

No. 17316

**UNITED STATES OF AMERICA
and
SAUDI ARABIA**

**Agreement for technical co-operation in desalination (with
appendices). Signed at Washington on 3 May 1977**

Authentic text: English.

Registered by the United States of America on 24 November 1978.

**ÉTATS-UNIS D'AMÉRIQUE
et
ARABIE SAOUDITE**

**Accord de coopération technique pour le dessalement de l'eau
(avec appendices). Signé à Washington le 3 mai 1977**

Texte authentique : anglais.

Enregistré par les États-Unis d'Amérique le 24 novembre 1978.

AGREEMENT¹ AMONG THE SALINE WATER CONVERSION CORPORATION AND THE MINISTRY OF FINANCE AND NATIONAL ECONOMY, GOVERNMENT OF SAUDI ARABIA, AND THE DEPARTMENT OF THE INTERIOR AND THE DEPARTMENT OF THE TREASURY, UNITED STATES OF AMERICA, FOR TECHNICAL COOPERATION IN DESALINATION

Article I. SCOPE

This agreement between the Saline Water Conversion Corporation and the Ministry of Finance and National Economy of the Government of Saudi Arabia (hereinafter referred to as SWCC and MFNE respectively), and the Department of the Interior and the Department of the Treasury of the United States (hereinafter referred to as USDI and USDT respectively) defines two technical cooperation projects: 1) the establishment of a Desalination Research, Development, and Training Center in the Kingdom of Saudi Arabia, and 2) a Technology Development Program for optimum-size multi-stage flash (MSF) distillation single-unit plants. USDI will assign four desalination specialists and one clerical assistant to work jointly with a SWCC assigned team (hereinafter referred to as the USDI-SWCC Joint Team) to provide, under the oversight administration of H.R.H., the Governor of SWCC, project direction and technical and administrative services. Three of the desalination specialists and a clerical assistant will be stationed in Jeddah for the duration of the project. The fourth specialist will be stationed in Washington, D.C. to provide technical support and coordination of activities in the U.S. Substantive scientific, engineering and consulting activities hereinafter outlined in this agreement, and those that subsequently may be added by mutual agreement of the two Governments will be carried out by U.S. firms under contract to SWCC whenever it is possible.

Article II. AUTHORIZATION

This agreement will be carried out under the auspices of the United States-Saudi Arabian Joint Commission on Economic Cooperation and in accordance with the provisions of the Technical Cooperation Agreement between the Governments of the United States and Saudi Arabia signed on February 13, 1975,² which is hereby incorporated by reference and becomes a part of this agreement.

Article III. PURPOSES AND OBJECTIVES

The economic conditions in the Kingdom of Saudi Arabia are creating rapidly expanding water requirements. Because of the limited availability of natural fresh water, a large percentage of the future water supplies of the Kingdom must be provided by desalting the waters of the Red Sea or the Arabian Gulf. Because of the size and scope of this water supply program, Saudi Arabia desires to conduct an extensive research and development program to advance desalination technology in Saudi Arabia in order to provide plants of lower capital investment, reduced operating

¹ Came into force on 30 August 1977, after signature by the Parties and deposit of the sum described in article XI, in accordance with article XII.

² United Nations, *Treaty Series*, vol. 998, p. 209.

costs, and increased reliability. The desalting plant construction program envisaged by SWCC also will require a large training program to provide skilled manpower for plant operation and maintenance.

The purpose of this agreement is to assist and cooperate with SWCC in the achievement of these objectives:

1. To establish a Research, Development, and Training Center in the Kingdom of Saudi Arabia (Project A), and
2. To initiate programs to develop the technology for single-unit MSF distillation plants with capacities of up to 250,000 M³ (66 million gallons) of fresh water per day (Project B).

Article IV. SERVICES TO BE PROVIDED

1. SWCC will contract with U.S. firms to provide technical, research, engineering, and consulting services to SWCC as described in Appendices A and B. These two appendices, "A Desalination Research, Development, and Training Center," and "A Technology Development Program for up to 250,000 M³/day MSF Distillation single-unit plants," are incorporated as a part of this agreement.

