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**REVISED  
FINAL REPORT**

**COMPUTER TECHNOLOGY PROJECT**

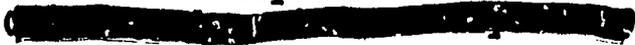
**REGIONAL INSTITUTE FOR INFORMATICS  
& TELECOMMUNICATIONS  
Tunis, Tunisia  
1986 - 1990**

**U.S.A.I.D.  
Contract No. 664-0334-C-6034-00**

**Prepared by the Computer & Systems Services Division**

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## INDEX TO ABBREVIATIONS

AED	The Academy for Educational Development
CBMI	Bourguiba Center for Micro-Informatics (see INBMI)
CNI	National Center of Informatics (government unit responsible for GOT automation)
CPG	Gafsa Phosphate Company
DGT	Tunisian Telecommunications Ministry
ENIT	National School for Engineering in Tunis
ETAP	Tunisian Semi-Public Oil Producing and Export Firm
GOT	Government of Tunisia
INBMI	National Institute for Administration and Micro-Informatics
IRSIT	Regional Institute for Informatics and Telecommunications
MESRS	Ministry of Higher Education and Scientific Research
MNE	Ministry of National Education
PTT	Tunisian Telephone Company

## I. EXECUTIVE SUMMARY

### TUNISIA COMPUTER PROJECT and the REGIONAL INSTITUTE FOR INFORMATICS & TELECOMMUNICATIONS (IRSIT)

#### A. BACKGROUND

Between August 1, 1986 and March 31, 1990, USAID, in conjunction with the Government of Tunisia, the Prime Minister's Office of the Cabinet, and the Academy for Educational Development completed a major technology transfer effort, designed to improve various sectors of the Tunisian economy through the appropriate use of more advanced technology. This \$3.3 million project, USAID Project Number 614-0334-C-6034-00, was designed to provide direct benefits to various sectors of the economy, including education, industry, and the service sector. It was also expected that certain types of investment in upgrading each of the sectors would result in a service delivery institution capable of being self-sustaining--that is, capable of supporting itself through contracts and grants from a variety of sources--and that would serve as a model for entrepreneurial effort and private/public partnerships.

While efforts of this nature frequently require five to seven years to design, staff, and operate, this project has resulted in a Regional Institute for Informatics and Telecommunications (IRSIT) in less than four years, including a year of intensive Government of Tunisia planning which preceded the start of the USAID project. Among IRSIT's most notable accomplishments include designation by a combined international group including the U.S. Geological Survey (USGS) as the satellite-based, data processing, and interpretation site for North Africa of earth resources images; development in pilot form of ground-breaking, new Arabic character and speech recognition techniques; assistance with computerization of the Tunisian secondary and, most recently, primary school system; development of a capability for independent analysis of the Tunisian telephone system; and establishment of active partnership arrangements with five U.S. private companies and concerns in a variety of areas. During the same time, the staffing level of IRSIT (staff which has been partially supported by the Tunisian government) increased from approximately seven to over 34. Along with this, the operating budget increased from approximately \$100,000 to its present level of over \$1 million. Illustration 1 provides a very brief overview of the activity levels in support of this project.

Even more important for the development and growth of this fledgling institute has been the widespread perception that IRSIT is an institute of capability, quality, and integrity--a reputation it has gained in a remarkably short period of time. Persons from

within governmental ministries or the private sector feel confident that in approaching IRSIT they will receive a fair and clear hearing, and that the technical issues which they need to resolve, as well as the organizational changes they may need to make, will be dealt with competently and quickly. These qualities and capabilities in the context of the predominantly government sector which has existed in Tunisia since its 1956 independence, represent no mean feat. The capabilities and sense of purpose underlying an applied research institute, the reason for IRSIT's existence, represent a fusion of an American approach to delivery of technical services and cost-effectiveness/consciousness with that of the unique Tunisian economic and political context.

#### **B. LEVEL OF EFFORT**

The activities of this project noted in Illustration 1, included 174 person-months of direct AED support, 44 person-months of consultant assistance, and 38 person-months of visits. In addition, over 17 pilot projects were begun during the 3.6 years of the IRSIT project. Illustration 2 highlights the projects and timelines. These efforts have been assisted by equipment including 182 microcomputers, 1 minicomputer, 3 high-capacity workstations, and nearly 442 volumes of technical literature, all totalling over \$1.2 million in value.

#### **C. CONSORTIUM MEMBERS**

At its inception, the contract with the Academy for Educational Development contemplated the involvement of a select consortium of institutions. This consortium of U.S. institutions was designed to undergird and provide access by IRSIT to the best that American technology and corporations had to offer. Illustration 3 lists the consortium members and active participants. A key outcome of this contract was the ongoing relationships at the end of direct contract support. Indeed, this has in fact taken place, with ongoing relationships established with at least six of the consortium or participating member institutions, and relationships with other U.S. universities, colleges, and private sector institutions based on common capabilities and interests.

#### **D. LINKS TO U.S.-BASED ORGANIZATIONS**

To highlight just a few of these ongoing relationships, IRSIT has established links with:

PC Linguistics of Texas: to develop a microcomputer-based Arabic-English and English-Arabic computer-assisted translation software. While IRSIT focuses primarily on the

development of the necessary dictionary support and rules of analysis necessary for the software, PC Linguistics is developing the software shell which makes such a product operable. At this stage, financed entirely by IRSIT and PC Linguistic contributions, the development effort has already reached a prototype stage, and can be in production for commercial marketing by the end of 1991.

AT&T Bell Laboratories: With the speech and linguistics department of Bell Laboratories, IRSIT continues a relationship of four years in areas of Arabic speech analysis and synthesis. Based on an exchange among three world-class linguistics specialists, IRSIT serves as a major source of Arabic linguistic information for Bell Laboratories and the site of selected small experiments conducted jointly.

Columbia Teacher's College: With Columbia Teacher's College, largely through two interested departments, the INBMI (National Institute for Administration and Micro-Informatics) is developing, refining, and conducting teacher training in computer-assisted instruction. This effort is designed to bring the majority of specialized secondary school teachers to a position where they are fully conversant in computer-assisted techniques and capable of using selected techniques within their own classrooms. Previously such activities assisted both bilingual and trilingual school programs to operate in a new and exciting environment (French, English, and Arabic). INBMI installed over 120 U.S. microcomputers of mixed manufacture along with U.S. software, initially in three schools, and then in over 20 schools.

Colorado School of Mines: With the Colorado School of Mines, the Gafsa Phosphate Company (CPG), and Blast Dynamics, Inc., IRSIT developed relationships which resulted in substantial new automation at CPG, with the development of specific approaches towards more efficient use of the mining area within Gafsa, and with enhanced planning for maintenance, development of land resources, and more efficient use of blasting materials at the mine. Given that CPG is the second largest export earner for Tunisia, such improvements in efficiency were considered essential.

U.S. Geological Survey (USGS): In a similar vein, the earth resources activity using satellite images holds considerable promise, and the possibility of larger regional (Mahgrebian) links in North Africa. Using data images available through the U.S. Geological Service (USGS), as well as commercially available software, IRSIT is now able to customize maps from satellite data for North Africa to the specific requirements of individual clients throughout North Africa. Using advanced imaging techniques, some of which were developed at IRSIT or by IRSIT researchers, higher resolution and quicker production

of effective maps is now possible. IRSIT will be working over the next several years for more efficient and enhanced distribution of products which, among other things, can be used by individual regions within Tunisia to track the progress of locust infestation. The physical infrastructure necessary to produce these maps includes use of the USAID-provided DEC 6320 minicomputer, high resolution digitizing tables and plotters from Compugraphics, and a sophisticated IVAS workstation to preprocess images. The results of these activities include easily readable and customized maps available for virtually every region of North Africa. USGS continues to work with IRSIT on improving the effective use of such maps and integrating pest control solutions with new sensing tools.

#### **E. FURTHER ORGANIZATIONAL LINKS**

With the combination of the above-stated links and IRSIT's particular spirit of development, IRSIT is undertaking projects with:

The Tunisian Bourse (Tunisian stock market), now newly renovated and enhanced, in part as a result of the World Bank-led structural readjustment effort, as well as the development of commercially feasible products for the Ministry of Telecommunications. This latter effort holds considerable promise to open up significant regions of Tunisia to improved telephone service and therefore enhance commercial capability in virtually every region.

The Tunisian Ministry of Telecommunications. Using a combination of new products (some derived from the French Minitel and computer-enhanced network management), as well as more specific approaches closer to the American model, IRSIT is assisting the Ministry of Telecommunications to develop inexpensive ways to extend telephone service and at the same time enhancing the quality of products available through the telephone service. IRSIT long ago recognized, as many development personnel have come to see, that the telecommunications networks in a country are the roads and highways of the 1990s. Without an effective system, natural resources in a competitive world economy can be wasted, and opportunities for private development are lost.

#### **F. CARTHAGE INSTITUTE OF TECHNOLOGY (CIT)**

Beginning in the second year of the Tunisian Computer Project under IRSIT sponsorship, AED conducted a major feasibility and pre-design effort for the Carthage Institute of Technology. This \$200,000 effort resulted in three reports, four major meetings, and

a needs survey, clearly documenting the need for a private, technologically and problem-oriented university of about 3,000 students in the Arab World. Unfortunately, the necessary private financing from Arab sources has not yet been available.

#### **G. SHORT-TERM PARTICIPANT TRAINING**

Perhaps as important as these products are from IRSIT, so too are the training and improvements of the local staff are important to maintain the staffing infrastructure necessary to keep IRSIT in operation. Through over 38 person-months of participant or invited guest-type training (the majority, 98%, short-term), IRSIT staff, as well as selected personnel from other Tunisian institutions, including CNI and INBMI, have had the opportunity to take U.S.-based short-term intensive training, to participate in carefully structured technical visits to sites which serve or could serve as models for IRSIT activity, and to participate as speakers, moderators, or technical contributors in over 12 different conferences and international fora. Illustration 4 summarizes the Participant and Invited Guests activities undertaken during the course of this contract.

#### **H. IRSIT-SPONSORED CONFERENCES**

IRSIT itself during the same time sponsored two major international conferences: the Regional Conference on Informatics and Arabization during March of 1988, and the 10th Tunisian-French Conference on Software Development in May of 1989. These conferences served in part to reestablish and legitimize IRSIT's contribution, particularly in the Arab scientific world, and to provide a forum for young, but well-trained researchers to publish and discuss their own work. Indirectly, such conferences also assisted in making IRSIT known among select users and clients who discovered new opportunities for use and development of IRSIT products.

#### **I. CONSULTANT ACTIVITIES**

At the same time as training and transfer of technology was occurring for IRSIT, a number of U.S. consultants assisted IRSIT with its development and the creation of various products and services. Initially, as would be expected in a project of this nature, in the first year-and-a-half of consulting assistance, most was focused on institution-building requirements and on creating capacity within IRSIT. This involved establishing the requirements for a powerful minicomputer within IRSIT, the establishment of effective operational plans for IRSIT's growth, the development of an entire network (which now stands as a model for North Africa in terms of capability, complexity, and flexibility), and assistance

with management aspects of a scientifically oriented, applied research institute. In latter years, consulting assistance focused much more on specialties and specific issues which IRSIT confronts. As an example, Dr. Albert Badre of the Georgia Institute of Technology has been assisting a Tunisian project participant, the National Center for Informatics (CNI), in evaluating the use of UNIX software solutions for presentation graphics. The graphics issue is an important contribution to effective office automation in an Arabic and French environment. Other consultants, for example, Dr. Mark Liberman from Bell Laboratories, worked directly with IRSIT to develop certain products--in this case Arabic speech recognition software. For just one of the four components of the project activities, namely, pilot projects, consultants assisted with water resources management projects, with selected electronic component development activities, and with strategies to use new, more highly developed products. Illustration 5 summarizes the activities undertaken by the consultants.

#### **J. STRUCTURE OF THE FINAL REPORT**

In subsequent sections, we outline the project in terms of the formal contract expectations (Section II), a detailed description of each activity under each of the four components (Section III), a summary of lessons learned in the last 3.6 years (Section IV), a detailed synopsis of participant and invited guest programs (Section V), and a description of project finances showing year-by-year and summary expenditures, as well as by project subcomponent (Section VI). This report is accompanied by a multivolume Appendix which includes key documents from all major events, as well as quarterly, semiannual, and annual progress reports.

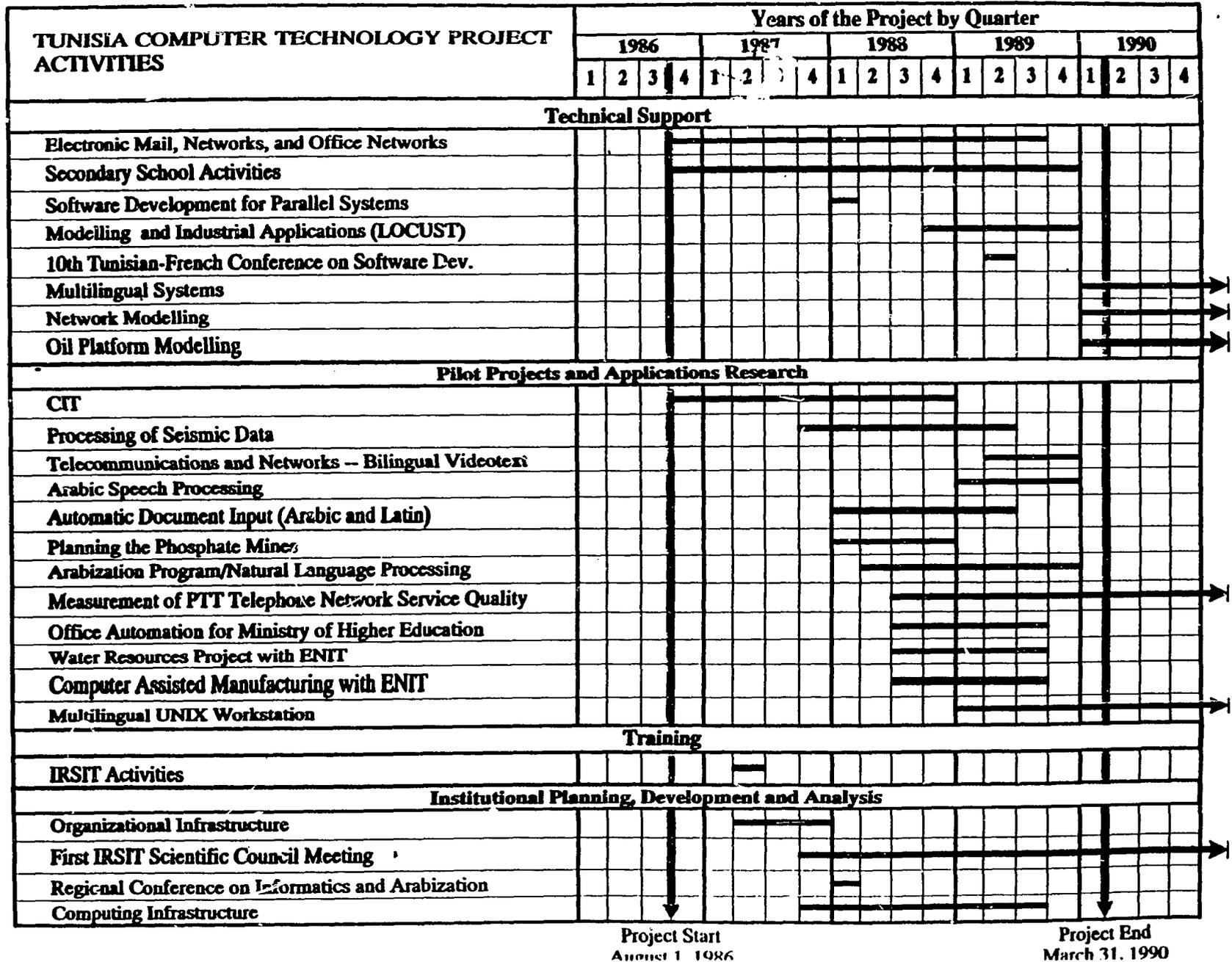
## ILLUSTRATION 1

### HIGHLIGHTS OF IRSIT ACTIVITIES (August 1986 - March 1990)

Number of Person-Months of Field Office:	69.0
Number of Person-Months of Home Office:	105.1
Number of Consultants Provided:	52
Number of Person-Months of Consultants:	44.0
Number of Participants/Invited Guests:	33
Number of Participant/Invited Guest Trips/Visits*:	37
Number of Person-Months of Participants/Invited Guests:	38.4
Number of Pilot Projects and IRSIT-Support Projects Begun:	17
Number of IRSIT Staff Added:	27
Total Value of the Project:	\$3,338,611
Total Value of Equipment Shipped:	\$1,230,666
Number of Computers (micros, minis, workstations, and terminals) Shipped:	196
Number of Books Shipped:	442
Number of Other Items Shipped:	8,429
Number of Formal IRSIT conferences:	2
Number of IRSIT Scientific Councils:	3
Number of U.S. Organizations Visited:	67
Number of Consortium Members or Participating Institutions:	23

\* Several participants/invited guests made multiple trips.

ILLUSTRATION 2



**ILLUSTRATION 3**  
**CONSORTIUM MEMBERS**  
**and**  
**PARTICIPATING INSTITUTIONS**

**Consortium Members**

University of California at Los Angeles  
Georgia Institute of Technology  
University of Southern California  
Virginia Polytechnic Institute and State University  
Northeastern University  
Columbia University  
Sperry Corporation  
AT&T International Advisory Services, Inc./Bell Laboratories

**Participating Institutions**

Colorado School of Mines  
United States Geological Survey/EROS  
PC Linguistics, Inc.  
Apple Corporation  
Blast Dynamics, Inc.  
University of Texas at Austin  
Cogniseis  
University of Florida at Tallahassee  
United States Telecommunications Training Institute  
Harvard B.R.I.D.G.E.S. program  
Cornell University  
Massachusetts Institute of Technology  
University of Michigan  
George Washington University  
Purdue University

## ILLUSTRATION 3A

### CONSORTIUM MEMBERS AND PARTICIPATING INSTITUTIONS

The following briefly summarizes the organizations and universities in the Consortium.

#### o University of California at Los Angeles (UCLA)

The Computer Science Department, part of the School of Engineering and Applied Science at UCLA, was the focal point for UCLA's participation in the Tunisia Computer Project. The Department provides education at the undergraduate and graduate levels necessary to understand, design, implement, and use the software and hardware for digital computers and digital systems.

The following IRSIT staff members visited UCLA during the life of the project:

1. Salem Ghazali
2. Nabil Sahli
3. Naceur Chemmam
4. Farouk Kamoun
5. Fayek Rachdi
6. Montasser Ouaily

#### o Georgia Institute of Technology (Georgia Tech)

Georgia Tech possesses one of the most advanced data communications networks in the country, using fiber optics, microwave, broadband cable, and baseband cable to connect a full complement of state-of-the-art computer mainframes, minicomputers, and microcomputers dispersed throughout the campus. In addition, Georgia Tech is organizing comprehensive laboratories for research and development of computer systems; for advancement of the state of computer-aided engineering, design, and management; and for the creation of software and courseware for advanced engineering education.

The following IRSIT staff visited Georgia Tech during the life of the project:

1. Nouredine Ellouze
2. Mohammaed Ben Sassi
3. Othman Chaouachi
4. Rifaat Chaabouni

The following faculty from Georgia Tech visited IRSIT during the life of the project:

1. Dr. Albert Badre
2. Dr. Michael McCracken

o University of Southern California (USC)

USC's participation was coordinated by the Center for Futures Research (CFR) at USC, a part of the Graduate School of Business Administration. The Center has four major project areas: the Twenty-Year Forecast Project; Information Technology Program; Policy Analysis, Methodology; and Planning Processes. Within each of these areas, specific studies are undertaken and sponsored by corporations, government agencies, and other organizations. The center offers specializations in: Personal Computer and Business Futures, The Personal Computer and Society, The Future of Network Information Services, Design Study for Urban Telecommunications Experiments, Telecommunications/Transportation Tradeoff, The Multinational Computer, and so on. The results of CFR research are given the widest possible distribution through publications, workshops, and presentations.

o Virginia Polytechnic Institute and State University

The Department of Computer Science offers four degree programs: a Bachelor of Science, a Master of Information Systems (MIS), a Master of Computer Science and Application (CSA), and a Doctoral program in Computer Science and Applications. The CSA program emphasizes both the applications and the science of computing, whereas the MIS program focuses on the design, development, operation, and evaluation of information system serving organizations.

o Northeastern University

Northeastern emphasizes an applications approach to computer science; not technology for its own sake, but technological solutions to real-world problems. Its relationship with industry is another reflection of this commitment to solutions for the real world. An Industrial Advisory Board made up of senior officers from firms representing many areas in the computing field provides guidance in developing concentrations and course designs that reflect the present and future needs of industry professionals.

o Columbia University

The University has two schools focusing on computer research and application: The Columbia Business School's Information Technology Project and the Center for Telecommunications Studies; and the School of Engineering and Applied Science which houses the Computer Science Department and the primary computer research facilities. The Information Technology Project is a three-year joint study by Columbia Business School and IBM. The major objectives are to produce a wide variety of courseware and to integrate the microcomputer into the curriculum. Directly tied to these objectives is improving teaching techniques and productivity. For the purposes of the IRSIT project, the Columbia Teacher's College was capable of providing additional assistance in the area of teacher training as pertains to computer-aided instruction.

