total of 279 workers is expected to be graduated during the five year period in the following types of programs:

Scholarships	12
Orientation	6
On-the-job training	<u>261</u>
Total	<u>279</u>

8.5.4.6 Organization. Early in the Plan period the Government will assess and clarify responsibilities of the several organizations having responsibility for product testing, and more effective coordination will be initiated between the various laboratories to eliminate apparent duplications. In addition, the separate enforcement powers in this area will be clearly defined.

8.6 FINANCIAL REQUIREMENTS

Third Development Plan expenditures for the activities outlined in this Chapter ⁽¹⁾ are as follows:

(SR millions in current prices,)

<u>Recurrent</u>	<u>Projects</u>	<u>Total</u>
1,097.6	2,079.5	3,177.1

(1) Aerial Survey and Mapping Department expenditure is included in the Economic Resources total (Chapter 4).