2. In performing the different phases of development described in Appendices A and B, SWCC has the right to make use of any of the studies and results which were previously obtained from the work carried out in the field of desalination by the USDI and made available to the public by USDI and any information available to the public.

3. Personnel will be assigned to this project by the USDI after review and approval by the SWCC.

Article V. CONFIDENTIALITY OF THE INFORMATION

USDI will keep confidential any information or data provided to them by SWCC or generated as a result of the activities of USDI pursuant to this agreement.

Article VI. PATENTS

1. All inventions and proprietary information which arise out of any work performed under this agreement shall remain the property of SWCC; when such inventions are patented and filed, all shall remain the property of SWCC.

2. The United States of America shall receive a royalty-free, non-exclusive, irrevocable license in any invention made pursuant to paragraph 1 of this Article VI, to practice and have practiced on its behalf the invention, and with the right to sublicense the invention in the United States.

Article VII. REPORTS AND COORDINATION

The assigned SWCC-USDI Joint Team will prepare and transmit to H.R.H., the Governor of SWCC, USDI and the Joint Commission Office in Riyadh (JECOR) quarterly reports covering the overall status and progress of the projects as well as areas of concern and recommendations.

Overall coordination of these two technical cooperation projects with other Saudi Arabian-United States Joint Commission on Economic Cooperation activities within

the United States Government and provisions of certain administrative facilities and support for these projects will be the responsibility of USDT. JECOR will serve as the point of contact for all procedural and policy-related communications among SWCC, MFNE, USDI and USDT concerning these projects, will facilitate activities under this agreement, and will monitor the implementation of the agreement in Saudi Arabia.

Article VIII. LOCAL SUPPORT

SWCC shall support the technical cooperation projects by:

1. Designating a senior technical SWCC official responsible for implementing the terms of this agreement;
2. Identifying and providing appropriate SWCC personnel to work with USDI personnel in forming the SWCC-USDI Joint Team;
3. Providing all available data and other information which may be needed by the SWCC-USDI Joint Team to fulfill its obligation under this agreement;
4. Providing all such facilities and support as agreed in Section 7 of the Technical Cooperation Agreement signed on February 13, 1975.

Article IX. FORCE MAJEURE

If any party to this agreement is rendered unable because of force majeure to perform its responsibilities under this agreement, these responsibilities shall be suspended during the period of continuance of such inability. The term, "force majeure" means acts of God, acts of the public enemy, war, civil disturbances, and other similar events not caused by nor within the control of the parties. During the period of suspension of performance caused by force majeure, USDI may continue to pay normal costs of maintaining USDI Joint Team personnel in Saudi Arabia from funds advanced to the United States by the SWCC. In the event of suspension of a party's duties because of force majeure, the parties shall consult and endeavor jointly to resolve any attendant difficulties.

Article X. ESTIMATED COSTS

The total cost of services provided by the USDI in Phase 1 of both Projects A and B as outlined in Appendices A and B is estimated to be \$1,244,920.

Other costs to be incurred by the SWCC during Phase 1 of both projects by way of direct contracts for private industry consulting services, technical assistance, and conceptual design services are estimated to be \$960,000.

Order of magnitude estimates of costs for succeeding phases of both projects are provided in Appendices A and B. These estimates will be refined in subsequent budget submissions that will accompany Joint Team proposals and recommendations to augment this agreement to fully accomplish the objectives of the agreement. The present order of magnitude budget estimates for Project A is \$30M and for Project B is \$49M, or a total of \$79M.

Article XI. METHOD OF PAYMENT

The Government of Saudi Arabia agrees to deposit in the dollar trust account in the United States Treasury, established by the Technical Cooperation Agreement, the

sum of \$2,204,920 to cover the estimated total costs for Phase 1 of Projects A and B referred to in Article X above and defined in Appendices A and B. Advances for succeeding phases shall be made prior to the end of each phase.