The following IRSIT staff visited Columbia University during the life of the program:

1. Nouredine Ellouze
2. Sami Krichen
3. Faouzi Ben Sedrine

The following Columbia University faculty visited IRSIT during the life of the project:

1. Dr. Robert Taylor

o Sperry Corporation

Sperry's special experience with regards to the Tunisia Computer Experience includes current experience in the Middle East and on-going support to Tunisia. It has supplied all forms of computer hardware, software, and support. Its projects have involved program planning; fiscal management; curriculum development; commodities procurement; vocation/technical education planning and implementation; tailored, specialized training; in-country and U.S.-based training programs; material production; and significant logistical support.

o AT&T International Advisory Services, Inc./Bell Laboratories

Through its international consulting subsidiary, AT&T International Advisory Services, Inc., AT&T makes available to public and private telecommunications administrations and users throughout the world, the managerial and technical expertise of AT&T and its associated companies. That expertise encompasses the entire spectrum of telecommunications networks and services.

The following IRSIT staff visited AT&T during the life of the project:

1. Salem Ghazali
2. Mondher Makni

The following AT&T staff visited IRSIT during the life of the project:

1. Dr. Mark Liberman
2. Dr. Adel Labib

o Colorado School of Mines (CSM)

The Colorado School of Mines plays a major role in providing Colorado, the nation and the world with skilled engineers and scientists, who help satisfy the needs for energy, minerals and advanced materials. CSM offers a unique blend of technical ability, environmental sensitivity, managerial leadership, applied research and wise stewardship of scarce, nonrenewable mineral resources.

As one of the world's leading institutions of mineral engineering, CSM concerns itself with all aspects of exploration, extraction and refinement of energy and mineral resources. The Mining Department at CSM is perhaps the best-known center for the study of mining engineering in the world. Computer applications in such areas as reserve estimation, mine design, rock mechanics, ventilation, and equipment selection are increasingly important to mining. Faculty members guide graduate students in state-of-the-art research in these fields.

The following CPG/IRSIT staff visited CSM during the life of the project:

1. Imed Jamoussi
2. Fethi Tenzekhti
3. A. El Amri
4. A. S'Himi
5. M. M'Rabet

6. R. Ben Mosbah
7. T. Mahari
8. K. Daly

The following CSM staff visited IRSIT during the life of the project:

1. Dr. Donald Gentry
2. Dr. Matthew Hrebar

ILLUSTRATION 4

Summary of

Participants & Invited Guests  
Short-Term Training Program

Name	Date	Location	Affiliation	Purpose
Ellouze, M.	May 30-June 18, 1987	Wash, D.C.; Atlanta, GA; Golden, CO; Houston, TX; New York, NY	IRSIT	Meetings re Institutional Development
Bourguiba, Jr., M	October 1-9, 1987	Wash, D.C.; New York, NY	CIT	Meetings re CIT development
Kamoun, F.	October 3-11, 1987 August 18-September 2, 1989	Wash, D.C. Los Angeles, CA; Santa Cruz, CA; Lake Tahoe, CA; San Francisco,	CMI CMI	Meetings re CIT development Participate in XI Computer Congress and Committee 6 AFRICOM 91 conference
Ben Aicha, A.	October 7-November 9, 1987	New Orleans, LA; Golden, CO; Sioux Falls, SD	IRSIT	Conferences/Meetings re processing seismic data
Ben Hamza, K.	October 22-November 7, 1987	Wash, D.C.; Binghamton, NY	CIT	Meetings re CIT development
Boudhaouia, V.	January 18-29, 1988	Wash, D.C., Rockville, MD; Arlington, VA	IRSIT	Training re 3Com systems management
Ghazali, S.	January 24-February 14, 1988 September 12-October 17, 1988 September 24-October 13, 1989	Los Angeles, CA; Murray Hill, NJ Cambridge, MA; Amherst, MA Murray Hill, NJ; Woodlands, TX; Austin, TX Murray Hill, NJ; Columbus, OH; Los Angeles, CA; Woodlands, TX	IRSIT IRSIT IRSIT	Meetings re development of Arabic speech processing Meetings with PC Linguistics re development of English-Arabic translation system Meetings with AT&T and MAASCOMP re speech processing workstations

(Short-Term Training cont'd)

Name	Date	Location	Affiliation	Purpose
Sahli, M.	February 13-March 21, 1988	Irvine, CA; Santa Clara, CA	IRSIT	Training re 3Com installation and support
Jamoussi, I.	March 31-April 30, 1988	Golden, CO; Wash, D.C.	IRSIT	Observation/Training re mine planning software for CPG use
Tenzekhti, F.	March 31-April 30, 1988	Golden, CO; Boston, MA; Wash, D.	IRSIT	Observation/training re mine planning software for CPG use
El Azri, A.	March 31-April 22, 1988	Golden, CO; Boise, ID; Sparks, N	CPG	Observation/training re mine planning software for CPG use
S'Mimi, A.	March 31-April 22, 1988	Golden, CO; Boise, ID; Sparks, N	CPG	Observation/training re mine planning software for CPG use
M'Rabat, M. M.	March 31-April 22, 1988	Golden, CO; Boise, ID; Sparks, N	CPG	Observation/training re mine planning software for CPG use
Ben Noebah, R.	March 31-April 22, 1988	Golden, CO	CPG	Observation/training re mine planning software for CPG use
Mehari, T.	March 31-April 22, 1988	Golden, CO	CPG	Observation/training re mine planning software for CPG use
Daly, K.	April 19-24, 1988	Wash, D.C.; Golden, CO	CPG	Observation/training re mine planning software for CPG use
Sellami, K.	April 10-May 2, 1988	Wash, D.C.; Boston, MA; New York, NY; Rockville, MD; Vienna, VA; Ann Arbor, MI	IRSIT	Training re systems management
	June 1-July 3, 1989	Wash, D.C.; Los Angeles, CA; Anaheim, CA	IRSIT	Training in VAX and CalComp systems

(Short-Term Training cont'd)

Name	Date	Location	Affiliation	Purpose
Boussan, M. R.	June 21-August 13, 1988	Ann Arbor, MI	EMIT	Participate in seminar re use of satellite data to monitor natural resources
Mekni, M.	July 6-August 19, 1988	Orlando, FL; New York, NY; Basking Ridge, NJ	IRSIT	Participate in seminars re telephone systems technology
Krichen, S.	July 21-August 16, 1988	Wash, D.C.; New York, NY; Boston, MA	IRSIT	Training re financial management
Cheman, M.	July 28-August 17, 1988	Atlanta, GA; Wash, D.C.; Sioux Falls, SD; Los Angeles, CA	IRSIT	Conference/Observation re satellite imaging software
	June 27-July 15, 1989	Wash, D.C.; Sioux Falls, SD; Reston, VA	IRSIT	Training re LAS and ADAPS software at USGS/EROS
Ezzine, M.	July 17-September 11, 1988	Cambridge, MA; Wash, D.C.; Philadelphia, PA	EMIT	Participate in Bridges seminar at Harvard re use of statistics methods to evaluate higher education
Ben Sassi, M.	August 17-September 8, 1988	Rockville, MD; Cambridge, MA; Waltham, MA; St. Paul, MN; Atlanta, GA	CMI	Meetings at MIT and Georgia Tech re x-windows and design of bilingual workstation
Cheouchi, O.	August 17-September 8, 1988	Cambridge, MA; Waltham, MA; St. Paul, MN; Atlanta, GA Atlanta, GA	CMI	Meetings at MIT and Georgia Tech re x-windows and design of bilingual workstation
Cheabouni, R.	September 15-30, 1988	Ithaca, NY; Ann Arbor, MI; Atlanta, GA; Thornewood, NY	EMIT	Meetings at Cornell Univ. re manufacturing technology

(Short-Term Training cont'd)

Name	Date	Location	Affiliation	Purpose
Ben Nimoun, R.	September 30-October 30, 1988	Wash, D.C.; Basking Ridge, NJ	IRSIIT	Observation at Brookings Inst., GSA, and Georgia Tech re technologies in support of microcomputers in teaching public admin. mgt.
Ben Sedrine, F.	October 9-30, 1988	Orlando, FL; New York, NY; Wash, D.C.	IRSIIT	Training re management systems
Latiri, M.	May 9-June 1, 1989	Wash, D.C. area; Columbus, OH; New York, NY; Cupertino, CA; Austin, TX	IMBNI	Observation/meetings re computer-applied instruction systems in secondary schools
Beebes, M.	July 13-21, 1989	Wash, D.C.; Columbus, OH	ENIT	Participate in Int'l Geological Congress re numerical modelling of underground water systems
Ezzine, A.	August 4-12, 1989	Wash, D.C.; Ithaca, NY	ENIT	Observation/participation in seminar re manufacturing technology software
Ounily, M.	August 26-September 12, 1989	Los Angeles, CA; Wash, D.C.	IRSIIT	Participate in network management seminars at AT&T and USITT; development of joint proposal with UCLA
Rachdi, F.	August 18-September 2, 1989	Los Angeles, CA; Santa Cruz, CA; Lake Tahoe, CA; San Francisco,	CNI	Participate in XI Computer Congress and Committee 6 AFRICOM 91 conference
Nasiri, K.	August 26-September 22, 1989	Wash, D.C.; W. Lafayette, IN; Gainesville, FL	ENIT	Observation/training at Univ. of Florida, and Purdue re water resource management software



Illustration 5 cont.

30-Jul-91 USAID/TUNIS COMPUTER PROJECT  
12:16 PM TUNISIA IRSIT CONSULTANTS

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NAME	DATES OF EMPLOYMENT	LOCATION	DAILY RATE	TOTAL DAYS WORKED	TOTAL FEE	DBA INS DAYS	AMOUNT DBA INS	PURPOSE OF ASSIGNMENT
	DEC 7-13, 14-19, 1987	NEW YORK	\$269.00	7	\$1,883.00	0	\$0.00	CIT DEVELOPMENT
		TUNIS	\$269.00	6	\$1,614.00	6	\$40.35	CIT DEVELOPMENT
	DEC 21, 1987	HOUSTON	\$269.00	1	\$269.00	0	\$0.00	CIT DEVELOPMENT
	JAN 4-6, 20-23, 1988	HOUSTON	\$269.00	7	\$1,883.00	0	\$0.00	CIT DEVELOPMENT
	JAN 24-30, FEB 1-5, 1988	TUNIS	\$269.00	7	\$1,883.00	7	\$47.07	CIT DEVELOPMENT
		HOUSTON	\$269.00	5	\$1,345.00	0	\$0.00	CIT DEVELOPMENT
	FEB. 6-8, 1988	HOUSTON	\$269.00	3	\$807.00	0	\$0.00	CIT DEVELOPMENT
	MAR 7-30, 1988	TUNIS	\$269.00	12	\$3,228.00	12	\$80.70	CIT DEVELOPMENT
	APRIL 4-28, 1988	TUNIS	\$269.00	12	\$3,228.00	12	\$80.70	CIT DEVELOPMENT
	CLARK, CLIFFORD	FEB 18-MARCH 16, 1987	TUNIS	\$269.00	13	\$3,497.00	13	\$87.42
JUNE 23-JULY 20, 1987		TUNIS	\$269.00	9	\$2,421.00	9	\$60.52	PHASE II INSTITUTIONAL ANALYSIS
OCT 23-25, 1987		BINGHAMPTON	\$269.00	3	\$807.00	0	\$0.00	CIT GRAD PLAN
DEC 8-9, 1987		BINGHAMPTON	\$269.00	1	\$269.00	0	\$0.00	CIT GRAD PLAN
MAR 4-10, 1988		WASHINGTON	\$269.00	7	\$1,883.00	7	\$47.07	CIT GRAD PLAN
APRIL 16-17, 1988		WASHINGTON	\$269.00	2	\$538.00	0	\$0.00	CIT GRAD PLAN
CHARMAT, ANDREW		JAN 31-FEB 5, 1988	TUNIS	\$269.00	5	\$1,345.00	5	\$33.62
	MAR 5-29, 1988	TUNIS	\$269.00	13	\$3,497.00	13	\$87.42	CIT GRAD PLAN
EL-ANSARY, ADEL	MAR 1-28, 1988	WASHINGTON	\$269.00	20	\$5,380.00	0	\$0.00	CIT MARKETING STUDY
	APRIL 4-11, 1988	TUNIS	\$269.00	5	\$1,345.00	5	\$33.62	CIT MARKETING STUDY
MEYWOOD, ROBERT	MAR 5-31, 1988	WASHINGTON	\$158.00	11.5	\$3,093.50	0	\$0.00	CIT FINANCIAL PLAN
	APRIL 1-25, 1988	TUNIS	\$158.00	13.5	\$2,133.00	13.5	\$53.32	CIT FINANCIAL PLAN
HOLNES, LUCY	SUBCONTRACT JAN-APRIL 1988	HOUSTON, TX		20	\$15,000.00			CIT FACILITIES PLANNING
STUART, WILLIAM	MAR 4-11, 1988	TUNIS	\$269.00	7	\$1,883.00	7	\$47.07	CIT STAFF/OPS PLAN
	MAR 31, APR 1-11, 1988	WASHINGTON	\$269.00	9.5	\$2,555.50	0	\$0.00	CIT STAFF/OPS PLAN
VOTRUBA, JAMES	MAR 5-11, 1988	TUNIS	\$269.00	7	\$1,883.00	7	\$47.07	CIT UNDERGRAD PLAN
BADRE, ALBERT	MAR 7-13, 1988	TUNIS	\$269.00	7	\$1,883.00	7	\$47.07	ARABIZATION CONF.
	MAY 15-JULY 15, 1988	ATLANTA/TUNIS	\$269.00	10	\$2,690.00	8	\$53.80	DEVELOPMENT OF BILINGUAL FLEXIBLE SOFTWARE DEVELOPMENT ENVIRONMENT (CNI)
	SEPT 16-DEC 8, 1988	TUNIS/ATLANTA	\$269.00	17	\$4,573.00	7	\$47.07	DEVELOPMENT OF BILINGUAL FLEXIBLE SOFTWARE
	JUNE-JULY 1989	TUNIS/ATLANTA	\$282.00	10	\$2,820.00	7	\$49.35	DEVELOPMENT OF BI-LINGUAL INTERFACE TO UNIX (CNI)
	FEB 25-MAR 2	TUNIS	\$282.00	5	\$1,410.00	5	\$35.84	DEVELOPMENT OF BI-LINGUAL INTERFACE TO UNIX (CNI)
GARROUCH, ALI	SUBCONTRACT MAR 1, 1988-MAY 31, 1989	AUSTIN, TX	\$35.00	120.4	\$4,800.00	0	\$0.00	PETROLEUM INDUSTRY ON-GOING INFO GATHERING

Illustration 5 cont.

30-Jul-91 USAID/TUNIS COMPUTER PROJECT  
12:25 PM TUNISIA IRSIT CONSULTANTS

NAME	DATES OF EMPLOYMENT	LOCATION	DAILY RATE	TOTAL DAYS WORKED	TOTAL FEE	DBA INS DAYS	AMOUNT DBA INS	PURPOSE OF ASSIGNMENT
BABB, ROBERT	MAR 23-28, 1988	TUNIS	\$200.00	6	\$1,200.00	6	\$30.00	SOFTWARE PRESENTATION
	MAY 21-29, 1989	TUNIS		9	\$200.00		\$0.00	DELIVER PAPER AT 10TH TUNISIAN FRENCH SEMINAR OF COMPUTER SCI.
GENTRY, DONALD	JAN 8, 11-15, 1988	TUNIS	\$269.00	11	\$2,959.00	11	\$73.97	CPG OBSERVATION/PLAN
	JAN 18-22, 1988							
	JAN 27-29, 1988	GOLDEN	\$269.00	11	\$2,959.00	0	\$0.00	REPORT ON CPG TRIP FINDINGS
	FEB 2-4, 8-11, 1988 FEB 14, 1988 MAR 31, APRIL 4-8, 1988 APRIL 11-15, 18-21, 1988 APRIL 27-29, 1988 MAY 2-3, 1988	GOLDEN BOISE RENO	\$269.00	20	\$5,380.00	0	\$0.00	SOFTWARE DEMO CPG/IRSIT
HREBAR, MATTHEW	JAN 8, 11-15, 1988	TUNIS	\$250.00	11	\$2,750.00	11	\$68.75	CPG OBSERVATION/PLAN
	JAN 18-22, 1988							
	JAN 23-25, 30-31, 1988	GOLDEN	\$250.00	11	\$2,750.00	0	\$0.00	REPORT ON CPG TRIP FINDINGS
	FEB 6-7, 13-15, 1988 APRIL 1, 5-8, 1988 APRIL 11-15, 18-22, 26, 1988 MAY 2,6, 1988	GOLDEN BOISE RENO	\$250.00	20	\$5,000.00	0	\$0.00	SOFTWARE DEMO CPG/IRSIT
BUGLIARELLO, GEORGE	DEC 11-20, 1987	NEW YORK	NO FEE					IRSIT SCIENTIFIC COUNCIL
VIDAL, JACQUES	DEC 11-20, 1987	TUNIS	\$269.00	10	\$2,690.00	0	\$0.00	IRSIT SCIENTIFIC COUNCIL
FLOYD, JOHN	MAY 21-29, 1988	TUNIS	\$200.00	9	\$1,800.00	9	\$45.00	CPG OPERATIONS
	OCT 17-21, 1988	COLORADO	\$200.00	5	\$1,000.00	0	\$0.00	PREPARE FOR GAFSA ON-SITE VISIT RE RECOMMENDATION IMPLEMENTATION
	OCT 23-31, 1988	TUNISIA	\$200.00	9	\$1,800.00	9	\$45.00	VISIT TO GAFSA MINES TO EVALUATE IMPLEMENTATION OF RECOMMENDATIONS
	NOV 1-9, 1988	COLORADO	\$200.00	9	\$1,800.00	0	\$0.00	REPORT PREPARATION
EL-SNAFEI	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
AL-MUNTASEB	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
MCBREARTY	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
BEKKOUCHE	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
DITTERS	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
EL-IMAN	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
HYDER	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE

Illustration 5 cont.

30-Jul-91 USAID/TUNIS COMPUTER PROJECT  
12:25 PM TUNISIA IRSIT CONSULTANTS

NAME	DATES OF EMPLOYMENT	LOCATION	DAILY RATE	TOTAL DAYS WORKED	TOTAL FEE	DBA INS DAYS	AMOUNT DBA INS	PURPOSE OF ASSIGNMENT
MAHJOUR	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
MESSAOUIDI	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
MOUH	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
HEGAZI	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
EL-JABIRI	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
TAYLI	MAR 9-11, 1988	TUNIS	\$0.00	3	\$0.00	0	\$0.00	ARABIZATION CONFERENCE
SULEIMAN, FUAD	MAR 4, 7-11; 18; 25; MAR 28-30, 1988  APRIL 11; 26-29, 1988  MAY 2; 17-19; 24; MAY 26; 31, 1988	WASHINGTON, D.C TUNIS CASABLANCA WASHINGTON, D.C TUNIS WASHINGTON, D.C CAIRO		11  5  7				CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT [23 PERSON DAYS TOTAL. CHARGES TO HOME OFFICE.]
STRICKLAND, SAMIRA	MAR 1-3; 7-10; 14-17; MAR 21-24; 28-31, 1988  APRIL 4-7; 11-14; APRIL 25-28, 1988 MAY 2-3; 9; 17-19; MAY 23-26; 31, 1988	WASHINGTON, D.C TUNIS CASABLANCA ALGIERS WASHINGTON, D.C TUNIS WASHINGTON, D.C TUNIS		9  12  11				CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT CIT DEVELOPMENT [42 PERSON DAYS TOTAL. CHARGES TO HOME OFFICE.]
MALLARD, GEORGE	MAY-JUNE 15, 1988 CCT 10-OCT 12, 1989 APRIL 3-APRIL 7	TUNIS TEXAS TUNIS	\$120.00 \$120.00 \$120.00	4 3 4	\$480.00 \$360.00 \$480.00	4 0 4	\$12.00 \$0.00 \$12.00	DEVELOPMENT OF ENGLISH/ARABIC TRANSLATION SYSTEM REVIEW ARABIC LANGUAGE CONSTRUCTION WITH DR. GHAZALI PARTICIPATE IN ENGLISH/ARABIC TRANSLATION PROJECT
LIBERMAN, MARK	JUNE 10-30, 1988	TUNIS	\$0.00	9	\$0.00	0	\$0.00	PREPARE INFORMATION FOR POSSIBLE RESEARCH AGREEMENT BETWEEN IRSIT AND ATT/BELL LABS REGARDING SPEECH RESEARCH
MCCRACKEN, MICHAEL	MAY 15-JULY 15, 1988 SEPT 4-DEC 21, 1988	ATLANTA/TUNIS ATLANTA	\$274.00 \$274.00	10 10	\$2,740.00 \$2,740.00	8 0	\$56.55 \$0.00	DEVELOPMENT OF BILINGUAL FLEXIBLE SOFTWARE DEVELOPMENT ENVIRONMENT (CMT) DEVELOPMENT OF BILINGUAL FLEXIBLE SOFTWARE DEVELOPMENT ENVIRONMENT (CMT)
SORA, SEBASTIAN	APRIL 10-APRIL 21, 1989 APRIL 22-DEC 31, 1989	TUNIS NEW YORK	\$285.00 \$285.00	11 9	\$3,135.00 \$2,565.00	11 0	\$78.37 \$0.00	STRATEGIC AND BUSINESS PLAN FOR IRSIT FOLLOW-UP REPORT RE IRSIT VISIT RE STRATEGIC AND BUSINESS PLAN
TAYLOR, ROBERT	JUNE 17-23, 1989	U.S./TUNIS	\$0.00	8	\$0.00	0	\$0.00	VISIT TO TUNISIA TO PREPARE FOR U.S. TRAINING OF TEACHERS (INSMI)

Illustration 5 cont.

30-Jul-91 USAID/TUNIS COMPUTER PROJECT  
12:31 PM TUNISIA IRSIT CONSULTANTS

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NAME	DATES OF EMPLOYMENT	LOCATION	DAILY RATE	TOTAL DAYS WORKED	TOTAL FEE	DBA INS DAYS	AMOUNT DBA INS	PURPOSE OF ASSIGNMENT
WILLS, RUSSELL	SUBCONTRACT APRIL 5-JULY 31, 1989	CANADA/TUNIS		30	\$22,472.00			STRATEGIC AND BUSINESS PLAN FOR IRSIT
NEANEY, JAMES P.	NOVEMBER-DECEMBER 1989	TUNIS	\$285.00	10	\$2,850.00	8	\$57.00	CONDUCT WORKSHOP ON USE OF STORM WATER MANAGEMENT MODEL
MOLARD, ROBERT	NOV 30-DEC 31, 1989	TUNIS/COLUMBUS	\$197.00	9	\$1,773.00	6	\$30.05	DEMONSTRATION AND DESIGN OF CAI PROGRAM FOR TUNISIAN LYCEES (INBMT)
TAPPAN, GRAY (USGS)	JULY 10-17, 1988 NOVEMBER 10-17, 1988 FEBRUARY 10-17, 1989	TUNIS TUNIS TUNIS	\$0.00 \$0.00 \$0.00	8 8 8	\$0.00 \$0.00 \$0.00	0 0 0	\$0.00 \$0.00 \$0.00	BRIEF MINISTRY ON GREENESS MAPPING RE AGRIC. PROJECTS IN TUNISIA CONDUCT CLASSES AT MINISTRY RE USE OF GREENESS MAPS RE LOCUST CONTROL FOLLOW UP MTGS. WITH MINISTRY RE USE OF GREENESS MAPS FOR LOCUST CONTROL
LOVELAND, TOM (USGS)	OCTOBER 16-28, 1988	TUNIS	\$0.00	13	\$0.00	0	\$0.00	IDENTIFY PROJECTS STEPS RE SAT. IMAGING TECH. TRANSFER TO IRSIT
QUIRK, BRUCE (USGS)	OCTOBER 16-28, 1988	TUNIS	\$0.00	13	\$0.00	0	\$0.00	IDENTIFY PROJECTS STEPS RE SAT. IMAGING TECH. TRANSFER TO IRSIT
LABIB, ADEL (AT&T)	OCTOBER 5-10, 1988	TUNIS	\$0.00	5	\$0.00	0	\$0.00	ASSESS MARKET POTENTIAL FOR AT&T PRODUCTS IN NORTH AFRICA
GRAND TOTAL				966.9	\$212,602.00	330.50	\$2,099.04	

## II. GENERAL PROJECT DESCRIPTION

## II. GENERAL PROJECT DESCRIPTION

### A. OVERVIEW OF IRSIT

#### 1. Institution Versus Projects

From the beginning at IRSIT, there has been a continuous and healthy tension between the demands of building an institution and completing appropriate projects. This tension is necessary since the driving element behind IRSIT, the ability and orientation to produce self-supporting products and services, is new to Tunisia and, in fact, new to the Mahgreb region. Given that so many of the core services in Tunisia are, to date, governmental or quasi-governmental, IRSIT must balance between the type of applied research with broad applicability (which can be used by current quasi-governmental organizations) and those products and services useful for smaller private enterprises within Tunisia. Each type of organization (or market) has a different orientation, approach, and scale.

#### 2. Proper Working Environment

IRSIT has worked extremely well, particularly during the last two project years, to establish a proper working environment for its staff, and to establish the infrastructure necessary to allow it to operate as a viable group in telecommunications and computer science. This effort has been accomplished very rapidly, given that it often takes five years to establish an applied research group. IRSIT already has a reputation within Tunis for:

- a) Well-trained, U.S.-educated working staff;
- b) Technically up-to-date, serious, and hardworking staff;  
and
- c) A group able to respond quickly to demands.

The comparative youth of the IRSIT staff--the average age is approximately 28 years--needs to be countered by the perception of considerable experience and project management capability as part of that youth.

#### 3. Breakthrough Relationships with Public and Private Sectors

IRSIT has established, in just three-and-a-half years, six long-term relationships with private sector companies or institutions, some of whom it has worked with for over two years. The continuation of these relationships is important to the overall mission of USAID, and to IRSIT in retaining its leadership role for applied products and services. In the quasi- and full-public sector, IRSIT has acquired contracts for work with the DGT (the Tunisian telephone company), ETAP (the parastatal oil company), and the Prime Minister's office.

## **B. DESCRIPTION OF PROJECT COMPONENTS**

The Tunisian computer Project was implemented almost completely by IRSIT, which coordinated all project activities. IRSIT worked with concerned ministries, institutions and the Tunisian private sector in carrying out activities in secondary and higher education and industry.

The project focussed principally on strengthening the capacity of IRSIT to lead in planning, managing and conducting research strategies for a broader, contextually appropriate, application of computer technology in Tunisia. Through training, technical support and the support of research and development and formal exercises, the resource base of IRSIT improved as well as that of the Ministry of Higher Education and Scientific Research (MHESR) and the Ministry of National Education (MNE). A key vehicle for the project was the selection and prosecution of pilot activities introducing computers into the higher, secondary and non-formal educational systems of the country. While these subprojects themselves were developmentally and economically important, they were justified primarily as providing the experience to the GOT in innovation in computer technology to allow forceful future efforts on a larger scale.

The project components, including a description of the specific outputs, inputs that were required to produce these and their associated financial requirements are described below.

### **Component No. 1: Technical Support**

Technical assistance under the project helped to establish institutional capacity of the GOT, through IRSIT, to develop the ability to critically assess the feasibility of potential computer research and development activities leading to applications throughout the Tunisian economy. This assessment has been with respect to cost benefit and practicality of applications, to evaluation of software and hardware, to modify applications accordingly for the Tunisian context, and to evaluate developments in computer technology. A primary objective of the technical support component of the project has been to establish linkages between Tunisian institutions, primarily IRSIT, and U.S. institutions and industry. Another objective has been to link Tunisian research capacity in computer technology with Tunisian industry and other sectors so that research could be driven by specific applications needs. AED has worked with IRSIT for the life of the project and provided a U.S. resident scientific advisor, as well as additional short-term T.A. advisors working as necessary with IRSIT, MHESR, MNE or pilot activities, institutional analysis, or planning exercises as were required. IRSIT provided a full-time counterpart for project activities and established research and development teams to support project research activities as necessary.

AED was responsible for developing linkages with U.S. and third country institutions, for developing exchanges of teachers and scientists, for developing a program for training of trainers, particularly for secondary education and, for designing observation tours to the U.S. so that key Tunisian scientists and educators could contribute to developing and reinforcing experiences. The technical assistance provided guidance in all project components and provided leadership to the GOT in developing its capability in these areas. Particular attention was given to development of Tunisia's ability to objectively evaluate activities in the area of computer technology with a focus on impact, cost effectiveness, and cost benefit. AED provided a computer science expert to the GOT, through IRSIT, who helped to stimulate an environment conducive to designing research projects, developing proposals for their execution, and funding these activities. The contractor and CNI, working on behalf of the National Committee for Computer Technology, also made recommendations to IRSIT for initial selection of institutions and substantive areas for project activities in computer technology. Finally, AED provided a framework for evaluating existing hardware and software with respect to Tunisian needs and resources.

Technical assistance helped IRSIT, the GOT, and the private sector to work with advisory groups for computer technology activities and assisted the GOT in establishing priorities for research in computer technology. A joint GOT/USAID advisory committee (including U.S. industrial and commercial sector representation) was established by AED for the project. A necessary output of this project component was clear research planning in the area of computer technology within IRSIT, and plans within the MHESR and the MNE for introducing computer technology and supporting activities.

#### Component No. 2: Pilot Projects and Applications Research

Pilot project activities were aimed primarily at developing the institutional capacity of IRSIT, the Centre Bourguiba des Micro-informatique (CBMI), and the MHESR to examine proposals for computer applications in education and other sectors and to determine feasibility, funding mechanisms, evaluation designs, and implementation plans. While there have been immediate outcomes for those participating in the pilot activities and users of products developed, the primary outcome from this project component has been a capacity, within Tunisia, to continue developing and evaluating appropriate applications of computer technology to the education sector and to the industrial and service sectors.

Activities in this project component fell into three broad categories: higher education pilot projects, secondary education pilot projects, and applications research. Pilot projects in all three categories sought to introduce computers in a manner which was efficient and cost effective.

In higher education, emphasis in the pilot projects was placed on computer applications to enhance the teaching environment. At this level, applications have been identified (e.g., CAD in the engineering schools) which will lead to greater productivity in post-collegiate employment and increased efficiency in use of the applications. Students who participated in these pilot projects are expected to be able to directly apply skills obtained in the project experiences immediately after graduation. Participation in the pilot activities prepared them for roles in computer technology directly applicable to Tunisian applications, and, accordingly, the sectors in which they now work are experiencing benefits from their participation in project pilot activities. Pilot activities in higher education have been based on complete proposals for activities, including plans for evaluating the impact of the activity on the learning from the activity and in terms of cost effectiveness and cost benefit of the application.

Projects in higher education were selected, based on merit, using the following criteria: 1) the estimated economic and developmental importance of the proposed innovation, to be verified by cost-benefit analysis as appropriate; 2) the need for innovation of computer technology in the field chosen; 3) the scientific and technical merit of the proposal (i.e., appropriate hardware, software and courseware, state-of-the-art applications, etc.); 4) the appropriateness and cost-efficiency of the didactic approach that would be followed; 5) the clarity and importance of the university/industrial linkage in the project; 6) the linkage with appropriate U.S. institutions; 7) the variety of projects approved (i.e., efforts were made to carry out subprojects in a variety of disciplines and institutions, both to maximize the experience gained and the demonstration effect); 8) the integration of practical Tunisian case study material with appropriate educational curriculum; and 9) quality and efficiency of proposed plans for evaluation of the pilot activity. In addition, the general criteria for all pilot activity proposals (listed below) were applicable.

In secondary education, the focus of the IRSIT project was on developing specific pilot activities within carefully chosen content areas and student populations to evaluate the efficacy of computer use in teaching. Both cost and quality factors were required in the designs of these activities. Activities required clear proposals defining the content to be delivered, the learning objectives to be achieved, and the methods for evaluating the impact and relative value of the computer-based activity. The primary vehicle for assistance to secondary education was the CBMI (later renamed the INBMI). This organization, only partially supported by GOT funds, provided computers, software, instruction, and evaluation in two significant pilot schools--the Lycée Bourguiba, and the Lycée Ariana--as well as providing "extension" type education to out-of-school and adult learners. The IRSIT project provided considerable Apple McIntosh, and IBM Clone

computers, as well as assorted printers to CBMI. Included in the service was initial configuration, installation, training of selected personnel, establishment of linkages with U.S. universities, and evaluation.

In addition, a competitive procedure was used to select other organizations and projects for funding, with selection criteria based on: 1) diversity of secondary school applications (i.e., it was preferable to have an application in electrical-mechanical studies and one in mathematics than to have two in mathematics); 2) scientific and technical merit of the proposals; 3) feasibility of the proposed innovation; 4) educational, economic and developmental importance of the proposed training innovation; 5) involvement of teacher training institutions and other institutions that would be required for the large scale dissemination of the subproject if successful; 6) involvement and approval of private sector representatives; 7) quality of the evaluation scheme proposed for the innovation; and 8) such other criteria as the MOE deemed appropriate.

The final set of pilot activities under the project were in the public and private sectors outside of the formal field of education. Activities in this area led to research enhancement or on-the-job training which made a specific sector or industry more productive as an immediately visible result of the pilot project. For non-education pilot projects, the activity had to have a clearly defined proposal including a systematic approach to evaluating the cost effectiveness and cost benefit of the activity. Half of these activities were aimed at the Tunisian private sector.

Assistance in pilot activities included co-financing costs with the GOT; helping IRSIT set up criteria for selecting activities and institutions, both in Tunisia and in the U.S. for involvement in activities; training of resource teachers; selection of curricular content appropriate for computer-based approaches; working with principal investigators and senior scientists of IRSIT, MHESR, and MNE in reviewing existing courseware and experiences in the areas; ensuring hardware and software access; working with IRSIT in training of personnel and developing a program for training teachers in computer-based instruction; and providing assistance and training in developing evaluation designs for activities.

The contractor worked to establish linkages, primarily for IRSIT, with U.S.-based schools, universities (see Exhibit 1), and other organizations involved in computer technology so that a continuous exchange of ideas and experiences could be developed. Information banks developed under the project served as a basis for examining previous experience in areas considered for pilot activities under the project. Finally, necessary hardware and software were provided under the project to ensure that the pilot activities could be accomplished without undue delay.

A coordinating committee was established early in the project, under the auspices of IRSIT, to review all proposals for pilot activities. This committee included members from IRSIT, CNI, and MHESR, and other GOT members as deemed necessary, including industrial/commercial sector representation, either on a permanent or ad hoc basis, to evaluate substantive proposals received. The chair of the committee was the Director of IRSIT, or his representative. For funding approval, the following criteria were necessary, but not complete prerequisites.

- o A clear detailed proposal indicating objectives, staffing, implementation plans, budget, timetable, equipment needs, and other support provided.
- o A justification for the proposed activity, including a clear explanation of the applicability of the results of the activity in reducing costs, expanding services, improving quality, etc. in a specific sector.
- o An assessment of the likely impact on cost in the sector or application.
- o A clear and methodologically sound design for evaluation of the activity.
- o Verification of institutional support for the activity by the institutions(s) involved in the implementation of the activity.

Evaluation of the proposal placed high priority on the potential of producing applicable products, cost implications (including cost benefit of likely products), and likelihood of continuation of the activity after pilot funding terminated.

Those activities which the committee recommended for funding were subject to A.I.D. final approval.

While no minimum or maximum values of funding were set a priori under the project, most activities did not exceed \$150,000 each. The project funded at least three and up to 10 activities in each of the three component areas.

### Component No. 3: Training

Training activities under the project fell into four categories: U.S. short-term training, in-country training, observational tours, and conference attendance. No long-term training was supported under this project. Long-term training was provided under USAID Project 664-0315, Technology Transfer.

U.S. training was necessary under the project since many activities in the area of computer technology have been under development in the U.S. and since computer usage in education is more advanced and computer technology is more widely used in U.S. industry than in Tunisia or other developing countries. IRSIT has been developing its capacity as a viable research institute via staff contact with state-of-the-art firms to make them competitive among developers of computer applications. U.S.-based training consisted primarily of supporting Tunisians in short courses, exchanges, and similar activities of one semester or less, primarily at U.S. institutions of higher education with outstanding computer programs and U.S.-based research institutions. Candidates for U.S. training were proposed by IRSIT's governing committee and subject to approval by A.I.D. for project funding. Preference was given to training which would lead to clearly applicable skills. The project supported, on average, 10 trainees per year for the 3.6 years of the project. Trainees were selected from IRSIT or, while under the auspices of IRSIT, drawn from Tunisian institutions of higher education and organizations involved in application of computer technology in Tunisia. Since long-term training was provided under agreement A.I.D. Project 664-0315, Technology Transfer, in the field of computer science, the project required that specific trainees supported under the Technology Transfer project be interviewed after their return to work with IRSIT or IRSIT projects.

Since research activity was clearly dependent on knowledge of existing research activities, previous findings, and present experiences, the project funded observational travel for key Tunisian researchers and planners involved in information technology. These visits included education institutions, research institutes, industry, and public and private sector organizations involved in computer technology. These visits were proposed by IRSIT and approved by AED. The project agreement required that the agenda, purpose and objectives of the visit be specific and of obvious worth for the individuals in the positions which they hold. The project supported those visits which were most applicable to directions being taken by the Tunisian program and a justification for the observational tour was presented to A.I.D. by IRSIT and the technical assistance contractor, which made logistical arrangements.

Since A.I.D. requires host country participation in project costs, consistent with A.I.D. policy and regulations, the GOT funded all international airline fares for training.

In-country training was targeted towards producing teachers qualified to introduce computer technology in appropriate educational settings and towards providing researchers, scientists, and end-users with skills necessary to apply computer technology in their work. While most of this training was conducted by Tunisians, the project supported the technical assistance necessary

to develop curricula for training and to set up institutional capacity after the project.

Component No. 4: Institutional Planning, Development, and Analysis

Activities under this project component focussed on developing a capacity within Tunisian institutions to maintain relevant research and other activities in computer technology after the project ended. The project worked with IRSIT, and through it with CNI, the MHESR, the MNE, and educational institutions such as CBMI, ENSI, ISG, etc., to develop a comprehensive plan for activities in the field of computer technology. IRSIT was chosen as the implementing agency and primary target for technical assistance under the project since it had been given high-level support and attention for this role by the GOT. Specific outputs from this project component included clear coordinating mechanisms for institutions involved in computer technology; a GOT statement of priorities in computer applications, including computer based education; and plans in both the MHESR and departments of the University of Tunisia, Tunis, for introducing computer technology in an integrated, cost-efficient, and cost-competitive way to the curricula of schools. The project provided technical assistance to the GOT to evaluate the impact of computer technology on education and to examine its needs in the area of computer and related technologies. These needs considered existing resources, both human and institutional, and manpower and demand projections. Based on the determination of needs, alternative solutions, with benefits and costs, were outlined. Project consultants examined the need for various new, discrete, computer-oriented institutions, such as the GOT's proposed, American-oriented, higher technology institute, labeled the Carthage Institute of Technology, included in the Tunisian FY 1985 request to A.I.D. Consultants also assessed the competing merits of modifying institutions already in existence to achieve the same technology end. On the basis of this examination of alternatives, recommendations were made to both the GOT and A.I.D. for separate and joint review.

The project specifically worked to establish linkages between higher education institutions and private industry in Tunisia to develop a needs-based approach to computer technology in higher education and research.

As a prerequisite to institutional capacity, the project provided support for developing a clearinghouse for evaluated applications in both education and industry, and provided necessary equipment to stimulate research capability at IRSIT.

Since communication was necessary to stimulate quality research, the project supported an annual colloquium for presentation of research activities, findings, and priorities.

This fell under the auspices of IRSIT and drew heavy regional participation.

Finally, since a research institution could not survive without senior scientists to stimulate activity and guide research efforts, the project provided support over the three years of the project for supplies and incidental costs of research for senior scientists at IRSIT, on the condition that half of the funding be obtained from other Tunisian or regional sources. The project also supported a BITNET connection between IRSIT and the U.S. The GOT provided the senior scientists for senior positions either on a permanent basis or on release time from university or private sector positions. This support recognized the commitment of the GOT to encourage individuals from throughout the region to assume posts as senior scientists at IRSIT.

### III. COMPUTER TECHNOLOGY PROJECT ACTIVITIES

### III. COMPUTER TECHNOLOGY PROJECT ACTIVITIES

The project activities in this section are outlined by Components. Within each component there are several major projects and in some cases, subprojects. Within each project and subproject the activities are broken down into the following subheadings:

Objectives, Clients, Key Research, Staff, Project Background, Major Equipment Purchased, Activities, Short-term Consultants, Participants, Accomplishments, Major Accomplishments, Future Plans, and Lessons Learned.

Under a few circumstances, this breakdown is condensed to describe the specific activity more accurately.

#### A. COMPONENT No. 1: TECHNICAL SUPPORT

##### 1. Modeling and Industrial Applications

Location of "Locusts" using Satellite Technology

##### Objectives

To create a capacity at IRSIT to produce satellite maps and geographic information systems.

##### Clients

Ministry of Agriculture, Center for Remote Sensing, National Institute of Meteorology.

##### Key research staff

Mr. Naceur Chemmam  
Mr. Khaled Bsaies

##### Project background, motivation, assumptions

In March 1988, it appeared that conditions in the Sub-Saharan countries would produce potentially dangerous numbers of locusts ("crickets") in Tunisia in Fall 1988, and perhaps in subsequent years. The USGS/EROS Data Center confirmed that a satellite imaging facility in Tunisia would be useful not only to control locusts, but also as a critical element in projects such as agricultural yield forecasting, pollution control, and desertification.

##### Major equipment purchased for project under USAID contract

##### Hardware:

The VAX 6320 purchased for the Core Computer Center was used in this project along with the following specialized peripherals:

-- Calcomp 5825 color laser printer.

- Image Viewing and Analysis System (IVAS image workstation).
- Schlumberger/Benson 6301 digitizer.
- Hewlett Packard Draftmaster I plotter.

**Software:**

LAS (public domain from USGS).  
ADAPS (public domain from USGS).  
PC-ARC/Info.

Activities

Produced greenness maps for use in Tunisia (done by USGS in 1988-1989), and conducted seminars for potential users of these maps in their application.