Article XII. EFFECTIVE DATE

This agreement shall become effective after signature by the representatives of the parties and after the deposit by the SWCC of the initial sum described in Article XI above, and shall remain in effect until terminated in accordance with Article XIII below, or the termination of the Technical Cooperation Agreement of February 13, 1975, whichever shall occur first.

Article XIII. AMENDMENT, EXTENSION OR TERMINATION

A. This agreement may be amended or extended by mutual agreement in writing.

B. This agreement may be terminated by any party notifying the others 60 days in advance in writing.

Article XIV. RESOLUTION OF DIFFICULTIES

SWCC, MFNE, USDI and USDT shall consult, upon request of any party, regarding any matter relating to the terms of this agreement and shall endeavor jointly in a spirit of cooperation and mutual trust to resolve any difficulties or misunderstanding that may arise.

Dated this 3rd day of May 1977.

For the Government
of the Kingdom of Saudi Arabia:

[Signed]

MUHAMMAD AL-ALI ABALKHAIL

For the Department of the Treasury:

[Signed]

W. MICHAEL BLUMENTHAL

For the Department of the Interior:

[Signed]

JAMES A. JOSEPH

APPENDIX A

A DESALINATION RESEARCH, DEVELOPMENT AND TRAINING CENTER
IN THE KINGDOM OF SAUDI ARABIA (PROJECT A)

I. INTRODUCTION

The SWCC has the responsibility for providing potable water to all parts of the Kingdom of Saudi Arabia* in the support of agriculture, industry, and national aspirations. Economic conditions in the Kingdom are creating rapidly expanding water needs requiring continued progress in the development of scientific skills to support the SWCC in this responsibility. The Desalination Research, Development, and Training Center** will focus on the development of

* May be hereinafter referred to as "the Kingdom".

** May be hereinafter referred to as "the Center".

these skills through research and training programs. As the skills develop, desalting development will be advanced through improvements to existing technology, solving of operational problems in existing desalting plants, and the development of improved desalting process technology.

II. DESALINATION RESEARCH, DEVELOPMENT, AND TRAINING CENTER OBJECTIVES

A. To provide scientific, technical, and developmental services in all matters directly or indirectly related to water desalination for the Kingdom by using known techniques or by developing new techniques, primarily for the purposes of improving the economics of water production through higher performance levels, power conservation, improving industrial materials, simplifying and developing less expensive operating and maintenance techniques in existing and future desalting plants in the Kingdom, prolonging the lives of machinery, and selecting the best techniques to be used in all areas based on the indicated requirements.

B. To train Saudis of different qualifications and levels to be capable of carrying out desalting projects for the Kingdom, including design, construction, operation and maintenance of desalting facilities.

III. SCOPE OF WORK

The work of establishing the Center consists of four major phases of action described in general terms as follows:

A. *Work Scheduled for Immediate Implementation*

Phase 1. The gathering of data, preparation of study reports, preparation of recommended programs, and preparation of conceptual designs for the Desalination Center to be located in the Kingdom of Saudi Arabia.

B. *Work Scheduled for Succeeding Phases*

Phase 2. Coordination of study reports and conceptual designs with appropriate authorities, consultants, and other technical experts for confirmation of criteria and concepts. Preparation of the final design for construction of the Center. Preparation and issuance of the bidding documents, solicitation of bids, and award of the construction contracts. Preparation and solicitation of proposals, and award of a contract for construction supervision.

Phase 3. Construction of the Center and preparation for operation, including the selection of an operating staff or contractor from the private sector.

Phase 4. Maintain staff expertise to implement and evaluate the progress of research, development and training programs.

IV. TECHNICAL PROPOSAL FOR IMPLEMENTATION

The proposal presented herewith details the work to be performed under Phase 1 of the Scope of Work. It is presumed that Phases 2 and 3 will be carried out but may be altered depending upon the results of Phase 1. While the detailed implementation steps for the succeeding phases cannot be prepared at present, order of magnitude-type costs estimated and time schedules are hereinafter indicated for these phases.

Phase 1. Scope of Work for Immediate Implementation (18 months)

A. The USDI/SWCC Joint Team will prepare appropriate proposal documents for issuance to qualified firms having an interest in assisting the SWCC as its prime technical support contractor in carrying out the implementation steps of Phase 1 of the Desalination Center Project. The technical support contractor will provide the technical, drafting and clerical support required to expedite production of the documentation required for this phase.

B. The SWCC will issue the Requests for Proposals and receive the responses.

C. Upon receipt of the responses, the USDI/SWCC Joint Team may find it necessary to engage, by consulting service contracts, additional expertise to assist in the evaluation of the proposals and selection of the technical support contractor.

D. The SWCC and USDI may expand the Joint Team to include representatives of the technical support contractor. The Joint Team will study the desalination programs of the Kingdom and prepare a tentative plan of action to be carried out which will establish the requirements for facilities to be contained within the Desalination Center. It is envisioned that the plan required to establish the requirements will include, but is not necessarily limited to, items E through I below.

E. Visit appropriate Saudi Arabian government officials, selected university professors, scientific agencies, and water research centers in the Kingdom, in other Arab countries, the United States, or elsewhere. Discuss with those professors, officials, or groups the objectives of this project and request their recommendations for programs, facilities, curricula, or special considerations which should be incorporated in the Desalination Center. During these visits determine:

1. The objectives and policies of scientific research programs and projects, the areas of application, future plans and programs, the scientific, regional, and international agencies with which they operate in projects and in exchanging scientific data.
2. The potential for, and the possibility of, enhancing the Desalination Center mission by cooperating with them through the utilization of existing facilities or existing capability.
3. The opportunity for acquiring qualified and appropriate expertise to support the work of the Center or to assist in planning and carrying out its mission.

F. Visit selected desalination plants in the Kingdom, in other Arab countries, and, if necessary, in other countries, to discuss operating and process problems and to receive from responsible officials in those plants, the problems and potential problems they face, their methods for resolution of problems, and their recommendations for programs, research, development, and training which should be incorporated into the Desalination Center. During the visits to plants in the Kingdom, survey the work force for their input as to areas and extent of training required prior to being employed in an operating desalting plant and for continuing education and training after employment.

G. Visit selected desalting plant design laboratories and research centers of international companies with which the SWCC conducts, or may conduct, business, and receive from appropriate officials within those companies their recommendations for research, development, and training programs which should be incorporated into the Center.

H. Conduct such other interviews, visits, studies, analyses, and activities as may be mutually agreed to by the Joint Team.

I. After all work under items E through H has been completed, the technical support contractor will:

- a. Assemble and evaluate all information and data collected in carrying out items E through H and prepare a comprehensive report for the Desalination Research, Development, and Training Center which will recommend the full range of activities to be conducted by or in the Center to fulfill the hereinbefore stated objectives. Each activity will be the subject of a study which will set forth the justification for the activity, the space requirements, the equipment and facilities required, the curricula, the staffing requirements, and the technical support facilities such as libraries and analytical laboratories, training aids, furniture, and personal accommodations.
- b. Prepare, if necessary, a comprehensive evaluation of proposed sites for the Desalination Center and a justification for the site recommended.
- c. Prepare a conceptual design for the Desalination Center which will accommodate the requirements set forth in the separately conceptualized activity studies mentioned above.

The conceptual design will consist of single-line drawings of plot plans, building elevations, floor plans, and such other drawings as may be required to display the concept including, but not necessarily limited to, an artist's rendering of the total facility as conceptualized. The drawings will be accompanied by brief general specifications and a budget estimate for final design, construction, furnishing, staffing and annual operating cost.

- d. Prepare the detailed implementation steps for Phases 2 and 3, time schedules, and preliminary cost estimates for performing those phases of the work.

J. The Joint Team will monitor all work and review all submittals by the Technical Support Contractor. The Joint Team will submit final recommendations for implementation of Phases 2 and 3 to H.R.H., the Governor of SWCC. Figure A shows a bar graph representation of the project schedule through Phase 3.