Defined hardware and software requirements for producing satellite maps at IRSIT, trained IRSIT staff in the use of hardware and software, installed hardware and software at IRSIT.

Short-term consultants

Mr. Gray Tappan to Tunis to observe IRSIT and brief Ministry of Agriculture on potential of greenness maps and geographical data bases in Agricultural projects in Tunisia.

Dates: July 10-17, 1988

Cost: Covered by PASA with USGS.

Mr. Tom Loveland and Mr. Bruce Quirk to IRSIT to identify project steps to transfer satellite imaging technology to IRSIT.

Dates: October 16-October 28, 1988

Cost: Covered by PASA with USGS.

Mr. Gray Tappan to Tunisia to conduct classes in Ministry of Agriculture in use of greenness maps to control locust activities.

Dates: November 10-17, 1988

Cost: Covered by PASA with USGS.

Mr. Gray Tappan to Tunisia to follow up on use of greenness maps for locust control with Ministry of Agriculture.

Dates: February 10-17, 1989

Cost: Covered by PASA with USGS.

Participants visiting the U.S.

Mr. Mohamed Rached Boussema to University of Michigan to participate in seminar on use of satellite data to monitor natural resources.

Dates: June 21-August 13, 1988

Cost: \$10,305

Mr. Naceur Chemmam to participate in Siggraph conference and observe satellite imaging software at USGS/EROS data center.

Dates: July 28-August 17, 1988

Cost: \$4,484

Mr. Naceur Chemmam to USGS/EROS data center for intensive hands-on training in LAS and ADAPS software.

Dates: June 26-July 21, 1989

Cost: \$2,115

#### Accomplishments

Distribution of greenness maps to Ministry of Agriculture and other GOT (10/88 through 4/89).

Identification and procurement of hardware and software for image processing (2Q89). (See, also, Core Computer Center below.)

Identification and delivery of geographical information system and training video tapes for PC-ARC/Info to IRSIT (3Q89).

Identification of NOAA-9 satellite data for historical database (4Q89).

IVAS Workstation has been installed and is operating as configured.

Procurement of appropriate NOAA-9 data for use at IRSIT.

#### Major Accomplishment

The production of the first satellite maps in North Africa.

#### Future plans and unresolved issues

Install LAS and ADAPS software at IRSIT.

Data was collected for a database that would enable method modelling within the LOCUST project. In light of the currently weak resources to access this information, support has been requested from the PNUD. A plan has been developed which outlines the necessity to extend the project from North Africa to a broader pan-African scale, including the sub-Saharan countries.

PNUD has voiced an interest in this project. Subsidies from this organization are expected through PNUD's Regional Software Development Center project in Tunisia. The image processing techniques are useful in the analysis, which is being conducted in collaboration with the company, SOTINFOR, in Tunis.

A new project to install a database on the Telecommunications Network has been identified with the Direction Generale des Telecommunications (DGT). It is foreseen that this project will commence early 1991.

IRSIT is taking steps to introduce new geographic information systems techniques to the Environmental Agency, the Ministry of Capital, the Ministry of Public Health, and the city of Sousse to resolve their specific problems.

### Lessons learned

Implementation of sophisticated software on sophisticated hardware for the first time in the region requires very close cooperation among several vendors, IRSIT, and the U.S. institution providing the technology. Often information from one source is incomplete or misleading. Every significant detail must be checked and crosschecked with all institutions and vendors concerned. Also, schedules are considerably more at risk than a similar enterprise would be in the U.S.

## 2. Electronic Mail, Networks, and Office Networks

[Note: Electronic Mail, Networks, and Office Networks also falls under the scope of Component No. 4 and will appear in that section, though fully described only here.]

### Objectives

To develop an infrastructure at IRSIT which will allow the research staff to use a variety of resources within IRSIT and internationally.

### Clients

IRSIT staff, cooperating institutions, and IRSIT clients.

### Key research staff

Mr. N. Abida  
Mr. M. Makni  
Ms. Vivian Boudhaouia  
Mr. Nabil Sahli

### Project background, motivation, assumptions

In order for IRSIT researchers to remain in the forefront of rapidly changing computer technology, they must be able to communicate with each other and with other key research scientists throughout the world. IRSIT's internal local area network and its connection with the worldwide research community through BITNET accomplished this.

### Accomplishments

Through the internal network at IRSIT, research staff are able to access the DEC/VMS system, the UNIX system on the DPX 1000, and the PC/DOS environments from each PC workstation.

### Major equipment purchased for project under USAID contract

3COM Local area network server and repeaters with connections to external telephone lines and to IRSIT personal computers and workstations.

IBM PC/AT workstations for technical staff and Apple SE microcomputers for administrative staff (all with connections to LAN and VAX).

Turbonet hardware and cabling for Apple computers.

TCP/IP software from Network Research Corporation (for VAX and PCs).

NFS software from Sun.

#### Activities

Selection and installation of a local area network, connection to the VAX/VMS, Sun, and Bull/UNIX systems.

#### Short-term consultants

Dr. Jane Lucas to IRSIT to prepare initial office automation requirements statement.

Dates: November 18-Dec 31, 1986

Person-days: 12

Cost: \$5,371

[See Appendices for full Consultant Report.]

#### Participants visiting the U.S.

Ms. Vivian Boudhaouia to Rockville, MD for courses in 3COM systems management

Dates: January 18-29, 1988

Cost: \$2,610

Mr. Nabil Sahli to Santa Clara and Los Angeles, CA for courses in 3COM installation and support.

Dates: February 13-March 21, 1988

Cost: \$7,353

#### Accomplishments

Local Area Network installed (3Q88), and connected to international lines (1Q89).

Service extended to 24 hours/day with uninterruptable power supply (3Q89).

#### Major Accomplishment

This is the first successful local-area network in Tunisia to integrate IBM PCs and Macintoshes. A similar system has been installed in the Ministry of Higher Education and another similar system is being considered by the Prime Minister's Office.

#### Future plans

Provide BITNET services to Tunisia through a BITNET node at IRSIT.

Provide LAN consulting services to the Tunisian public and private sectors.

### Lessons learned

Network services quickly become necessities both within IRSIT and externally. For example, the AED/Washington office and AED/Tunis correspond daily via E-Mail rather than by telephone. Because of this it is crucial that reliability, availability, and maintainability be designed into such systems. It is equally important that a network manager be trained and assigned to resolving problems, upgrading the network, etc. With the advent of the system, telecommunication charges between Washington and Tunis dropped by 50 percent, while the sense or "feeling" of contact improved.

### 3. Secondary School Activities

[Note: Secondary School Activities fall under the scope of all four project components and will appear under each, though fully described only here.]

Director of Institut National de Bureautique et MicroInformatique: (INBMI) Dr. Moktar Latiri.

#### Objectives

To increase the use of microcomputers in secondary schools in Tunisia.

#### Clients

The INBMI, headed by Dr. Moktar Latiri.

#### Key staff

Dr. Moktar Latiri

Staff at INBMI

Selected teachers at Lycee Ariana and Bourguiba.

#### Project background, motivation, assumptions

In order to develop a computer-literate professional class in Tunisia, experience in the U.S. has shown that computers should be introduced as early as practical into the educational curriculum. To this end, three advanced Lycees were selected (Ariana, Bourguiba, and CBMI) as pilot institutions for the introduction of modern microcomputer facilities.

#### Major equipment purchased for project under USAID contract

41 Apple Macintosh Plus computers with custom wiring kits.

72 Apple II GS microcomputers with 512 KB and external disk drives.

13 IBM PC/AT personal computers.

2 Zenith Laptop computer.

- 1 IBM PS/2/80 personal computer.
- 2 Apple MacIntosh II.

System software for the above.

Activities

Selection and installation of Apple and IBM microcomputers.

Training of teachers in Lycees.

Development of pilot trilingual software (English, French, and Arabic).

Short-term consultants

Mr. Bruce Geisert in Washington, DC to identify procurement services.

Dates: December 8-12, 1986

Person-days: 2

Cost: \$360

[See Appendices for full Consultant Report.]

Dr. David Wyatt to Tunis to identify requirements for microcomputers at INBMI (then CBMI).

Dates: December 4-21, 1986

Person-days: 57.5

Cost: \$13,800

[See Appendices for full Consultant Report.]

Dr. David Wyatt to Tunis to conduct training of trainers course for CBMI and selected Lycees.

Dates: May 16-24, 1988

Person-days: 29

Cost: \$6,960

[See Appendices for full Consultant Report.]

Dr. Robert Taylor (Columbia Teachers College) to Tunis to determine need and training requirements for training the teachers of secondary schools in Tunisia.

Dates: June 19-23, 1989

Person-days: 8

Cost: \$2,000

[See Appendices for full Consultant Report.]

Dr. Robert Howard (ACOT Program Supervisor, Columbus, Ohio) as follow-up to visit by Dr. Taylor, to Tunis to work with Dr. Latiri and Tunisian Lycees on existing CAI capability in order to stimulate interdisciplinary approaches to problem-solving; with students to conceive, design, and implement computer problem-

solving systems; and to provide demonstrations, workshops, and teacher training.

Dates: December 2-9, 1989

Person-days: 9

Cost: \$1,773

[See Appendices for full Consultant Report.]

#### Participants visiting the U.S.

Dr. Moktar Latiri visited high schools in the Washington, DC area and Apple Corporation to observe leading edge use of microcomputers in secondary education in the U.S.

Dates: May 12-31, 1989

Cost: \$5,609

[See Appendices for Participant Travel Report.]

#### Accomplishments

Selection of Apple France as supplier of Apple microcomputers (4Q87).

Installation and acceptance testing of microcomputers at CBMI and Lycees (4Q88).

Training of trainers initiated (2Q89).

#### Future plans

Dr. Robert Taylor's recommendation that a Teachers College for Informatics be established in Tunisia should be studied and developed further.

#### Lessons learned

This pioneering effort for the introduction of new pedagogical approaches in a dual language environment in Tunisia provided several important lessons for technology transfer.

The first is that an activity undertaken with considerable voluntary effort and somewhat outside the formal educational structure of a country can have a substantial impact. Not only have students with little prior training learned considerably more about computer use, but their parents as well (many of them influential in government, business, and academics) have benefited from both direct and indirect exposure to educational computing.

Second, the very process of experimentation with new pedagogical approaches opens up new avenues for faculty and teachers trained in traditional ways. While the process of learning to use new pedagogical tools appears slow, an alteration in pedagogical approach seems to create some rethinking of both the substance and timing of material being taught.

Third, this effort has indicated that administrative linkages and faculty incentives (and perceived rewards) remain important when introducing new pedagogical approaches. Only a few faculty, at any one time, are usually willing to make the extra effort and take the extra time to work with new techniques.

Typically, with computers, students tend to adopt new approaches more quickly than the teachers.

Finally, introduction of computer-assisted instruction nationwide requires careful attention to the support structure and in-service teacher training which accompanies an introduction. Lacking this, the pace of "reform" is much slower than most donor agencies foresee.

The INBMI is a breakthrough innovation--not often seen in Arab countries. Its lessons, drawing as the foundation does on considerable U.S. and European experience, are extremely relevant to other Arab countries.

#### **4. Miscellaneous Activities**

Dr. Robert Babb to Tunis to present paper on software development for parallel systems.

Dates: March 23-28, 1988

Person-days: 6

Cost: \$1,200

Dr. Robert Babb to Tunis to chair session on parallel software development at 10th Tunisian-French conference on software development.

Dates: May 21-29, 1989

Person-days: 9

Cost: \$200

#### **5. New Project Initiatives**

The following projects have been undertaken by IRSIT since January of 1990 as a direct result of activities performed under the auspices of the USAID-sponsored Tunisia Computer Project:

##### **a. Multilingual Systems**

This project, which is being implemented with INRIA (France) has placed at IRSIT's disposal a font editor which permits the generation of multiple fonts in Arabic. Moreover, a font generation project for the Microsoft (USA) account is being conducted in cooperation with Sphere Informatique (Tunisia). These fonts are aimed at enhancing the printing capabilities of software

packages which use the Arabic version of MS DOS. This operation should be complete by the end of 1991.

#### **b. Network Modelling**

This new project, developed in collaboration with INRIA, aims to acquire expertise in the fields of simulation, information and telecommunications modelling. The Sphinx software, developed by INRIA, has been installed on the IRSIT SUN machines which were recently acquired by IRSIT. Initial experiments are being performed on the local network by IRSIT. In the framework of these activities, IRSIT is participating in the international Sphinx association.

#### **c. Oil Platform Modelling**

This is a project to stabilize offshore oil platforms, implemented by SEREPT. Begun in January 1990, this project was completed in December of 1990.

### **B. COMPONENT No. 2: PILOT PROJECTS AND APPLICATIONS RESEARCH**

#### **1. Arabization Program**

Principal Scientist: Dr. Salem Ghazeli

##### Goal

The mastery of hardware and software technologies for Arabized systems, and the development of high technology products which promote the Arabic language. The program focused on techniques for Arabizing computer systems and also on processing the Arabic language, text and speech. The work was divided into four activities.

##### Activities

The "Arabization Program" is a general descriptive title for a group of separate activities involved in the development of Arabized systems and high technology products. These different activities or subprojects are listed in this subheading and are fully described thereafter. Since each of these subprojects contains all the elements of a major project, they will be broken down using the general subheadings.

#### **a. Natural Language Processing**

Computer-aided translation from other languages into Arabic has many difficulties related to the structure of the language. Tools such as a dictionary and a grammatic analyzer were developed. These tools will allow IRSIT to develop English-to-Arabic translation products in the future.

b. **Speech Processing**

This aspect focused on spectral and temporal analysis of the acoustic signal and its parameterized description. Future applications are related to the development of systems of Arabic speech synthesis.

c. **Automatic Document Input**

This aspect was based on optical character recognition. The ALCARI system developed at IRSIT features very high recognition accuracy. Software and hardware approaches are being considered to improve recognition speed.

d. **Multilingual Systems**

Arabization of systems requires expertise in the concepts of generating Arabic characters, text editing, the interfaces between applications software and operating systems, and development of standards.

The following describes each of the above subprojects.

a. **Natural Language Processing**

Objectives

The processing of lexical and morpho-syntactic Arabic to develop the following:

- a computer-assisted English to Arabic dictionary
- an Arabic Spelling check program
- Arabic teaching materials
- a computer-assisted English to Arabic translation system (based on the IBM-compatible Personal Computer).

Clients

This research was conducted as an internal project within IRSIT. Future clients are expected to include Tunisian companies and international companies with an Arabic-speaking market, e.g., companies with a need to translate maintenance manuals into Arabic or executives who receive telexes and correspondence in English and want to get the "sense" in Arabic before passing the correspondence to a professional translator.

Worldwide Communications Corporation (WCC) expressed an interest in cooperating with IRSIT to bring its computer-assisted translation technology (French-English-Arabic) to Tunisia. Dr. Ghazali met with Mr. Nevil Garret, President of WCC, in early 1988. There, Dr. Ghazali discussed the automated translation technology produced by WCC and how it could be integrated most effectively into Tunisian industry.

Key research staff

Dr. S. Ghazeli  
Mr. C. Bel Falah  
Mr. M. Achour  
Mr. N. Garbout

Project background, motivation, assumptions

Automatic translation from English to Arabic to date has only been accomplished on large, expensive minicomputers (e.g., DEC VAX) using prohibitively expensive software (\$50,000). A new American company, PC Linguistics, has developed translation software from English to Spanish or French, which runs on IBM compatible personal computers. IRSIT, working with PC Linguistics, is using its approach to produce an English-Arabic translation system which is inexpensive and runs on IBM-equivalent personal computers.

Major equipment purchased for project under USAID contract

IBM PC/AT, Compact Disk Reader for CD-ROM's, Arabized MS/DOS, Arabic text editor, Greenleaf software development tools.

Activities

English-Arabic dictionary was constructed.

English syntax parser, Arabic verb conjugation system and translation system in C-language were constructed so that it was portable across various computer systems.

Parser with English-Arabic dictionary was constructed.

Short-term consultants

Mr. George Mallard (PC Linguistics) in Tunis May 1988 to prepare joint project agreement with IRSIT and to design English-Arabic system for PC.

Dates: May 10-14, 1988

Person-days: 7

Cost: \$840

Mr. George Mallard in Tunis April 1989 to deliver, compile, and modify translation software, both source and executable versions, for English to Arabic; word-for-word translation at IRSIT.

Dates: April 3-11, 1989

Person-days: 4

Cost: \$480.00

Mr. George Mallard in Tunis October 1989 to follow up on IRSIT-PC linguistics design and implementation of translation system.

Dates: October 10-12, 1989

Person-days: 4

Cost: \$480

[See Appendices for full Consultant Reports.]

### Participants visiting the U.S.

Dr. Salem Ghazeli to visit PC Linguistics in October 1988, to complete the joint agreement between PC Linguistics and begin development of English-Arabic translation system.

Dates: September 11 through October 17, 1988\*

Cost\*: \$5,698

\*This visit also contributed to the Speech Processing project.

### Accomplishments

Investigation of PC Linguistics and WCC as candidates for cooperative projects with IRSIT completed (2Q88).

Proposal from PC Linguistics accepted and joint agreement signed (3Q88).

PC Linguistics supplied with Arabic alphabet and simplified Arabic grammar (3Q88).

Construction of a PC-based Arabic-English dictionary (45,000 English words corresponding to 150,000 Arabic words) which may be an independent product (3Q89).

Development of a graphics-oriented Arabic conjugator which may be an independent product (2Q89).

A prototype dictionary has been created on a CD-ROM to assist in understanding the issues in using this new technology (3Q89).

### Future plans

Within the the context of the computer-assisted translation project, a translation drive has been developed and a fundamental default directory has been finalized. This will enable the translation of the most complex structures: word and verb groups.

An electronic English-Arabic and Arabic-English dictionary is currently being finalized for the Wang (USA) account.

The Arabic Sound Bank is being developed with Tunisian and foreign partners.

### Lessons learned

IRSIT should stay in continuous, informal communication with cooperating consultants from the U.S. They often have small, informal suggestions which turn out to be of major importance. In this case, Mr. Mallard's suggestion to use CD-ROM for the dictionary was a major design innovation.

## **b. Speech Processing**

### Objectives

**Short-term:** The building at IRSIT of a speech analysis and synthesis capability.

**Long-term:** The development of speech analysis and synthesis applications such as text-to-speech. Such applications are used in medicine (for the visually impaired), industry, and the public telephone system.

### Clients

This is an internal project.

### Key research staff

Dr. S. Ghazeli  
Mr. M. Achour  
Mr. A. Braham

### Project background, motivation, assumptions

This project aims to develop a technology rather than a specific product. The technology to analyze and synthesize Arabic speech will make many products possible, and give IRSIT greater leverage in negotiating cooperative agreements with institutions to make specific products. While contact with AT&T Bell Labs helped IRSIT identify the necessary hard- and software for the project, AT&T's proposed cooperative agreement with IRSIT to develop Arabic speech technology was judged to be unfavorable to IRSIT. Negotiations were undertaken with a Kuwaiti firm and with a major U.S. software vendor for a more favorable joint development agreement.

### Major equipment purchased for project under USAID contract

IBM PC/AT, Data Translation analog-digital card, and analysis software.

MAC II with Viking monitor, and GW instruments software.

Sun 3/150 with AT&T digital card and WAVES software.

Microphones, amplifiers, and speakers.

### Activities

Speech analysis workstation and associated software installed at IRSIT.

This workstation was used to analyze Arabic speech and demonstrate a basic speech recognition and synthesis system.

### Short-term consultants

Dr. Mark Liberman (AT&T Bell Laboratory) in Tunis June 10-30, 1988 to prepare a joint IRSIT-Bell Labs proposal to AT&T.

Person-days: 21.

Total cost: 0 (Dr. Liberman waived his fee.)

Mr. Adel Labib (AT&T Marketing) in Tunis October 5-10, 1988, to assess market potential for AT&T products in North Africa.

Person-days: 5

Total cost: \$0

#### Participants visiting the U.S.

Dr. Salem Ghazeli to visit AT&T Bell Labs in January 1988; also to MASSCOMP to initiate contact with AT&T and observe potential speech-processing workstations.

Dates: January 24-February 14, 1988

Cost: \$3,387

#### Accomplishments

Two experimental models of speech workstations were configured: PC-based in 2Q88 and MAC II-based in 1Q89. Based on these experiences a third advanced model was procured by the project. Based on the Sun 3/150 it was completed (4Q89).

Creation and refinement of acoustical and evaluation.

#### Future plans

Identification of a U.S.-based research partner whose goals mesh with IRSIT's.

Continual development of evaluation and acoustical corpi.

Development of a management system for acoustical data.

Analysis (segmentation and labeling) of speech data.

Selection of synthesis techniques and development of algorithms.

#### Lessons learned

Cooperation with "big name" commercial partners, such as Bell Laboratories may not always be in IRSIT's best interest. Such partners often see North Africa and Tunisia as too small a market for them and often want to set up "one-sided" agreements for sharing the results of cooperative research.

### **c. Automatic Document Input**

#### Objectives

To create an environment for automatic input of multilingual documents (Arabic and Latin) consisting of:

- software for recognition of Arabic and Latin text
- Arabic-Latin dictionary for spelling checking.

#### Clients

Prime Minister's Office.