V. COST ESTIMATE

Phase 1. Preliminary Estimate for the Work Being Immediately Implemented (18 months)

USDI Team for joint project management (total cost)	\$ 622,460.
Consulting Service Contracts	\$ 120,000.
Technical Support Contract	\$ 400,000.
Total Phase 1	\$1,142,460.

COST PROPOSAL NOTES. 1. The estimate for the work under Phase 1 is considered to be preliminary and is subject to change at any time during the course of the work.

2. The estimates are based on an USDI full time staffing level of 1½ technical positions with clerical support as required in Jeddah, Saudi Arabia, and ½ manyear technical support and coordination in Washington, D.C.

The following order of magnitude-type estimates are for the work covered under succeeding phases of the project:

Phase 2. Preparation of Study Reports and Final Design (15 months)

USDI Team for joint project management (total cost)	\$ 319,000.
Consulting Service Contracts	\$ 250,000.
Final Design Contract	\$ 2,000,000.
Construction Contract	\$ 15,000,000.
Technical Support Contract	\$ 1,000,000.
Total Phase 2	\$18,569,000.

Phase 3. Construction of Research and Development Center (27 months)

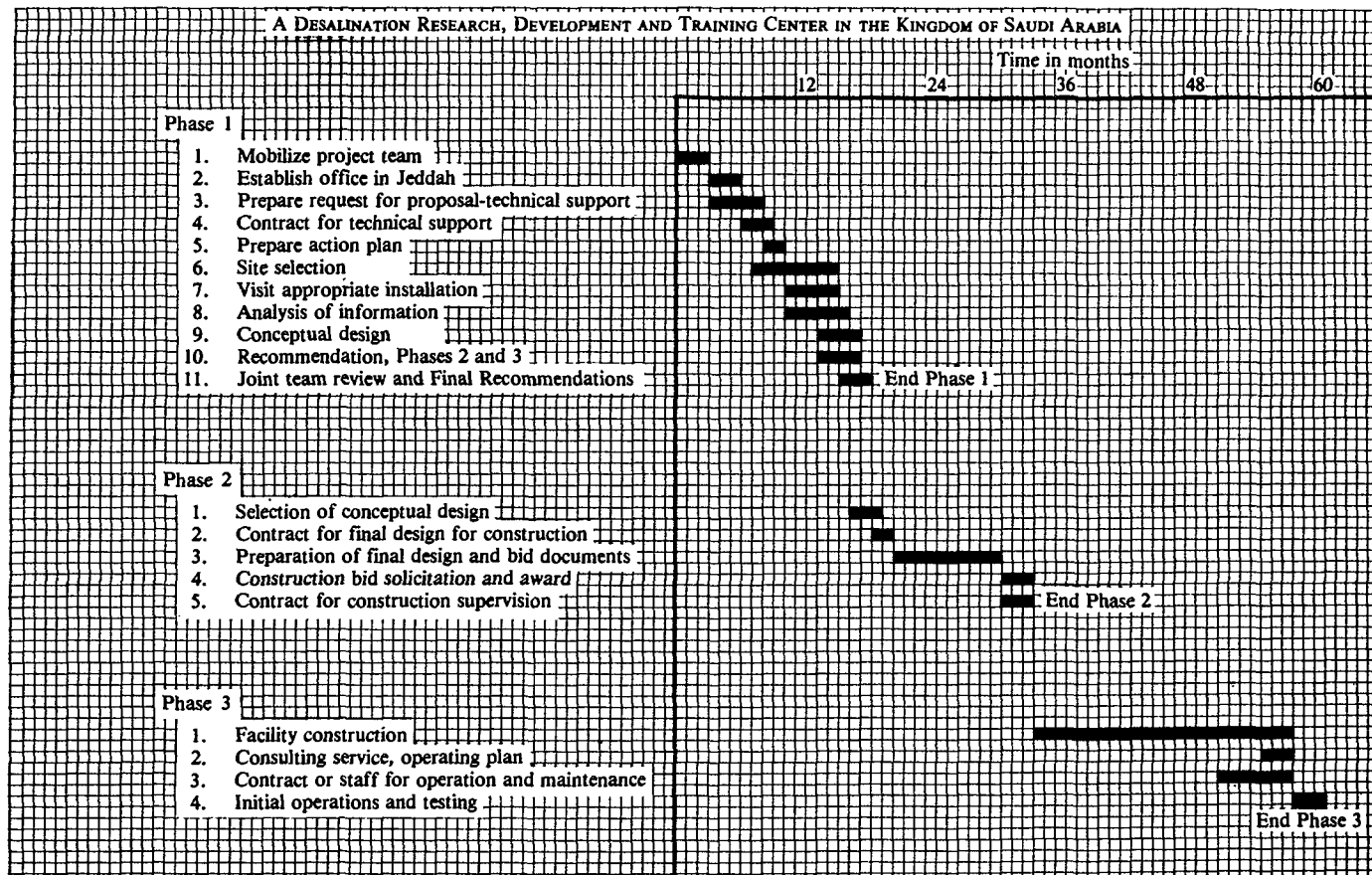
USDI Team for joint project management (total cost)	\$1,215,250.
Consulting Service Contracts	\$ 50,000.
Management, Operation and Maintenance (O&M) (by contract or by staffing — \$2M per year)	\$2,000,000.
Total Phase 3	\$3,265,250.

Phase 4. Research, Development and Training Program Implementation (36 months)

USDI Team for joint project management (total cost)	\$2,025,000.
Management, Operation and Maintenance (O&M)	\$5,000,000.
Total Phase 4	\$7,025,000.

Summary:

Phase 1	\$ 1,142,460.
Phase 2	\$18,569,000.
Phase 3	\$ 3,265,250.
Phase 4	\$ 7,025,000.
Project Totals	\$30,001,710.



Total Cost Analysis:

USDI Team for the Joint Project Management	\$ 4,181,710.
Consulting Service Contracts	\$ 420,000.
Technical Support Contracts	\$ 1,400,000.
Design Contract	\$ 2,000,000.
Construction Contract	\$15,000,000.
O&M Contract	\$ 7,000,000.
Project Totals	\$30,001,710.

VI. TIME SCHEDULE

<i>Time to complete</i>	<i>Cumulative time</i>
Phase 1 18 months	18 months
Phase 2 15 months	33 months
Phase 3 27 months	60 months
Phase 4 36 months	96 months
Total estimated time from start: 96 months or 8 years.	

APPENDIX B

A TECHNOLOGY DEVELOPMENT PROGRAM FOR 250,000 m³/DAY MSF DISTILLATION
SINGLE-UNIT PLANTS (PROJECT B)

I. INTRODUCTION

In 1975, the Government of Saudi Arabia outlined the plans of the Saudi Arabian Saline Water Conversion Corporation (SWCC) for construction of extremely large-scale desalting plants during a second five-year program beginning around the year 1981.

The current five-year program implicates the use of existing technology and a basic unit size of 20,000 m³/day (5mgd) as the building block for larger scale desalting facilities.

For the installations of the future, the SWCC reasonably envisages operating jointly four or more MSF distillation units of the order 250,000 m³/day (66 million gallons) to provide the total capacity required.

The Government of Saudi Arabia has requested the assistance of the U.S. Government in a development program to provide desalting technology for the Saudi Arabian Government's second five-year desalting plant program.

The Office of Water Research and Technology (OWRT), United States Department of the Interior, has experience in conducting desalting research and development programs both on new process technology and the scale-up of existing technology for use in large size, dual-purpose power and water desalting plants.

Capital and energy costs, as well as the demand for potable water, have been increasing rapidly over the past several years, necessitating a reassessment of the optimum economical MSF unit size. If, in fact, single-unit MSF capacities up to 250,000 m³/day can be economically justified, some component and process testing will be necessary to minimize the number of technical unknowns for such large, single-unit MSF plants and provide necessary detailed design data. Both technical and economic factors must be thoroughly evaluated before proceeding with the design of a 250,000 m³/day plant.