### Key research staff

Mr. Chedly Mohamed Fehri

Mr. Mohsen El Hafsi

### Project background, motivation, assumptions

The recognition of Arabic characters poses problems not encountered in the recognition of Latin text. Printed Arabic text joins the characters (as in written Latin script), and the characters may be "stretched" or compacted to fit stylistic ends. This necessitates innovative algorithms for Arabic character recognition.

Once such a system is developed, it could be used stand-alone, or as an added system in an Arabic office automation system.

### Major equipment purchased for project under USAID contract

Compaq '386 PC, Windows and Wordstar software.

Microtec 300AC scanner and Latin character recognition software.

The VAX 6310 is also used for this project.

### Activities

A highly accurate prototype character recognition system was developed. The recognition rate is 98.5%.

### Short-term consultants

All work was performed by IRSIT staff.

### Participants visiting the U.S. and the Middle-East

8 Staff and guests from IRSIT/CNI to First Kuwait Conference on Informatics (see below: Arabized Videotext)

Dates: March 7-11, 1989

Cost: \$3200

### Accomplishments

Prototype complete of hardware/software system for automatic input of both Arabic and Latin documents complete (1Q88).

Special purpose processors architectures investigated for potential improvement in performance (2Q88). Dynamic programming card selected (3Q88), delivered to IRSIT (2Q89).

Official journal of Government of Tunisia (1957 to present) being input for creation of legal database (ongoing).

### Future plans and unresolved issues

Optimization of Latin and Arabic text-recognition systems by modifying the software algorithm and/or use of specialized hardware. It is likely that the addition of specialized hardware to the personal computer will increase the cost considerably and limit the market potential for this product.

Development of Arabic-Latin dictionary (in cooperation with Natural Language Processing activity above).

The Character Recognition projection has been adapted according to the specifications requested by the company, El Alamiah, and is being finalized.

A new search and recognition project is being identified for Wang (USA).

#### Lessons learned

When proprietary algorithms originally developed for minicomputers are implemented on microcomputers--even very powerful microcomputers such as the 80386--the performance may require significant software and hardware modifications to be practical. These modifications can change the cost and therefore the market for the original product.

#### **d. Multilingual Systems**

##### Objective

To develop a multilingual software development environment under UNIX.

##### Clients

This is an internal project.

##### Key research staff

Mr. Marouen Ben Zineb  
Mr. Meddeb Hamrouni Boubaker  
Ms. Najoua Essoukri Ben Amara

##### Project background, motivation, assumptions

The development of multilingual computer applications is facilitated by allowing the development team to develop the software in a multilingual environment. Such an environment will encourage software development in Tunisia and enhance the teaching of informatics in the universities.

##### Major equipment purchased for project under USAID contract

None.

##### Short-term consultants

None.

##### Participants visiting the U.S.

None.

### Accomplishments

Interface to use Arabic Postscript fonts developed (1Q89).

Prototype for a PC-based font editor constructed (1Q89).

### Future plans

Installation of the MALIN system (a font editor, terminal emulator, context analysis) on the BULL DPX 1000.

Integration of the MALIN tools under X-Windows.

Arabic character generation according to Arabic calligraphy standards and hardware limitations.

### Lessons learned

Average time required considerably exceeds estimates.

## **2. Planning the Phosphate Mines**

### Objectives

To improve the operating and engineering efficiency of the Compagnie Des Phosphates de Gafsa (CPG) through improved planning and use of computers by the engineering staff.

### Clients

Compagnie Des Phosphates de Gafsa (CPG).

### Key research staff

Mr. Imed Jamoussi

Mr. Fethi Tenzekhti

### Project background, motivation, assumptions

Major savings in the cost to extract phosphate are possible with proper planning of the open pit mines in Gafsa. Location of roads, ratios of digging and hauling equipment, blast site preparation, etc., are major examples. In addition, normal mining engineering activities can be much more effectively accomplished with appropriate use of computers. To these ends the CPG signed an accord with IRSIT on September 30, 1987 to pursue the application of computers in the engineering and operations of the CPG.

### Major equipment purchased for project under USAID contract

4 IBM PS 2/50 microcomputers with VGA monitors.

1 IBM PS 2/70 microcomputer with VGA monitor.

### Activities

A training center at the CPG was established for training the engineering staff.

Mine planning software was selected and installed and the mining engineers were trained in management and use.

Short-term consultants

Drs. Donald Gentry and Matthew Hrebar (Colorado School of Mines) to Tunis and Gafsa to outline project and identify needs of the CPG. Also, time in the U.S. to support a visit to Colorado by IRSIT and CPG staff.

Dates: January 8-22, 1988

Person-days: 84

Cost: \$22,596

[See Appendices for full Consultant Reports.]

Dr. John Floyd to Tunis and Gafsa to observe drilling and blasting operations and recommend actions.

Dates: May 21-29, 1988

Person-days: 14

Cost: \$2,800

Dr. John Floyd to Gafsa to follow up on actions taken to improve drilling and blasting efficiency and safety at CPG.

Dates: October 23-31, 1988

Person-days: 18

Cost: \$3,600

[See Appendices for full Consultant Reports.]

Participants visiting the U.S.

IRSIT-CPG team to observe mine planning software and identify characteristics for CPG use.

IRSIT Team, March 31-April 30, 1988:

Mr. Imed Jamoussi, team leader

Mr. Fethi Tenzekhti, principal analyst

Cost: \$10,300

CPG Team, March 31-April 22, 1988

Mr. Kais Daly, Director of Technology

Mr. Ridah Ben Mosbah, Director of Computer Center

Mr. Abdelhamid El Amri

Mr. Abdelmajid S'himi

Mr. Mohamed Nejib M'rabet

Mr. Tahar Mehari

Cost: \$11,345

Accomplishments

Training center installed in Gafsa (2Q88).

Mine planning software selected by CPG/IRSIT group (2Q88).

Drilling and blasting procedures reviewed and recommendations implemented (4Q88).

#### Future plans and unresolved issues

This project was suspended pending further discussions with CPG and possible recruitment of additional staff at IRSIT to replace the two staff members who joined CPG. As of project closing, a permanent hold has been placed on efforts. The CPG itself is installing a LAN.

#### Lessons learned

Professional staff members are perhaps the most important part of a project. Their combination of training in the U.S. and experience in Tunisia is much more difficult to replace than equipment. IRSIT should find ways to retain valuable professional staff in the face of intense competition from other institutions.

Project terms and conditions should be well defined on paper before any action is taken. This avoids misunderstandings between IRSIT and its partners.

### 3. Processing of Seismic Data

#### Objectives

Introduce advanced oil exploration and exploitation technologies to ETAP, the national oil company, so it can better use the data collected by private oil companies in Tunisia and select and adapt exploration software from software development companies.

#### Clients

ETAP

#### Key research staff

Ms. Sophia El-Hedda-Sahnoun

Mr. Aleya Ben Aicha

#### Project background, motivation, assumptions

Tunisia's known oil reserves are expected to be exhausted in 1992. ETAP has access to the data collected in Tunisia by private oil companies. Yet, because its analysis techniques are largely manual, this data cannot be used to the national advantage. This project aims to improve ETAP's ability to locate oil by introducing computer-based analysis technologies.

#### Major equipment purchased for project under USAID contract

None. (Several workstations, and software packages were investigated.)

### Activities

Technology survey of workstations and micro/minicomputer software for oil exploration.

Appropriate hardware/software was selected to assist ETAP in computer-assisted oil exploration.

### Short-term consultants

Mr. Ali Garrouch in the U.S. 1 day/week to locate articles of interest to IRSIT staff and potential consultants to the project.

Dates: 1 day/week January 1988 through May 1989

Person-days: 120

Cost: \$4,800

[See Appendices for full Consultant Reports.]

### Participants visiting the U.S.

Mr. Aleya Ben Aicha to Society of Exploration Geologists, meet with Colorado School of Mines and USGS to observe oil exploration workstations and to survey leading-edge exploration technology.

Dates: October 7, 1987-November 8, 1987

Cost: \$5,843

### Accomplishments

Technology survey of microcomputer-based workstations completed (1Q88).

Technology survey of Vertical Seismic Profiling (VSP) software characteristics and preliminary negotiations with CogniSeis and Seismic Services Limited complete (3Q88).

Preliminary definition of project to transfer VSP technology to ETAP completed (4Q88).

### Future plans and unresolved issues

This project is on hold pending further discussions with ETAP.

### Lessons learned

Oil exploration software and training is very expensive and educational discounts are rarely offered to cooperative projects with ETAP, the national oil company.

As projects are planned and proposals are elaborated, investigators should be sure of the availability of human and computing resources for the project.

#### 4. Telecommunications and Networks/Bilingual Videotext

##### Objectives

To introduce bilingual (Arabic-Latin) videotext to executives, officials, and the general public of Tunisia.

##### Clients

Director General of Telecommunications (PTT). This is a \$370,000 contract between IRSIT and the PTT.

##### Key research staff

Mr. Fethi Anane  
Dr. Karima Bounemra  
Mr. Mustapha Garbi  
Mr. Imed Ghorbel  
Mr. N. Makhlouf  
Mr. Kanaan Jemili

##### Project background, motivation, assumptions

The use of a videotext information system (in the form of MINITEL terminals) has transformed the French lifestyle and is being introduced by several companies in the U.S. (notably the IBM/Sears Prodigy system). With such an information system, Tunisian officials and executives could access financial and other databases, and use services such as electronic mail for more effective management. The general public could use a videotext system (perhaps installed in shopping arcades) for such things as news, theater reservations, shopping, sports, and weather summaries.

The MINITEL project is designed to adapt the French terminal and keyboard to the very particular requirements of the Arabic language. Lacking a worldwide standard for the transmission, interpretation, and presentation of Arabic character sets, IRSIT has pilot-tested a modified MINITEL terminal in a bilingual environment. This project was initiated in 1987 and is ongoing.

##### Major equipment purchased for project under USAID contract

1 Minitel Terminal.  
ORCAD computer-aided design software.  
NOHAU In-circuit-emulator.  
Network analyzer.  
Miscellaneous soldering/desoldering equipment.

##### Activities

Bi-lingual (Arabic-Latin) videotext system "BALVT" developed and demonstrated.

A national videotext standard for Arabic and Latin characters was developed.

### Short-term consultants

None.

### Participants visiting the U.S. and the Region

The following IRSIT and CNI staff participated in the First Kuwait Computer Conference March 27-31, 1989 to present papers on Arab character recognition, extend the contacts made during IRSIT's International Conference on Arabization and Informatics (March 1988), and investigate the applications and market for Arabized Videotext in the Mid East:

Mr. Maher Khemakhem  
Ms. Najoua Essoukri  
Dr. Abdel Belguith  
Mr. Fethi Anane  
Mr. Karim Bouhlila (CNI)

Dates: March 27-31, 1989

Cost: \$3,200

### Accomplishments

Demonstration of a low-cost bilingual Arabic-Latin videotext terminal based on Minitel (2Q89).

Demonstration of a videotext terminal based on the Minitel design and capable of EGA image quality (2Q89).

### Major Accomplishment

Formal signing of a contract with DGT for \$377,000 (4Q89). IRSIT's first revenue-generating contract.

### Future plans

Development of prototype of a "diskless PC"-based, Arabic-Latin videotext terminal (for possible sale in the Mid-East).

The specifications of the bilingual videotext system were proposed to DGT (Direction Generale des Telecommunications). This has expedited the finalization of the second phase of the project. The prototype for the Arabic version of the bilingual videotext, which is currently being analyzed for its industrial applications, is entering its last stage. The bilingual videotext emulator on the PC has recently been finalized. Development of a second project for the MAC has begun.

As for the bilingual feeder, a plan has been developed with Sphere Informatique for the production of a feeder; some new projects are envisioned with Tunis Air and the Tunis Stock Exchange. In conformity with Africa Systems, a project to Arabize the videotext feeder on VAX is being researched. This project may be implemented in collaboration with Digital Corporation.

A North African educational seminar, sponsored by the engineers from DEC, for Algerian, Moroccan, and Tunisian technicians was planned for October 1990.

Finally, the tools for the structure of bilingual pages for the videotext feeder have been developed. A taskforce visit of experts from IRSIT to CNET (France) permitted an evaluation of the work on the internationalization of the Videotex System undertaken by IRSIT. Some standardization steps are being tackled within the framework of the standardization groups under the aegis of INNORPI.

#### Lessons learned

IRSIT took the risk of developing an Arabic prototype before a contract was actually signed with the PTT. This nine-month effort was rewarded with a contract. Research contracts in Tunisia often require considerable effort before the contract is signed because the client wants to see his product before he pays for it.

### 5. Measurement of PTT Telephone Network Service Quality

#### Objectives

Long-term: To rationalize the Tunisian voice telephone network in support of its plan to double the number of subscribers in the early 1990s.

Short-term: To measure the service characteristics of the voice telephone network as actually perceived by the subscribers.

#### Clients

Director General of Telecommunications (DGT) of the Tunisian PTT.

#### Key research staff

Dr. Montasser Ouaily

Mr. Mondher Makni

#### Project background, motivation, assumptions

The Tunisian PTT indicated a strong interest in improving service quality of the voice telephone network and published an RFP for measurement equipment in 1Q88. The PTT and IRSIT have begun a cooperative project to design a measurement system and install a prototype in selected PTT offices.

#### Major equipment purchased for project under USAID contract

None.

#### Activities

A proposal was prepared that was suitable to both the Tunisian PTT and to USAID for measurement of the voice telephone system in Tunisia.

### Short-term consultants

Mr. Jerry Reid (AT&T Ireland) in Tunis October 5-10 to initiate contact between AT&T/Ireland and IRSIT for telephone service quality measurement project.

Person-days: 5

Total cost: \$0

### Participants visiting the U.S.

Mr. Mondher Makni to participate in telephone seminars at AT&T and present IRSIT's draft proposals to AT&T.

Dates: July 6-August 19, 1988

Cost: \$10,520

Dr. Montasser Ouaily to participate in network management seminars at AT&T and USTTI, and develop a joint proposal with UCLA.

Dates: August 9-September 12, 1989

Cost: \$2,438

### Accomplishments

Preliminary proposal presented to Tunisian PTT (2Q88).

Draft proposal prepared with UCLA (3Q89).

### Future plans

Preparation of draft proposal to USAID and to PTT.

A telephone meter-reading project is being implemented for the DGT account. This project is the focus of a research and implementation contract for the sum of approximately TD90,000. Its finalization is expected by the beginning of 1991.

A basic textual data interrogation system has been developed on MAC II. JORT's 1988 legal notices have been submitted in full and consultative experiments on the text are being performed on this basis.

In addition to the Parcel Service X400 which has been developed with the support of CNET, the installation of a BITNET international center is being completed following the acquisition of the feeder software before being installed on the VAX. Moreover, the TCP/IP connections, which enable the exchange of files primarily with the U.S., have been the focus of an agreement between IRSIT and INRIA.

Within the context of French cooperation, the Videotex and Networks projects have been redirected for the coming years. In the future, the electronic parcel services will be handed over to Tunisian researchers. A project will be implemented with CNET for the development of a Videotex X400 interface. This will enable the researchers to access the X400 Parcel Service by Minitel.

The North African Network Research Project has begun to take shape with the installation of a BITNET center in Tunisia and, in the near future, the EMI Center in Morocco. The Algerian Center would be operational through the national data transmission networks and through the contributions of the engineers from IRSIT.

IRSIT is collaborating with CERT on the International Telecommunication Union's (Geneva) Arab Telecommunications Network project. The July 1990 conference, held in Tunis, afforded the opportunity to introduce a plan of work.

The expertise on local network acquired at the time of the installation of the IRSIT network facilitated the transfer of this technology to other users on a national scale. As a result, the Ministry of Higher Education acquired the installation of its network in 1989, and the Public Enterprise Government Relations Office (la Direction des Entreprises Publiques au Premier Ministere), INS, AME, CNRPS, and the Ministry of Foreign Affairs benefited from IRSIT's support of the study and the installation of their networks.

A seminar on local networks, was organized for May 1990, with the support of CNET and French cooperation, and resulted in the participation of some 80 Tunisian technicians from the industrial and service sectors. This seminar stressed the importance of shared computer techniques, particularly those from the local enterprise networks.

#### Lessons learned

It is too early in this project to conclude definite lessons.

### **6. Higher Education Activities**

Director of project: Dr. Mourad Ezzine, Secretary of Ministry of Higher Education and Scientific Research (MEESRS).

#### Goal

The goal of this activity is to improve the capacity of Tunisian higher education institutions in the areas of telecommunications and computer sciences, and to increase the coordination between educational laboratories and departments, and Tunisian industry, both private and state supported.

#### Activities

The subprojects within this section are broken down into five separate activities:

- Carthage Institute of Technology (CIT)
- Office Automation for Ministry of Education

- Water Resources Project with ENIT
- Computer-aided Manufacturing with ENIT
- Bilingual Flexible Software Development Environment with ENIT.

These subprojects are described fully below.

**a. Carthage Institute of Technology (CIT)**

Objectives

To explore the cost, utility, and marketability of a new institute of higher learning in Tunisia.

Clients

Government of Tunisia (represented by Dr. Farouk Kamoun).

Key staff

Dr. Farouk Kamoun  
Mr. Habib Bourguiba, Jr.  
Dr. Kacem Ben Hamza

Project background, motivation, assumptions

Tunisia's interest in acquiring computer and telecommunications technology--which led to the establishment of IRSIT--also spawned the idea that there might be need for an institution to train persons in these fields. The IRSIT project agreement contained a provision for an "Institutional Analysis" program to evaluate the prospects of establishing such an institution.

Major equipment purchased for project under USAID contract

1 IBM PC/AT for administrative use by CIT personnel, returned to IRSIT at the close of the project.

Activities

An institutional analysis was carried out October 1986-July 1987 by a team assembled by AED consisting of two U.S. and one Tunisian senior educator--Drs. Hoelscher, Clark, and Ben Ahmed, respectively. The team recommended the establishment of a new institution for the study of technology, rather than the expansion or creation of new programs within existing universities. The GOT envisioned that such an institution could play an important role in Tunisia's development. By expanding the emphasis on computer technology and telecommunications to include fields relating directly to economic, social, and industrial development, CIT could train professionals in the technical knowledge and management capability to lead future development.

Short-term consultants

Drs. Clifford Clark and Hal Hoelscher to Tunis to prepare initial feasibility study and identify issues.

Dates: February 18-March 16, 1987

June 23-July 20, 1987

Person-days: 42

Cost: \$11,298

[See Appendices for full Consultant Report.]

Dr. Hal Hoelscher in Tunis to prepare for first board meeting of CIT.

Dates: September 1,2-10-19, 1987

November 4-19, 1987

January 24-30, 1988

April 4-28, 1988

Person-days: 141

Cost: \$37,929

CIT Planning Team:

Team Leader: Dr. Fuad Suleiman ( March 4-18, 1988)

Team Members: Dr. Clifford Clark (graduate school plan in New York and Washington, D.C., October 1987-April 1988)  
Ms. Lucy Holmes (facilities plan, March 4-11, 1988)  
Dr. Andrew Charwat (graduate school plan, January 31-February 5; March 5-19, 1988)  
Dr. Adel Ansary (marketing study, April 4-11, 1988)  
Dr. William Stuart (staffing and operational plan, March 4-11, 1988)  
Dr. Robert Heywood (financial plan, March 4-18, 1988)  
Dr. James Vortruba (undergraduate plan, March 5-11, 1988)  
Dr. Samira Strickland (marketing in the region, March 19-28,1988)

In Tunis to gather data and prepare an Operational Plan for CIT

Person-days: 124.5

Cost: \$33,490

Participants visiting the U.S.

Mr. Habib Bourguiba, Jr., and Dr. Farouk Kamoun to establish initial contacts with American educational institutions and private companies for cooperation with CIT.

Dates: October 1-11, 1987)

Cost: \$1,465

[See Appendices for Participant Travel Report.]

Dr. Kacem Ben Hamza to attend seminar on organization of institutes of higher education.

Dates: October 22-November 7, 1987

Cost: \$2,062

[See Appendices for Participant Travel Report.]

#### Accomplishments

Initial studies for need of CIT in Tunisia (1Q87).

CIT officially founded by GOT (3Q87).

First International Board meeting of CIT (4Q87).

Draft of CIT planning study submitted to GOT for review (2Q88).

Final CIT Plan submitted to USAID and GOT (4Q88).

#### Future plans and unresolved issues

Four major tasks remain in this development effort: a commitment at the highest levels of the Tunisian government to develop CIT; a master plan developed, start-up funds, and a comprehensive marketing effort for faculty, administrators, and students must begin. CIT's Board of Trustees must assume a leading role in ensuring that these tasks are accomplished.

#### Lessons learned

The Carthage Institute of Technology Pilot Project was an important step in formulating a Tunisian vision of a private (in the Western sense), technologically oriented, problem based institute of world caliber. While the vision for the Institute received considerable conceptual support from a diverse group of Tunisian leaders--in the governmental, commercial, and academic sectors--the financial realities related to private sponsorship were, for the time, ultimately too daunting. The process of planning a CIT showed that an international group of public spirited citizens could indeed develop a compelling concept for a technologically oriented institute. It also showed that some structures necessary for a private institution still need development in Tunisia, and indeed, in many Arab countries.

Creation of an international institution of the size and scope of CIT requires considerable long-term political and nonpolitical support within Tunisia. It also requires exceptional stability within the government. Tunisia's change of government and successive appointment of three Ministers of Higher Education during the ICT project work made it difficult for the necessary long-term stability.