II. PROJECT OBJECTIVES

The objectives of the project are as follows:

A. Determination of the most advantageous MSF distillation plant innovation, from both a technical and economical standpoint, for large scale plants (of unit size up to 250,000 m³/day) to be built in Saudi Arabia in the 1980's.

B. Construction and operation in Saudi Arabia of appropriate component and process module test facilities, as necessary, to minimize design unknowns for the MSF unit size.

C. Preparation of a complete design package and bidding documents for the appropriate number of MSF units (250,000 m³/day) suitable for international tender in the 1980's.

III. SCOPE OF WORK

In order to meet the objectives stated, a five phase development program is envisioned:

- Phase 1: determination of optimum MSF Process innovation and unit capacity;
- Phase 2: design of required component and MSF Process test module;
- Phase 3: test module construction;
- Phase 4: module testing;
- Phase 5: detailed plant design and bidding specifications.

IV. TECHNICAL PROPOSAL FOR IMPLEMENTATION

It is estimated that this project, through completion of the engineering design and preparation of bidding documents, will take a maximum of 8 years. The complete development program required can only be outlined in general terms at this time since the results of the first phase will define the scope of component and process testing required to obtain the necessary design information.

This proposal, therefore, provides a complete scope of work for Phase 1 with relatively firm estimates of the costs involved. Succeeding phases are outlined to describe the anticipated course of action, including module construction and test operations, data analysis and the preparation of the detailed plant design.

Order of magnitude-type cost estimates and a general work schedule are also provided for Phases 2 through 5 of this agreement.

A SWCC-USDI Joint Team will provide the technical and administrative management services required to implement Phase 1. It is anticipated that the SWCC-USDI Joint Team will provide similar services required for Phases 2 through 5 in accordance with a scope of work to be proposed for these phases.

Phase 1. Scope of Work for Immediate Implementation (18 months)

During Phase 1 appropriate consulting, engineering, construction and manufacturing firms will be employed to provide, on the basis of a set of ground rules specifying the local conditions in Saudi Arabia, a composite evaluation of the most advantageous MSF Process innovations for application at a single-unit plant capacity of up to 250,000 m³/day. These studies will also, on the same basis, recommend an economically optimum unit size for application in extremely large desalting facilities.

With the assistance of appropriate consulting service, the SWCC-USDI Joint Team will monitor, manage and direct the work of Phase 1, to:

1. Assimilate background data on selected MSF plant size, define study parameters, and prepare documents for solicitation of proposals from qualified firms for preparation of conceptual design studies to include:
 - a. A comparative evaluation of MSF Process innovations over a range of large scale plant designs.

- b. An evaluation of the optimum single unit MSF plant size.
 - c. A recommendation for the most advantageous MSF Process innovation at the 250,000 m³/day plant size.
 - d. A conceptual design of the optimum single unit MSF plant.
 - e. A complete delineation of engineering unknowns of the optimum single unit MSF plant.
 - f. A conceptual design of the component and process test module which will be required to investigate the identified engineering unknowns for the optimum MSF plant.
 - g. A proposed development test program to resolve the engineering unknowns for the optimum MSF plant.
2. Evaluate proposals in "1" above.
 3. Negotiate conceptual design study contracts. (In order to fully utilize existing expertise and expedite the program, a minimum of three parallel conceptual design contracts are recommended.)
 4. Monitor progress of conceptual design contracts and prepare quarterly technical progress reports for H.R.H., the Governor of SWCC.
 5. Evaluate conceptual designs and contractors' recommendations for required component and process training.
 6. Submit detailed recommendations to H.R.H., the Governor of SWCC, for the conduct of Phases 2 through 5 of the development program.

Phase 1 is estimated to take 18 months for completion, including solicitation of proposals and negotiation of contracts.