Secondly, the planning process indicated that many academic leaders in Tunisia could support a complementary higher education institution which offered academic alternatives to more traditional

institutions. A significant group of motivated, well-trained, and experienced academics from existing institutions provided considerable academic insight and support to the project.

Finally, the project established a need within the Arab world for a high quality, technically oriented institution. The need, found through a marketing survey, was extremely clear for the 250 students graduating in the next two years from INBMI-related institutions within Tunisia and approximately 25 times the actual projected enrollment of a CIT-type institution from throughout the Arab world.

The CIT planning effort (involving a mission, and an organizational, academic, personnel, physical and financial plan) was completed with a summary and revised final report in February of 1989. The activity represents a complete Phase I, and will serve as a solid grounding for Phase II and III implementation.

[See Appendices for CIT Executive Summary Report.]

#### **b. Office Automation for Ministry of Higher Education**

##### Objectives

To improve the effectiveness with which working groups in the Ministry share data and process statistical and financial information within the Ministry.

##### Clients

Ministry of Higher Education.

##### Key research staff

Dr. Mourad Ezzine (Ministry of Higher Education)

Mr. Mondher Makni (IRSIT)

##### Project background, motivation, assumptions

At the request of the Ministry of Higher Education, IRSIT analyzed the operation of several workgroups within the Ministry and found that their effectiveness could be greatly improved if they could share PC data over a network rather than manually. The Ministry had installed a local area network in 1984, but because it was installed without the appropriate support mechanisms in the Ministry, it was operational for only one week before it failed. The network remained nonoperational until 1989 when IRSIT staff repaired and extended it.

##### Major equipment purchased for project under USAID contract

Memory upgrades for existing PC/XTs and PC/ATs.

1 Hewlett Packard PC/XT equivalent.

1 Hewlett Packard PC/AT equivalent.

3COM network cards, cables, software for 5 PC/XTs.

### Activities

A local area network designed and installed at the Ministry.

Ministry technical staff trained in 3COM network management and operation.

### Short-term consultants

None.

### Participants visiting the U.S.

Dr. Mourad Ezzine to participate in BRIDGES seminar at Harvard University on use of statistical methods to evaluate higher education.

Dates: July 17-September 11, 1988

Cost: \$7,008

### Accomplishments

Ministry requirements analyzed and presented (1Q89).

Hardware and software configuration designed (2Q89).

Installation of 3COM hardware and software, and preliminary of training of a network manager in the Ministry (3Q89).

### Future plans

The Ministry of Higher Education must develop an informatics strategy to accommodate the increased demands on its data processing for the coming years.

The Ministry of Higher Education network should be expanded from 4 PCs and 1 server to 8-10 PCs within one year.

The Prime Minister's Office and Ministry of Finance have observed the local area networks at IRSIT and at the Ministry of Higher Education and envision similar networks within their ministries.

### Lessons learned

A local area network must be supported with Tunisian expertise in order to be operationally effective. It is not realistic to rely on foreign consultants.

An on-site network manager must be trained for a local area network to be effective.

## **c. Water Resources Project with ENIT**

### Objectives

To transfer to ENIT the technology for modern PC-based water resource management.

### Clients

ENIT is the first beneficiary, and the Ministries of Agriculture and urban planning will benefit in the longer term.

### Key research staff

Dr. Mustapha Besbes (Director of ENIT)

Dr. Klifa Maalel (ENIT)

### Project background, motivation, assumptions

Present water resource software at ENIT does not take advantage of the powerful and inexpensive microcomputers available today. Education would be very much improved if it focused on modern software to model such things as storm water drainage, sewers, and underground reservoirs with 80386-based personal computers.

### Major equipment purchased for project under USAID contract

Hewlett Packard 80386-based PC with VGA monitor.

Hewlett Packard 7475 small format plotter.

Epson LQ 1050 printer.

### Software:

Complete Statistical System (CSS) software.

Windows '386.

### Activities

Modern water resource software was analyzed and transferred to courses in ENIT.

U.S.-developed software was adapted and enhanced for the needs of Tunisia and the region.

### Short-term consultants

Dr. James P. Heaney to Tunis to conduct seminar on water resources software at ENIT.

Dates: December 3-11, 1989

Person-days: 7

Cost: \$2,850

[See Appendices for full Consultant Report.]

### Participants visiting the U.S.

Dr. Mustapha Besbes (Director of ENIT) presented a paper on numerical modelling of underground water systems at the 28th International Geological Congress.

Dates: July 13-20, 1989

Cost: \$1,615

Dr. Klifa Maalel visited the University of Florida and Purdue University to observe water resource management software and train in its use.

Dates: August 28-September 22, 1989

Cost: \$3,246

#### Accomplishments

Selection and analysis of SWMM software at University of Florida.

Dr. J. Heaney conducted an initial seminar at ENIT on use of PC-based software for water resource management (December 1989).

#### Lessons learned

It is too early in the total life of this project to consider the lessons learned.

### **d. Computer-aided Manufacturing with ENIT**

#### Objectives

To transfer modern technology to Tunisia for factory simulation and to use modern factory simulation tools in ENIT engineering courses.

#### Clients

ENIT department of Industrial Engineering.

#### Key research staff

Dr. Rifaat Chaabouni (ENIT)

Dr. Ouafa Ezzine (ENIT)

#### Project background, motivation, assumptions

Present industrial engineering courses at ENIT do not emphasize simulation, and when simulations are included in the courses, they do not use modern simulation languages and generally are run on minicomputers rather than microcomputers. Educational effectiveness within ENIT will be significantly improved if students study modern factory simulation tools running on personal computers.

#### Major equipment purchased for project under USAID contract

1 Hewlett Packard 80386 PC with VGA monitor.

#### Software:

386-Windows.

Factory Simulation software from Cornell University.

(Manufacturing Operations Game and Manufacturing Systems Development Game.)

#### Activities

Faculty members from ENIT were trained in the use of simulation tools for senior courses and graduate projects.

Short-term consultants

None.

Participants visiting the U.S.

Dr. Rifaat Chaabouni visited Cornell University to continue contacts with Professor Peter Jackson and define project in manufacturing technology.

Dates: September 16-30, 1988

Cost: \$2,226

Dr. Ouafa Ezzine visited Cornell University to observe use of manufacturing technology software at Cornell and attend seminar Designing an Effective Manufacturing System.

Dates: August 4-12, 1989

Cost: \$1,840

Accomplishments

Software identified and personal computer configured to support Manufacturing Operations Game and Manufacturing System Development Game (1Q89).

Mdm. Ezzine trained in use of manufacturing simulation software and conduct of seminars in its use (3Q89).

Hardware and software delivered to ENIT (3Q89).

Future plans

The PC-based manufacturing simulation software will be incorporated into industrial engineering courses at ENIT.

Lessons learned

It is too early to recognize the lessons this project has to offer.

**e. Bilingual Flexible Software Development Environment with CNI**

Objectives

The development of a bilingual (Arabic-Latin) flexible software development environment under UNIX and using the X-windows graphics interface.

Clients

The CNI is implementing this project and through Dr. Kamoun's professorship at the University of Tunis, the University will benefit from the software developed by this project.

Key research staff

Mr. Mohamed Ben Sassi

Mr. Othman Chaouachi

### Project background, motivation, assumptions

The teaching of software development should be enhanced if portions of the development environment are in the native language of the developer. Functional descriptions of modules are often identified in Arabic and such things as error messages should be more meaningful when expressed in the native language of the developer. Also, a software development environment which is flexible and adapts itself to the level of the user could improve the learning experience for a wide class of university students.

### Major equipment purchased for project under USAID contract

Hewlett Packard 9000 workstation.  
X-Windows development software.

### Activities

The design and development of a bilingual, flexible software development environment on the HP 9000.

### Short-term consultants

Dr. Albert Badre and Mr. Michael McCracken to CNI to define project in bilingual software development environments under X-Windows and UNIX.

Dates: May 15-31, 1988

Person-days: 47

Cost: \$10,053

Dr. Albert Badre to CNI to design audience requirements for transitional user interface for bilingual environment.

Dates: December 4-7, 1988

Person-days: 17

Cost: \$4,573

Dr. Albert Badre to CNI to assist with the design for a transitional user interface for bilingual environment.

Dates: July 2-7, 1989

Person-days: 10

Cost: \$2,690

[See Appendices for full Consultant Reports.]

### Participants visiting the U.S.

Mr. Mohamed Ben Sassi and Mr. Othman Chaouachi visited MIT and Georgia Tech to attend X-Windows seminar and initiate design of bilingual workstation.

Dates: August 17-September 8, 1988

Cost: \$11,940

### Accomplishments

Preliminary design of project (2Q88).

Configuration of workstation for development of bilingual, flexible environment (3Q88).

Flexible interface requirements design (4Q88).

Installation of workstation in CNI (4Q89).

Dr. Albert Bader visited CNI in December 1989 to finalize the design of the software and advise about the machine-specific aspects of this design.

#### Future plans

The design and implementation of the bilingual interface will continue at CNI after the project has finished.

#### Lessons learned

Very significant delays in schedule were encountered because of the decision to purchase the workstation from Hewlett Packard in Geneva. The project made this decision because of the important cost savings over a U.S. source and because service from the local distributor could only be guaranteed if the workstation was purchased from the European distributor.

### **7. Secondary School Activities**

[See under A. Component No. 1 (Item 3) for project description.]

### **8. Miscellaneous Activities**

Mr. Hugh Applewhite to Tunis to identify issues in design of Textstar Arabization card developed by CNI and advise concerning the steps to follow for the manufacture of this card in quantity outside Tunisia.

Dates: July 8-20, 1987

Person-days: 5

Cost: \$1,035

[See Appendices for full Consultant Report.]

### **9. Projects Initiated but Suspended**

The Tourism and Videotext projects have been halted due to a lack of key Ministry support and/or a change in priorities. They are described below.

#### **a. Tourism/Client Welcome Project**

First, a survey would be made of the existing computer equipment in the hotels. This information, if the project is to make use of the hotels' computers, would become part of the IRSIBANK for longer term use. Then, in cooperation with the Ministry of Tourism, one hotel would be selected as a pilot hotel for a

prototype system. Working with this pilot hotel and selected members of the tourist industry, IRSIT would develop the "Welcome System." It would be implemented (probably with DB 3 on an IBM microcomputer) and installed in the pilot hotel for a preliminary evaluation. After evaluation, the system would be revised and marketed to hotels in Tunisia.

#### **b. Videotext/Statistical Database Project**

This project would begin with discussions with appropriate individuals from Tourism, and the departments of Sociology and Statistics from various institutes of higher education. These discussions would enable IRSIT to determine what information would be useful to understand tourists from abroad, how to survey tourists to collect this information, and how to sample the populations surveyed.

Following this, a database would be defined which would first allow structured reports of information requested by the tourism industry. Later, this database would be refined to allow unstructured inquiries to ad hoc questions.

A preliminary survey would then be conducted, perhaps with the help of professional organizations, and the database design tested and refined with the results. Following this preliminary test, a full survey would be performed, and the database created. Periodic reports would then be delivered to appropriate tourist industries and hotels to improve Tunisia's services. Direct marketing, a concept which has proven so successful in the U.S., could then be attempted based on the tourist profiles in the database.

#### **C. COMPONENT No. 3: TRAINING**

Many of the projects contained herein in previous and subsequent Components include training as an integral part of the activities and will not be listed separately in this section. The following are descriptions of activities that are specifically described as Training.

##### **1. IRSIT Activities**

IRSIT Director General: Dr. Nouredine Ellouze

In the three years that IRSIT has been in existence, it has grown from a staff of three engineers to over 27 and has embarked on a wide variety of applied research projects and projects to build its own infrastructure. The applied research projects fall into three major programs: Arabization, Telecommunications and Networks, and Modeling and Industrial Applications.

Participants visiting the U.S.

Dr. Nouredine Ellouze in May 1987 to initiate contact with key U.S. research institutions and industries.

Dates: May 30-June 18, 1987

Cost: \$3,179

[See Appendices for Participant Travel Report.]

2. Secondary School Activities

[See under A. Component No. 1 (Item 3) for project description.]

3. Miscellaneous Activities

Dr. Romdhane Ben Mimoun visited Brookings Institute, General Services Administration and Georgia Tech to observe technologies supporting use of microcomputers in teaching public administrative management.

Dates: September 15-30, 1988

Cost: \$3,185

Drs. Farouk Kamoun and Fayek Rachdi participated in the XIth World Computer Congress. Dr. Kamoun chaired a session and both were key participants in the meeting of Technical Committee 6 to plan AFRICOM 91 conference on telecommunications to be held in Tunis in 1991.

Dates: August 19-September 2, 1989

Cost: \$6,770

D. COMPONENT No. 4: INSTITUTIONAL PLANNING, DEVELOPMENT, AND ANALYSIS

While this component primarily involves institution-building, for the purposes of clarification and consistency, some distinct targets within the primary goal are identified as follows.

1. Organizational Infrastructure

Objectives

To assist IRSIT with its growth from three engineers to a major informatics influence in Tunisia and the region.

Clients

IRSIIT

Key staff and management

Dr. Nouredine Ellouze (Director General)  
Mr. Sami Krichen (Administrative Director)

Project background, motivation, assumptions

The creation of a new research and development institution in Tunisia should take into account both the Tunisian environment and approaches from technologically advanced countries such as the United States. IRSIT's challenge is to integrate these different approaches into a viable "corporate culture."

Major equipment purchased for project under USAID contract

Timeline Project Management software.

Short-term consultants

Dr. Sebastian Sora and Dr. Russel Wills to Tunisia to prepare Strategic and Business Plans for IRSIT.

Dates: April 10-April 21, 1989

Person-days: 27 (Sora)

Cost: \$7,695 (Sora)

Subcontract with Dr. Wills: \$22,472

[See Appendices for full Consultant Reports.]

Participants visiting the U.S.

Dr. Nouredine Ellouze (May 1987). See Section I. IRSIT activities.

Mr. Sami Krichen to attend American Management Association courses.

Date: July 21-August 16, 1988

Cost: \$6,067

Mr. Faouzi Ben Sedrine to attend American Management Association courses; visit Columbia University School of Management; Small Business Administration and George Washington University School of Public Administration.

Date: October 3-9, 1988

Cost: \$4,874

Accomplishments

Initial staffing (3Q87).

Appointment of Administrative Director (1Q88).

Appointment of Research Director (3Q89).

Future plans and unresolved issues

Identification of Resident Research Director. The resident advisor's experience in Singapore indicates that this could take as long as two years.

### Lessons learned

The Project Grant Agreement identified creation of an institution as a principal goal of this project. To support this, organization and management had to be specifically addressed.

## 2. Computing Infrastructure

### Objectives

To install at IRSIT a state-of-the-art computer center which is expandable, with exceptional reliability, availability, and maintainability in the Tunisian environment.

### Clients

IRISIT and all of IRSIT's partners and clients benefit from the computer center.

### Key research staff

Mr. Khaled Sellami  
Dr. Kamel Hamrouni (ENIT/IRISIT)  
Mr. Mondher Makni

### Project background, motivation, assumptions

IRISIT's computer center is the informatics backbone of IRSIT and is used constantly by IRSIT's staff, project partners and clients. It links computers from six different manufacturers in France and the U.S. in a single integrated environment.

### Major equipment purchased for project under USAID contract

Digital Equipment Corp. VAX 6320 and peripherals (including 10 terminals and connections to international lines).

### Activities

Computer center was designed; RFP prepared; hardware/software evaluated and selected; hardware and software installed.

### Short-term consultants

Dr. Paul Plourde to IRSIT to prepare draft RFP for minicomputer acquisition.

Dates: July 18-25, 1987

Person-days: 20

Cost: \$5,380

[See Appendices for full Consultant Report.]

### Participants visiting the U.S.

Mr. Khaled Sellami to George Washington University and New York in April 1988 for courses and hands-on training in systems management.

Dates: April 10-May 2, 1988.

Cost: \$10,087

Mr. Khaled Sellami to Los Angeles and New York in June 1989 for courses in VAX systems management and repair of Calcomp color printer.

Dates: June 5-July 6, 1989

Cost: \$6,269

#### Accomplishments

IRSIT's distributed system designed (4Q87).

Request for Proposal complete and VAX selected (3Q88).

VAX installed at IRSIT (2Q89) and upgraded (3Q89).

#### Major Accomplishment

When complete, this computer center will be the only one in Tunisia to integrate computers from over six manufacturers and allow IRSIT researchers to use the VAX/VMS, UNIX, and DOS environments from their workstations.

#### Future plans

The VAX will be used to support a BITNET node at IRSIT, offering worldwide network services to Tunisia and the region.

The VAX 6320 will probably require additional disk or processor power within two years.

#### Lessons learned

The process of preparing the RFP and selecting the minicomputer was exceptionally educational since it was done almost entirely within IRSIT. This process also encouraged institutional support for the decision.

The selection of a minicomputer is far more than the selection of hardware, software, or even a particular technology. It is the selection of a company with which IRSIT plans to work for several years. Therefore the relationships between IRSIT and all the vendors must be carefully examined and preserved.

### **3. Electronic Mail, Networks, and Office Networks**

[See under A. Component No. 1 (Item 2) for project description.]

### **4. Secondary School Activities**

[See under A. Component No. 1 (Item 3) for project description.]

## 5. IRSIT Scientific Council

As part of the official statement instituting IRSIT, the Government of Tunisia described the function of the Scientific Council:

It is to perform in an advisory role. It is called upon to evaluate and advise IRSIT on the scientific activities of the institute and on the research budget.

In particular, it is responsible for:

- 1) Proposed improvements in methods and means of implementing the mission of IRSIT;
- 2) Suggestions for new orientation; and
- 3) Analysis on new trends.

The scientific reports of this council are submitted to the board or the appropriate board of directors by the President of the Institute. It is composed of the Director General and fifteen (15) members chosen for their qualifications in the field of informatics, telecommunications, and associated technologies. Those members could be from within the Institute or from outside. They are nominated by the President of the Institute, whether they are Tunisian or other, resident or non-resident.

The President can call upon any competent person to assist in the Scientific Council meetings. He can delegate one of its members to preside over the Council.

The Scientific Council of the Institute meets at least twice a year. The Council also will meet each time the President of the Institute deems necessary.

Minutes recording the decisions of the Scientific Council are recorded in a Minutes Book signed by the President of the meeting.

### Activities

In December of 1987, the Scientific Council held its first open meeting. The following areas were discussed and developed, culminating in a Presentation Report:

The scientific and technical IRSIT projects address a number of needs in national economic development. They also take into consideration Arab civilization and its culture.

These projects focus on specific objectives of the Institute:

- to track the evolution of new technologies;
- to master these latest technologies;
- to manage the acquisition and transfer of scientific and technical information;
- to contribute to technology between universities and industry.

The Institute's projects are classified according to the following categories:

- o ARABIZATION. This consists of developing several applications on an Arabized workstation. Both calligraphy and terminology are fundamental projects for the implementation of Arabized systems. Speech, character recognition, automatic translation, processing of the natural language, and development of Arabized software will help to obtain concrete short-term results without neglecting long-term research needs.
- o DATABASES. The project plans to develop and use databases in IRSIBANK which is a database dedicated to scientific and technical information in the areas of information and telecommunications. The tourism project concerns the improvement of service quality in the tourism sector. A study is also in progress concerning juridical and medical databases.

o COMMUNICATIONS

Networks

-- IRSINET. The network will service researchers as well as the industrial sectors, and encompass national, regional, and international levels.

-- OASIS is a project that can offer integrated services on a local area network for researchers, engineers, and administrators. The project is an experiment at IRSIT that could eventually be adapted for other organizations.

Telecommunications

-- Remote Measurement of the Telephone Network. This project is concerned with the implementation of an automatic telephone measurement system for measuring selected parameters of the telephone network. The statistical analysis of these parameters will help to improve the network's quality.

-- Videotext. This project is based on the adaptation of a videotext system to Arabic characters. A second aspect of this project is to identify potential services and to study the impact of videotext on the existing telephone network.

o INDUSTRY. The development of new management and communication technologies in the industrial sector. It includes two projects:

-- The first concerns a production control system in the phosphate mining industry. Mine planning is an important aspect of this project.

-- The second concerns seismic signal processing, use of an oil data bank, and oil field simulation in the exploration and exploitation states.

### Participants

The following organizations were contributors to the meeting and the final Presentation Report:

- Academy for Educational Development, USA
- Bell Laboratories (AT&T), USA
- Centre National des Etudes des Telecommunications, France
- Centre National de l'Informatique, Tunisia
- Compagnie des Phosphates de Gafsa, Tunisia
- Colorado School of Mines, USA
- Direction Generale des Telecommunications, Tunisia
- Ecole Nationale des Ingenieurs de Tunis, Tunisia
- Entreprise Tunisienne des Activites Petrolieres, Tunisia
- Groupe de Recherche en Communication, France
- International Bureau of Informatics, Italy
- Institut de la Communication Parlee, France
- Institut National de Recherche en Informatique et Automatique, France
- Institut National de Normalisation et de la Propriete Industrielle, Tunisia
- Ligue des Etats Arabes
- Societe de Exploitation et de Recherches Petrolieres en Tunisie, Tunisia
- Societe Italo-Tunisienne d'Exploitation Petroliere, Tunisia
- Tunisian Universities

### Accomplishments

The above-specified areas of interest have been pursued and developed by IRSIT during the life of the project with the exception of the IRSIBANK tourism project. Specific activities undertaken in these areas are described under the "Components" section of this Final Report.

A second open Scientific Council meeting was held in February 1990 in Tunis.

[See Appendices for Scientific Council reports.]

## 6. Regional Conference on Informatics and Arabization

### Objectives

Regional seminars are an important aspect of regional and international linkages because they increase IRSIT's visibility and give the staff and management the opportunity to meet other researchers face to face.

### Accomplishments

The conference on Informatics and Arabization was held March 9-11, 1988 in Tunis, Tunisia. It was open to select researchers and specialists from the Arab World, Europe, Africa, and America who

were fielded by AED to attend the conference. The topics covered were:

- Systems and workstations
- Automatic speech processing
- Natural language processing
- Character recognition and generation
- Terminology
- Computer-assisted teaching
- Computer-assisted editing
- Database systems management.

The first goal of the conference was to present the latest research related to informatics and its Arabization in the Arab World and countries.

The second goal was to provide a forum where Arab researchers could exchange their ideas and views concerning the development of informatics products.

Finally, this meeting was an opportunity to promote joint efforts between the universities and the research centers of the region.

#### Participants

Youssif Al Imam (Kuwait)  
M.S. Ahmed (Saudi Arabia)  
Husni Al Muhtasseb (Saudi Arabia)  
Nadia Hegazi (Egypt)  
Yahya Mir Al Alam (Syria)  
Ben Hamadou (Tunisia)  
Nabil Ali (Kuwait)  
Jaffal Jaafar (Arab League)  
Nassar M. Shaikh (Saudi Arabia)  
Moncef Kallala (England)  
Ahmed Mahjoub (Saudi Arabia)  
M. Miouka (France)  
Adnan Nouh (Saudi Arabia)  
Sayed Hayder (Saudi Arabia)  
Maher Khemakhem (Tunisia)  
Karim Bouhlila (Tunisia)  
Murat Tayli (Saudi Arabia)  
Hayet Ben Mahmoud (Tunisia)  
A. Abid & Marrakchi (Tunisia)  
MC Loughlim (England)  
George Bugliarello (USA)  
Jacques Vidal (USA)  
Everhard Ditters (Netherlands)

A comprehensive report on the proceedings of the Arabization Conference was published by IRSIT. It included the program and author presentations by Andre Belotti, Laid Bouzidi, Abdelmajid Ben Hamadou, Kevin McBrearty, Hayet Mahmoud, and Akil Sid Ali.

[See Appendices for Arabization Conference report.]

## 7. Miscellaneous Activities

Mr. Michael Denny to Tunis for employment interview and to propose technology gateway activities to IRSIT.

Dates: February 7-13, 1987

Person-days: 7

Cost: \$1,883

Mr. Stan Rifkin to Tunis for employment interview.

Dates: February 13-19, 1987

Person-days: 4

Cost: \$1,076

Ms. Elena Sachet in Washington, D.C., to code 400 resumes for review by IRSIT.

Dates: June 2-10, 1987

Person-days: 7

Cost: \$1,470

Dr. Jacques Vidal to Tunis to attend Inaugural meeting of IRSIT Scientific Council.

Dates: December 11-20, 1987

Person-days: 10

Cost: \$2,690

Dr. George Bugiareello in New York to review projects for IRSIT's Inaugural meeting of Scientific Council.

Dates: December 11-20, 1987

Person-days: 4

Cost: \$0 (Dr. Bugiareello waived his fee.)

**IV. LESSONS LEARNED**

#### IV. LESSONS LEARNED

The USAID Computer Technology Project has emphasized three activities: the building of IRSIT, the improvement of secondary school education (INBMI), and the investigation of the cost/benefits of the Carthage Institute of Technology (CIT), as well as related institutional improvement. Of these three, IRSIT development has involved the greatest commitment of time and resources, and is therefore emphasized in this summary of the Lessons Learned.

##### Overall Project Organization

IRSIT's professional staff and management assigned to the project work most effectively if the project is an integral part of their "job description". Thus, project managers should be managers and executives of institutions actively involved in the project. Many Tunisian managers are exceptionally busy and have little time for activities which do not contribute directly to their own jobs. If they are involved in extracurricular project-related activities, it will probably be as a consultant rather than as a principal.

The analysis of Lessons Learned is divided into nine sections (A through I).

##### A. IRSIT

###### 1. IRSIT Financing

IRSIT began in 1985 with a commitment of core funds for operations from the Tunisian government. This commitment has been renewed each year. USAID provided the start-up money and expertise.

###### 2. IRSIT Staffing

In institutions such as IRSIT, which must "sell" its intellectual prowess, the institution literally is its staff. IRSIT faces the challenges common to such institutions in recruiting and retaining excellent staff. There is significant competition from the several academic institutions in Tunisia and from IRSIT's clients. As the Tunisian private sector grows, it too will compete with IRSIT for educated professional staff.

IRSIT has had to choose between young professional staff with a U.S. orientation or more experienced employees with a more traditional Tunisian background, often educated in France, the Eastern Block, or other countries. IRSIT has chosen the former, and based on limited experience, this has proven to be correct.

The low pay of the government sector, hoerbrt, to which most IRSIT pay scales are linked, limits IRSIT's ability to attract excellent staff.

IRSIT has been able to attract senior researchers from universities to act as project managers. This has produced both positive and negative results. On one hand, such researchers bring recent practical experience at IRSIT to their academic assignments. They are often senior professionals with extensive research backgrounds which balances the younger research staff at IRSIT. On the other hand, the senior project managers which IRSIT has recruited from academia are only available part-time at IRSIT. This shortage of experienced, highly educated professionals is part of the challenge faced by Tunisia and other developing countries.

### 3. IRSIT Procedures

Every young institution faces the problems of establishing procedures within the institution and with respect to its clients and cooperating peers. IRSIT has experimented with different working hours, an employee sign-in sheet, innovative compensation schemes, and several employee contracts.

IRSIT also is balancing its need to receive compensation for its services with its desire to express its gratitude to its funding sources within Tunisia and from foreign sources. This requires balance as IRSIT moves gradually to a market-oriented service.

## B. LOCAL INFRASTRUCTURE

### 1. Communications Infrastructure

IRSIT has learned that telephone contact with foreign cooperating institutions is critical to its success. IRSIT has pioneered the use of FAX, local area networks, and electronic mail within Tunisia, and the use of these services by foreign institutions cooperating with IRSIT requires considerable use of telephone service.

IRSIT has found that the Tunisian telephone service (PTT) is adequate for these services, but it is expensive. Extension of IRSIT's network to allow IRSIT to be an international BITNET node using the Tunisian X.25 network will considerably reduce the cost of international electronic mail. This will give Tunisian researchers at IRSIT and other institutions access to the international academic and research community which is not constrained by the high telephone tariffs imposed by the PTT.

## 2. Electrical Power in Tunisia

The quality of electrical power in Tunisia depends dramatically on the physical location of the building using the power. IRSIT has found that surge protection is necessary for the personal computers, but uninterruptable power supplies are only used for the local area network servers and VAX minicomputer.

Printers and monitors purchased in the USA for operation on 110 volts, 60 cycle have functioned reliably with the use of a step-down transformer in Tunisia's 220 volt, 50 cycle environment. IRSIT has not experienced any damage to 60 cycle equipment by operating it in the 50 cycle environment.

By far the most serious source of equipment failure at IRSIT is the connection of 110 volt equipment to 220 volt power. IRSIT has minimized this by insisting that only a designated engineer install equipment when it arrives at IRSIT. This engineer understands the power requirements of the equipment and installs transformers, etc., when appropriate. A simple lesson is that 220 volt equipment be purchased whenever possible, since even trained users can make costly mistakes.

No matter what precautions are taken, the possibility of connecting 110 volt equipment to a 220 volt source exists, and it is well to plan for it with spare power supplies.

## C. EQUIPMENT

IRSIT has gained considerable experience in high technology equipment. Some Lessons Learned include the following:

- 1). Try not to be the first or only user of any hardware and software in the country. "First and only" users experience the most severe maintenance problems. Note that this guideline conflicts with IRSIT's goal to be a technology gateway, so a balance must be reached. IRSIT has attempted to purchase a critical mass of items or duplicates to minimize the effect of equipment failure.
- 2). Buy for quality rather than price. Because of the cost and difficulty of maintenance in Tunisia, it is better to pay costs up front and purchase high quality equipment which fails less often. This also minimizes work disruptions when the equipment fails.
- 3). Selection, procurement and delivery of technical equipment can take three to nine months and is often unpredictable. Since delays can seriously affect project

schedules, equipment should be specified and ordered as soon as possible in a project.

- 4) It is essential to budget at least 10 percent of the total equipment funds for maintenance and/or spares.
- 5) Carefully check the local service facilities of all proposed vendors.
- 6) Carefully investigate the willingness of local vendors to service equipment procured directly from the USA. They may be reluctant to service this equipment.

#### 1. Systems Design

In designing hardware/software systems for clients, reliability, availability, and maintainability are critical to the success of the system. Attempt to use interchangeable components, personal computers of the same manufacturer, and commonly available cables, connectors, etc.

#### D. CONSULTANTS

- 1) A medium- to high-level technology effort such as IRSIT must be prepared to pay USAID maximum. The current rate for short-term, established, experienced, and professional active computer consultants is between \$250 and \$1,000 per day in the private sector.
- 2) Quality consultants tend to be available for two weeks or two years, with almost nothing by way of time in between. Time commitments must be carefully monitored to gain maximum effect.

#### E. PARTICIPANTS AND VISITORS TO THE U.S.

Short professional courses have proven to be very effective ways of augmenting the technical education of Bachelor and Master level staff at IRSIT. For those with a Ph.D., however, such short courses must be carefully screened to ensure high quality. Staff and management beyond the Ph.D. level benefit most from attendance at seminars and conferences, and through meetings with executives and staff of cooperating institutions.

Short-term technical management courses are effective ways to introduce technical staff to the issues and techniques of management. Ph.D. staff, in particular, have found these courses to be useful. Senior management, on the other hand, have found

management courses to be very culturally dependent and of limited usefulness.

USAID participant per diems are inadequate for the U.S. locations of most computer activity (e.g., New York, Los Angeles, San Francisco, Silicon Valley). Even when treated as "invited guests," the per diem rates are barely adequate, and often limit certain important social interactions.

#### **F. LINKAGES**

Effective institutional linkages must be facilitated and be based on mutual benefits between the institutions and personal contacts. This often requires considerable time and exchange between IRSIT and the potential partner just to recognize the mutual benefits. More time and exchanges are necessary to define projects. This time and cost (particularly communications cost) must be included in schedules and budgets. Secondly, commonality of research/application interest is essential for long-term cooperation.

#### **G. CARTHAGE INSTITUTE OF TECHNOLOGY (CIT)**

Because of the singular nature of the CIT project, we are reproducing the "Lessons Learned" from the final feasibility report.

The Carthage Institute of Technology Pilot Project was an important step in formulating a Tunisian vision of a private (in the Western sense), technologically oriented, problem based institute of world caliber. While the vision for the Institute received considerable conceptual support from a diverse group of Tunisian leaders--in the governmental, commercial, and academic sectors, the financial realities related to private sponsorship were, for the time, ultimately too daunting.

The process of planning CIT showed that an international group of public spirited citizens could indeed develop a compelling concept for a technologically oriented institute. It also showed that some structures necessary for a private institution still need development in Tunisia, and indeed, in many Arab countries.

Creation of an international institution of the size and scope of CIT requires considerable long-term political and non-political support within Tunisia. It also requires exceptional stability within the government. Tunisia's change of government and successive appointment of three Ministers of Higher Education during the project period made it difficult to accomplish the necessary long-term stability.

Second, the planning process indicated that many academic leaders in Tunisia could support a complementary higher education institution which offered academic alternatives to more traditional institutions. A significant group of motivated, well-trained, and experienced academics from existing institutions provided considerable academic insight and support to the project.

Finally, the CIT feasibility effort established a need within the Arab World for a high quality, technically oriented institution. The need, found through marketing surveys, was extremely clear for the 250 students graduating in the next two years from INBMI-related institutions within Tunisia, and for at least the number of graduates from a 3,000-student, CIT-type institution from throughout the Arab World.

#### H. SECONDARY SCHOOLS

This pioneering effort for the introduction of new pedagogical approaches in a dual language environment in Tunisia, begun at CBMI and later, INBMI, provided several important lessons for technology transfer.

The first is that an activity undertaken with considerable voluntary effort, and somewhat outside the formal educational structure of a country, can have a substantial impact. Not only have students with little prior training learned about computer use, but their parents as well (many of them influential in government, business and academics) have benefited from both direct and indirect exposure to educational computing. As in the U.S., students often carried the message of the future to their parents.

Second, the very process of experimentation with new pedagogical approaches opened up new avenues for faculty and teachers trained in traditional ways. While the process of learning the use of new pedagogical tools appears slow, an alteration in pedagogical approach seemed to create rethinking of both the substance and timing of material being taught. This was particularly true in science and mathematics.

Thirdly, the effort has indicated that administrative linkages and faculty incentives (and perceived rewards) remain important when introducing new pedagogical approaches. Only a certain few faculty at any one time were willing to make the extra effort and take the extra time to work with new techniques. Typically, with computers, the students tend to adopt new approaches more quickly than the teachers.

Finally, introduction of computer-assisted instruction nationwide requires careful attention to the support structure and in-service teacher training which accompanies an introduction.

Lacking this, the pace of "reform" is much slower than most donor agencies foresee.

The INBMI has been a breakthrough innovation not often seen in Arab countries. Its lessons, based in part on considerable U.S. and European experience, are extremely relevant to other Arab countries.

I. SUMMARY

Support of a technology-oriented, applied research institution stretches the traditional approaches and timeliness of donor agencies, as well as many host governments. For many of the countries emerging from Third World status, just such stretching is important and valuable. Project management focusing on human and organizational development becomes crucial if technology use is to be truly institutionalized.

**V. PARTICIPANTS AND INVITED GUESTS  
SHORT-TERM TRAINING PROGRAM**

## V. PARTICIPANTS AND INVITED GUESTS SHORT-TERM TRAINING PROGRAM

### A. BACKGROUND

From its inception, it was recognized that the establishment of a major regional research facility in North Africa would involve not only assisting IRSIT with procurement of state-of-the-art technology, and the establishment of institutional links to the U.S., but also would require that personnel be trained in the use and maintenance of the equipment, as well as in project business and management and organizational finance. As the institution began to grow, it became clear that specific project areas would require additional expertise and therefore training in such as geology, telecommunications, mining, remote sensing, linguistics, hydrology, computer-assisted learning, and engineering, to name a few. This training would enable IRSIT to provide the highest caliber expertise in existing areas of research as well as development of new projects. As a result, fielding short-term training participants and setting up observation/training tours for invited guests comprised a significant part of the home office level of effort for the Tunisia Computer Project. Detailed training plans were developed annually by project personnel and the Resident Expert in order to anticipate training needs for each project year. As new projects were developed by IRSIT, these annual training plans were amended to include new training needs.

### B. PROCEDURES AND APPROVALS

Participants were drawn from across the four project components based on the need for specific training related to ongoing or pilot projects within IRSIT, CNI, and INBMI. Training areas were identified by the Resident Expert (Dr. Michael Denny) in conjunction with the Directors of IRSIT, CNI, and INBMI, and the specific project leaders. Based on interviews with prospective trainees or invited guests, and review of available training materials, training programs were proposed in writing for approval by the Director of IRSIT and CNI, as well as USAID/Tunis.

Upon approval by all parties of the proposed programs, AED staff were then charged with enrolling participants in courses, making appointments with private and/or public institutions, arranging observational tours, as well as handling all logistical and financial arrangements. A draft itinerary was then sent back to IRSIT for final approval by the participant/guest and the Resident Expert. The Resident Expert or staff assistant conducted a pre-trip briefing and reviewed in detail USAID requirements and regulations.

**C. PARTICIPANT/GUEST ACTIVITIES**

Typically, the participant/guest would arrive first in Washington, D.C. to receive an expense check and orientation from AED staff. Orientation essentially entailed a thorough explanation of financial matters, travel arrangements, and, when needed, a discussion of customs particular to the U.S. Occasionally, AED project personnel also were called upon to accompany participants on observational/training tours, acting as translators and facilitators. The participant/guest then continued on with the itinerary, reporting in to AED Washington on the average of once a week. An exit interview was held with most participants. This debriefing was deemed extremely valuable in terms of feedback on the programs, courses, etc., and any particular comments the participant might have on the actual arrangements. Participants/guests were required to write a report within 14 days of their return to Tunisia. This after-action report on their training and experiences was shared with project personnel in Tunisia and filed with AED/Washington.

**D. FINANCE OF TRAINING ACTIVITIES**

International airfare was paid for by the Government of Tunisia, but all U.S. travel-related expenses and course/training costs were financed by USAID through AED. The participant/guest was typically issued an expense check based on U.S. Government-approved rates for travel and per diem.

**E. TRAINING DETAIL**

Following is a complete enumeration of all participant and invited guest activities during the life of the project.

**Participants and Invited Guests  
Short-Term Training Programs**

1.

Participant: NOUREDDINE ELLOUZE  
 Dates: May 30-June 18, 1987  
 Program: Meetings with the following organizations:  
     Academy for Educational Development, Higher  
     Education Div., Washington, DC  
     USTTI, Washington, DC  
     Embassy of Tunisia, Washington, DC  
     Georgia Institute of Technology, Atlanta, GA  
     Colorado School of Mines, Golden, CO  
     Houston Contechs, Houston, TX  
     Columbia University, New York, NY  
     Polytechnique Institute, New York, NY.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,000.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$1,179.00

2.

Participant: HABIB BOURGUIBA, JR.  
 Dates: October 1-9, 1987  
 Program: Meeting with the following:  
     IBM, Armonk, NY  
     Stevens Institute, New York, NY  
     Bankers Trust, New York, NY  
     Rutherford Oil, New York, NY  
     Various Members of Congress, Washington, DC  
     Hariri Foundation, Washington, DC  
     Council for International Exchange of Scholars,  
     Washington, DC  
     U.S. Information Agency, Ofc. of Director, Ofc.  
     of Near East, South Asia and North Africa,  
     Washington, DC  
     International Management Development,  
     Washington, DC  
     Acad. for Educational Dev., Washington, DC

CACI, Fairfax, VA  
 Overseas Private Insurance Co., Ofc. of  
 President, Washington, DC  
 American Assn. of Advancement of Sciences,  
 Washington, DC  
 East-West Financial Services, Washington, DC  
 U.S. Dept. of State, Ofc. of Political Affairs,  
 Washington, DC  
 Johns Hopkins University, Ofc. of Provost,  
 Baltimore, MD.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$297.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$168.00

3.

Participant: FAROUK KAMOUN  
 Dates: October 3-October 11, 1987  
 Program: Meetings with the following:  
 Acad. for Educ. Dev. staff, Washington, DC  
 Hariri Foundation, Washington, DC  
 Council for International Exchange of Scholars,  
 Washington, DC  
 U.S. Information Agency, Washington, DC  
 George Washington Univ. School of Business,  
 Washington, DC  
 CACI, Inc., Washington, DC  
 Center for Dev. Information and Evaluation,  
 Rosslyn, VA  
 Several Members of Congress, Washington, DC  
 East-West Financial Services, Ltd., Washington,  
 DC

U.S. Dept. of State, Ofc. of Political Affairs,  
Washington, DC  
Johns Hopkins University, Ofc. of Provost,  
Baltimore, MD.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,000.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	0

4.

Participant: ALEYA BEN AICHA  
Dates: October 7-November 8, 1987  
Program: SEG Conference, New Orleans, LA  
Meetings at:  
Geophysical Laboratories in New Orleans area  
Colorado School of Mines, Golden, CO  
U.S. Geological Survey, Sioux Falls, SD.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$165.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$4,500.00
(2) books/equipment	\$319.00
Travel	
(1) international	0
(1) U.S.	\$859.00

5..

Participant: KACEM BEN HAMZA  
Dates: October 22-November 7, 1987  
Program: Meetings with:  
Acad. for Educational Dev., Washington, DC  
U.S. Information Agency, Washington, DC  
George Washington Univ., Washington, DC  
State Univ. of New York, Binghamton, NY.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,825.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$237.85

6.

Participant: VIVIAN PERINI-BOUDHAOUIA  
Dates: January 18-29, 1988  
Program: Meetings with:  
BO, Inc., Washington, DC  
3+Comm, 3+Network, courses, Rockville, MD  
Networking Personal Computers course, Arlington,  
VA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$1,610.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,000.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	0

7.

Participant: SALEM GHAZALI  
Dates: January 24-February 14, 1988  
Program: Meetings with:  
MAASCOMP, Bethesda, MD  
Univ. of Calif. Los Angeles, Dept. of  
Linguistics, Los Angeles, CA  
AT&T Bell Laboratories, Linguistics, Murray  
Hill, NJ  
M.I.T., Elec. Eng. & Computer Sci., Linguistics,  
Cambridge, MA  
Univ. of Massachusetts, Amherst, MA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,700.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$687.00

8.

Participant: NABIL SAHLI  
Dates: February 13 - March 21, 1988  
Program: Hands-On X 25 course, Irvine, CA  
3System Installation & Support course, Santa Clara, CA  
3+Network Comm course, Santa Clara, CA  
3Wizard Advanced Systems course, Santa Clara, CA  
Univ. of Calif. Los Angeles, Mario Gerla, Los Angeles, CA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$2,815.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$4,000.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$538.00

9.