V. OUTLINE SCOPE OF WORK FOR SUCCEEDING PHASES

Phase 2. (18 months)

1. Contract for engineering design and preparation of bid documents for construction of component and/or process test module based on selected conceptual design for the optimum single-unit MSF plant capacity.
2. Monitor, manage, and direct engineering design contract.
3. Prepare complete bid package for construction of the full-scale plant.

Barring unforeseen operational problems, sufficient information should be available 18 months after the start of the test program so that work on the complete plant design and construction specifications can be started. Construction bid specifications could then be complete approximately 12 months after the completion of Phase 4. The total time for Phases 4 and 5 is therefore 36 months.

Figure B shows a bar graph representation of the project schedule through Phase 3.

Cost Proposal. Preliminary Estimate for Immediate Implementation

Phase 1. Determination of Optimum MSF Process Innovation and Unit Capacity (18 months)

USDI Team for the joint project management (total cost)	\$ 622,460.
Consulting Service Contracts	\$ 80,000.
Conceptual Design Contracts (3)	\$ 360,000.
Total for Immediate Funding	\$1,062,460.

NOTES. 1. The estimates are based on a USDI full-time staffing level of 1½ technical positions with clerical support as required in Jeddah, Saudi Arabia, and ½ manyear of technical support and coordination in Washington, D.C.

2. The estimate for the contract prices is considered to be preliminary and is subject to change by mutual agreement between SWCC and USDI during the course of the work.

A TECHNOLOGY DEVELOPMENT PROGRAM 250,000 3/DAY MSF DISTILLATION UNIT

Time in months

12

24

36

48

60

Phase 1

1. Mobilize project team
2. Establish office in Jeddah
3. Prepare request for proposals on large plant conceptual design
4. Evaluate proposals and contract for large plant conceptual designs
5. Complete conceptual design
6. Joint team evaluation and recommendations
7. Consulting services for joint team

End Phase 1

Phase 2

1. Negotiate contract for design of test module and/or component testing
2. Joint team monitor design effort
3. Prepare design and bid documents
4. Consulting services for joint team
5. Solicit construction bids

End Phase 2

Phase 3

1. Negotiate construction contract
2. Contract for construction supervision
3. Construction of test module
4. Consulting service for detail of development test program
5. Prepare request of proposals for operation and maintenance contract
6. Contract for O&M service
7. Conduct acceptance tests

End Phase 3

Phases 4 and 5

1. Module testing and full scale plant design

30 months

End Phases 4 and 5

*Order of Magnitude Estimates for Succeeding Phases**Phase 2. Design of Required Component and MSF Process Test Module (19 months)*

USDI Team for the joint project management (total cost)	\$ 413,667.
Consulting Service Contracts	\$ 50,000.
Module Design Contract	\$1,000,000.
Total Phase 2	\$1,463,667.

Phase 3. Test Module Construction (23 months)

USDI Team for the joint project management (total cost)	\$ 1,120,583.
Construction supervision and development of test program	\$ 1,200,000.
Construction	\$10,000,000.
O&M Contract/Mobilization and first year of testing (includes utilities) ...	\$ 3,000,000.
Total Phase 3	\$15,320,583.

Phase 4. Module Testing (24 months)

USDI Team for the joint project management (total cost)	\$1,400,000.
Consulting Service Contracts	\$ 50,000.
O&M Contract and Data Evaluation (includes utilities)	\$3,050,000.
Total Phase 4	\$4,500,000.

Phase 5. Detailed Plant Design and Bidding Specifications (18 months)

USDI Team for the joint project management (total cost)	\$ 625,000.
Consulting Service Contracts	\$ 200,000.
Design Contract	\$26,000,000.
Total Phase 5	\$26,825,000.

Total Cost — Analysis

USDI Team for the Joint Project Management (total cost)	\$ 4,181,710.
Consulting Service Contracts	\$ 1,580,000.
Design Contracts	\$27,360,000.
Construction Contracts	\$10,000,000.
O&M Contracts	\$ 6,050,000.
PROGRAM TOTAL	\$49,171,710.