Participant: IMED JAMOUSI  
Dates: March 31-April 30, 1988  
Program: Colorado School of Mines, Golden, CO  
Successful Program & Project Management course, Washington, DC  
How to Manage Software Development Projects course, Washington, DC.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$1,530.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$3,770.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$500.00

10.

Participant: FETHI TENZEKHTI  
Dates: March 31-April 30, 1988  
Program: Colorado School of Mines, Golden, CO  
CASES course, Boston, MA  
How to Manage Software Development Projects  
course, Washington, DC.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$1,590.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,470.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$440.50

11.

Participant: ABDELHAMID EL AMRI  
Dates: March 31-April 22, 1988  
Program: Colorado School of Mines, Golden, CO  
Morrison-Knudsen Co., Boise, ID  
Mine Development Assn., Sparks, NV.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,900.00
(2) books/equipment	0
(1) international	0
(1) U.S.	\$893.00

12.

Participant: ABDELMAGID S'HIMI  
Dates: March 31-April 22, 1988  
Program: Colorado School of Mines, Golden, CO  
Morrison-Knudsen Co., Boise, ID  
Mine Development Assn., Sparks, NV.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,900.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$893.00

13.

Participant: MOHAMMED NEJIB M'RABET  
Dates: March 31-April 22, 1988  
Program: Colorado School of Mines, Golden, CO  
Morrison-Knudsen Co., Boise, ID  
Mine Development Assn., Sparks, NV.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,900.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$893.00

14.

Participant: RIDHA BEN MOSBAH  
Dates: April 17-22, 1988  
Program: Colorado School of Mines, Golden, CO.  
Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	

(1) living allowance/per diem	\$470.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$458.00

15.

Participant: TAHAR MAHARI  
 Dates: April 17-22, 1988  
 Program: Colorado School of Mines, Golden, CO.  
 Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$470.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$545.00

16.

Participant: KAIS DALY  
 Dates: April 19-24, 1988  
 Program: Academy for Educational Development, Washington, DC  
 Colorado School of Mines, Golden, CO.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$470.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$545.00

17.

Participant: KHALED SELLAMI  
 Dates: April 10-May 2, 1988  
 Program: George Washington Univ., Computer Center, Washington, DC  
 ADA Programming & Software Engineering Hands-on Intro. course, Boston, MA

EDP Computer Operations Management course, New York, NY  
 EDP Computer Performance Measurement & Capacity Planning course, Rockville, MD  
 ICS Management & Control Workshop course, Vienna, VA  
 University of Michigan, Computer Center, Ann Arbor, MI.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$4,605.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$4,750.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$732.50

18.

Participant: MOHAMMED RACHED BOUSSEMA  
 Dates: June 21-August 13, 1988  
 Program: Center for Research on Econ. Dev. seminar, Univ. of Mich., Ann Arbor, MI.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$4,900.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$5,000.00
(2) books/equipment	\$25.00
Travel	
(1) international	0
(1) U.S.	\$380.00

19.

Participant: MONDHER MAKNI  
 Dates: July 6-August 19, 1988  
 Program: Data Comm I course, Orlando, FL  
 Network Management course, New York, NY  
 Telecom I, II courses, New York, NY  
 AT&T (Adel Labib), Basking Ridge, NJ.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$5,080.75
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$5,000.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$439.00

20.

Participant: SAMI KRICHEN  
Dates: July 21-August 16, 1988  
Program: AMA Senior Project Management seminar, Washington, DC  
DELTEL Management Skills for First-Line Supervisors course, New York, NY  
Columbia University, New York, NY  
Teachers College, Columbia University, New York, NY  
Columbia University Presbyterian Medical Center, New York, NY  
Control Data Corp. Negotiating Computer Vendor Contracts course, Boston, MA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$2,790.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,788.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$489.00

21.

Participant: NACEUR CHEMMAM  
Dates: July 28-August 17, 1988  
Program: Siggraph '88 Conference, Atlanta, GA  
Meeting with A.I.D., Ofc. of Foreign Disaster Assistance, Washington, DC  
Meeting with A.I.D., Africa Desk, Washington, DC  
U.S. Geological Survey, Sioux Falls, S.D.  
Univ. of Calif. Los Angeles, Los Angeles, CA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$1,405.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,350.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$729.00

22.

Participant: MOURAD EZZINE  
Dates: July 17-September 11, 1988  
Program: BRIDGES Workshop (Harvard), Cambridge, MA  
American Council on Education, Washington, DC  
Academy for Educational Development, Washington, DC  
University of Pennsylvania, Director of Planning, Philadelphia, PA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$3,500.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$3,000.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$508.00

23.

Participant: MOHAMMED BEN SASSI  
Dates: August 17-September 8, 1988  
Program: Contel ASC, Rockville, MD  
XHIBITION '88 Conference, Cambridge, MA  
M.I.T., Cambridge, MA  
G.T.E., Waltham, MA  
Artificial Intelligence: A Practical Overview course, St. Paul, MN  
Georgia Institute of Technology, Dept. of Computer Science, Atlanta, GA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$2,825.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,312.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$833.50

24.

Participant: OTHMAN CHAOUACHI  
Dates: August 17-September 8, 1988  
Program: CONTEL ASC, Rockville, MD  
XHIBITION '88 Conference, Cambridge, MA  
M.I.T., Cambridge, MA  
G.T.E., Waltham, MA  
Artificial Intelligence: A Practical Overview  
course, St. Paul, MN  
Georgia Institute of Technology, Dept. of Computer  
Science, Atlanta, GA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$2,825.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,312.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$833.50

25.

Participant: SALEM GHAZALI  
Dates: September 12-October 17, 1988  
Program: AT&T Bell Labs, Linguistics Dept., Murray Hill,  
NJ  
PC Linguistics, The Woodlands, TX  
University of Texas at Austin, Dept. of  
Linguistics, Austin, TX.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$5,000.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$698.00

26.

Participant: RIFAAT CHAABOUNI  
Dates: September 15-30, 1988  
Program: Cornell University, School of Operations Research,  
School of Industrial Engineering, Ithaca, NY  
University of Michigan, Dept. of Industrial  
Engineering, Ann Arbor, MI  
Georgia Institute of Technology, School of  
Industrial and Systems Engineering, Atlanta, GA  
IBM Manufacturing Institute, Education Center,  
Thornewood, NY.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,550.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$676.00

27.

Participant: ROMDHANE BEN MIMOUN  
Dates: September 30-October 20, 1988  
Program: Academy for Educational Development, Washington,  
DC  
Georgia Institute of Technology, Atlanta, GA  
Brookings Institute, Center for Public Policy  
Education, Washington, DC  
General Service Administration, Ofc. of Deputy  
Director of Training, Washington, DC  
AT&T, Hands-on database management, Basking Ridge,  
NJ.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,535.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$650.00

28.

Participant: FAOUZI BEN SEDRINE  
Dates: October 9-30, 1988  
Program: AMA Basic Program Management Planning, Scheduling,  
and Control course, Orlando, FL  
AMA The Controller's Job in Today's Environment  
course, New York, NY  
Columbia University, School of Management, New  
York, NY  
Academy for Educational Development, Washington,  
DC  
Small Business Administration, Ofc. of Dir. of  
International Programs, Washington, DC  
George Washington University, School of Public  
Administration, Washington, DC.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$1,925.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,650.00
(2) books/equipment	0
Travel	
(1) international	0
(1) U.S.	\$299.00

29.

Participant: MOKHTAR LATIRI  
Dates: May 9-June 1, 1989  
Program: Academy for Educational Development, Washington,  
DC  
Eleanor Roosevelt High School, Greenbelt, MD  
Agency for International Development, Roslyn, VA  
Fairhill Center, Fairfax, VA

Thomas Jefferson School of Science & Technology,  
 Alexandria, VA  
 Maryland Public T.V., Owings Mills, MD  
 Southern High School, Baltimore, MD  
 West High School, Columbus, OH  
 Columbia University Teachers College, New York,  
 NY  
 Portal School, Cupertino, CA  
 Garden Gate Elementary, Cupertino, CA  
 Monta Vista High School, Cupertino, CA  
 Kennedy Junior High School, Cupertino, CA  
 Apple Corporation, Cupertino, CA  
 University of Texas, Austin, TX  
 Texas Education Agency, Austin, TX  
 Lanier High School, Austin, TX  
 Kealing Junior High School, Austin, TX  
 Lyndon B. Johnson Senior High School, Austin, TX  
 Blair Math & Science Magnet School, Rockville, MD  
 Quince Orchard High School, Rockville, MD  
 U.S. Department of Education, Washington, DC.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$4,017.00
(2) books/equipment	0
Travel	
(1) international	0
(2) U.S.	\$1,592.00

30.

Participant: KHALED SELLAMI  
 Dates: June 1-July 3, 1989  
 Program: Academy for Educational Development, Washington,  
 DC  
 Digital Equipment Corp. courses (VAX/VMS), Los  
 Angeles, CA  
 Budde International course (CalComp), Anaheim, CA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$1,495.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$4,316.00
(2) books/equipment	0

Travel	
(1) international	0
(2) U.S.	\$458.00

31.

Participant: NACEUR CHEMMAM  
 Dates: June 27-July 15, 1989  
 Program: Academy for Educational Development, Washington, DC  
 U.S. Geological Survey, Sioux Falls, SD  
 U.S. Geological Survey, Reston, VA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,715.00
(2) books/equipment	0
Travel	
(1) international	0
(2) U.S.	\$399.99

32.

Participant: MUSTAPHA BESBES  
 Dates: July 13-21, 1989  
 Program: Academy for Educational Development, Washington, DC  
 28th International Geological Congress, Washington, DC  
 International Symposium of Engineering, Columbus, OH.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$250.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,047.00
(2) books/equipment	0
Travel	
(1) international	0
(2) U.S.	\$318.00

33.

Participant: AOUFA EZZINE  
Dates: August 4-12, 1989  
Program: Academy for Educational Development, Washington,  
DC  
Cornell University course "Designing an Effective  
Manufacturing System," Ithaca, NY.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$675.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$882.00
(2) books/equipment	0
Travel	
(1) international	0
(2) U.S.	\$283.00

34.

Participant: FAROUK KAMOUN  
Dates: August 18-September 2, 1989  
Program: UCLA, Los Angeles, CA  
SCO Forum, Santa Cruz, CA  
Committee Six Meetings, Lake Tahoe, CA  
IFIP Conference, San Francisco, CA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$860.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,673.00
(2) books/equipment	\$500.00
Travel	
(1) international	0
(2) U.S.	\$352.00

35.

Participant: FAYEK RACHDI  
Dates: August 18-September 2, 1989  
Program: UCLA, Los Angeles, CA  
SCO Forum, Santa Cruz, CA  
Committee Six Meetings, Lake Tahoe, CA  
IFIP Conference, San Francisco, CA.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	\$860.00
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$2,173.00
(2) books/equipment	0
Travel	
(1) international	0
(2) U.S.	\$352.00

35.

Participant: MONTASSER OUAILY  
Dates: August 26-September 12, 1989  
Program: Meetings with UCLA, Los Angeles, CA.  
Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,980.00
(2) books/equipment	0
Travel	
(1) international	0
(2) U.S.	\$458.00

36.

Participant: KHLIFA MAALEL  
Dates: August 26-September 22, 1989  
Program: Academy for Educational Development, Washington, DC  
Purdue University (School of Civil Eng.), West Lafayette, IN  
University of Florida (Dept. of Env. Eng.), Gainesville, FL  
George Washington University (Dept. of Civil, Mech. Env. Eng.), Washington, DC  
The World Bank, Washington, DC.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	

(1) living allowance/per diem	\$1,201.30
(2) books/equipment	\$1,344.70
Travel	
(1) international	0
(2) U.S.	\$700.00

37.

Participant: SALEM GHAZALI  
 Dates: September 24-October 13, 1989  
 Program: Academy for Educational Development, Washington, DC  
 AT&T Bell Labs, Murray Hill, N.J.  
 Ohio State University (Dept. of Speech & Hearing Sciences), Columbus, OH  
 UCLA (Dept. of Linguistics), Los Angeles, CA  
 PC Linguistics, Woodlands, TX.

Costs:

<u>Description</u>	<u>Cost</u>
Training	
(1) tuition/fees	0
(2) interpreter/escort	0
Allowances	
(1) living allowance/per diem	\$1,710.00
(2) books/equipment	\$500.00
Travel	
(1) international	0
(2) U.S.	\$1,592.00

**VI. PROJECT FINANCES**

## VI. PROJECT FINANCES

The Tunisia Computer Project, USAID Contract Number 664-0334-C-00-6034-00 began August 1, 1986 and ended March 31, 1990. The initial project authorization was for \$3,306,495. It was expected that approximately 164 person-months of direct effort by AED would be expended and that 82 person-months of consultant assistance would be required.

During the course of the 3.6 years, one budget revision and two contract amendments were made. The first revision, occurring in August 1987 involved the addition of staff in the AED home office to support the expanding project needs. Specifically, an additional Tunisian training and orientation officer was added to the AED staff. In December 1988 Amendment No.1 was signed to allow AED to take full responsibility for procurement (an effective strategy to improve responsiveness to IRSIT requests), to correct some clerical errors in the original contract, and to allow more commitment of AED time through reductions in participants and consultants. IRSIT and staff were unable to absorb the time commitments necessary for all the training originally proposed.

In September 1989 a second amendment was completed for the project. The amendment added \$49,500 to the contract for expenses not previously programmed, making a total commitment of \$3,355,995. In addition, line item adjustments were authorized to allow an estimated 175 person-months of AED staff, and approximately 42 person-months of consulting assistance. In addition, reallocations were made to account for the increased direct expenses as a result of more home office based assistance and the communications requirements associated with procurement of pilot project equipment.

As of project end, AED committed 174 person-months of effort and provided 44 person-months of consulting assistance. Final project costs, as noted on Exhibit 1 totaled \$3,338,612, representing 99.5% of projected budget and providing a slight unexpended surplus of \$17,383. Exhibit 2 shows the expenditure flow by year of the project through October 1989 as well as a summary of expenditures by detailed line item of the budget.

Exhibits 3 and 4 provide an estimation of the allocation of total project expenses by subproject category. While some judgment is required to allocate pooled expenses (such as indirect costs, and field office time) these exhibits note the value of equipment and services to subprojects, including: IRSIT core activity including work for DGT, for ETAP, and other direct clients; INBMI--largely supporting secondary school computerization; CNI for work in Arabic interpreter hardware and UNIX; CPG for assistance with mine planning and operation; the

Carthage Institute of Technology (CIT) feasibility work; and Higher Education Projects serving a variety of institutions in Tunisia.

As noted, over 79% of direct project value has been expensed to IRSIT, INBMI, and pilot projects. In addition, costs associated with home and field offices have not been fully allocated to supporting the efforts in each of these areas--to which consultant and training time were allocated.

**EXHIBIT 1**

**SUMMARY OF PROJECT FINANCIAL ACTIVITY  
A/O February 23, 1991**

<u>Category</u>	<u>Budget</u>	<u>Project Cost</u>	<u>Percent</u>
Salaries	\$ 528,280	\$ 536,448.22	101.5
Benefits	\$ 134,171	\$ 131,513.57	98.0
Consultant	\$ 194,179	\$ 190,577.20	98.1
Travel/Transp.	\$ 250,732	\$ 268,639.74	107.1
Other Direct	\$ 220,706	\$ 258,099.99	116.9
Indirect	\$ 362,259	\$ 385,899.20	106.5
Subcontract	\$ 97,163	\$ 111,787.18	115.0
G & A	\$ 1,942	\$ 2,017.29	103.8
Allowances	\$ 60,701	\$ 54,375.07	89.6
Equipment	\$1,294,929	\$1,230,666.78	95.0
Partic. Exp.	\$ 174,933	\$ 132,587.69	75.8
Fixed Fee	<u>\$ 36,000</u>	<u>\$ 36,000.00</u>	<u>100.0</u>
<b>TOTAL</b>	<u><u>\$3,355,995</u></u>	<u><u>\$3,338,611.93</u></u>	<u><u>99.5</u></u>

EXHIBIT 2

CATEGORY	TOTAL REVISED CONTRACT AMOUNT	TOTAL EXPENDITURES TO-DATE 10/31/99	BALANCE FUNDS AVAILABLE
1. SALARIES & WAGES	\$528,285	\$547,804	\$21,196
2. BENEFITS	\$136,171	\$121,944	\$12,227
3. CONSULTANT FEES	\$194,179	\$175,271	\$18,908
4. TRAVEL & TRANSPORTATION	\$230,732	\$248,136	\$2,594
5. OTHER DIRECT COSTS	\$220,706	\$261,187	(\$20,481)
SUBTOTAL	\$1,328,868	\$1,295,424	\$34,444
7. INDIRECT COSTS @ 28%	\$362,259	\$352,615	9,644
8. OVERSEAS ALLOWANCES	\$40,701	\$53,075	\$7,426
9. EQUIPMENT	\$1,294,929	\$439,336	\$455,593
10. PARTICIPANT EXPENSES	\$174,933	\$133,589	\$41,344
11. SUBCONTRACT EXPENSES	\$97,143	\$111,786	(\$14,623)
12. G.A. @ 2%	\$1,942	\$2,231	(\$289)
SUBTOTAL	\$3,319,995	\$2,786,256	\$533,739
13. FIRED FEE	\$34,000	\$29,037	\$6,963
GRAND TOTAL	\$3,355,995	\$2,815,293	\$540,702



15-Nov-89 CONTRACT: USAID IRSIT COMPUTER  
 09:28 PM CONTRACT NO: 644-0334-C-00-6034-00  
 CONTRACT PERIOD: 8/1/86-12/31/89  
 REPORTING PER: 8/1/86-10/31/89

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CATEGORY	PROJECT YEAR 1	PROJECT YEAR 2	PROJECT YEAR 3	PROJECT YEAR 4 QUARTER #1			PROJECT YEAR 4 QUARTER #2			TOTAL PROJECT YEAR 4	LIFE OF PROJECT EXPENDITURES TOTAL EXPENDITURES 8/1/86-12/31/89
	ACTUAL COSTS 8/1/86-7/31/87	ACTUAL COSTS 8/1/87-7/31/88	ACTUAL COSTS 8/1/87-7/31/88	ACTUAL COSTS 8/31/89	ACTUAL COSTS 9/30/89	ACTUAL COSTS 10/31/89	ACTUAL COSTS 11/30/89	ACTUAL COSTS 12/31/89	ACTUAL COSTS 1/31/90		
<b>4. TRAVEL &amp; TRANSPORTATION</b>											
<b>A. INTERNATIONAL TRAVEL (642)</b>											
Resident Expert & 1 dependant	1,096	1,268	2,920	0	0	0	0	0	0	80	\$5,284
Excess Baggage	0	0	0	0	0	0	0	0	0	80	80
Unaccom Air Freight	1,487	419	0	0	0	0	0	0	0	80	\$1,906
Household Shipment/Storage	0	9,161	2,006	0	0	356	0	0	0	\$356	\$11,523
Vehicle Shipment	0	0	0	0	0	0	0	0	0	80	80
RT USA/Tunisia (Consultants)	15,076	49,339	13,353	0	0	0	0	0	0	80	\$77,768
Home Office Mgt USA/Tunisia	2,929	12,233	20	0	0	0	0	0	0	80	\$15,182
In-country Travel (Consultants)	226	4,575	134	0	0	0	0	0	0	80	\$4,935
Meals/cher	0	3,327	0	0	0	0	0	0	0	80	\$3,327
CIT Personnel	0	22,470	0	0	0	0	0	0	0	80	\$22,470
<b>TOTAL INT'L TRAVEL</b>	<b>20,814</b>	<b>102,792</b>	<b>18,433</b>	<b>0</b>	<b>0</b>	<b>356</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>356</b>	<b>142,395</b>
<b>B. INTERNATIONAL SUBSISTENCE (643)</b>											
Per Diem/Tunisia (Consultants)	11,852	8,807	15,521	436	0	0	0	0	0	\$436	\$36,616
Home Office Visits @ 10 days each	20	4,081	407	0	0	0	0	0	0	80	\$4,508
Meals/cher	0	4,334	0	0	0	0	0	0	0	80	\$4,334
CIT Personnel	0	8,637	0	0	0	0	0	0	0	80	\$8,637
<b>TOTAL INT'L SUBSISTENCE</b>	<b>11,872</b>	<b>25,859</b>	<b>15,928</b>	<b>436</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>436</b>	<b>54,095</b>
<b>C. DOMESTIC TRAVEL (640)</b>											
Misc USA RT @	7,376	(198)	8,866	1,759	144	0	0	0	0	\$1,903	\$17,947
Misc DC Local Transportation @	139	0	1,315	444	0	0	0	0	0	\$444	\$1,898
Meals/cher	0	3,742	0	0	0	0	0	0	0	80	\$3,742
CIT Personnel	0	1,610	0	0	0	0	0	0	0	80	\$1,610
<b>TOTAL DOMESTIC TRAVEL</b>	<b>7,515</b>	<b>5,154</b>	<b>10,181</b>	<b>2,203</b>	<b>144</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2,347</b>	<b>25,197</b>
<b>D. DOMESTIC SUBSISTENCE (641)</b>											
Trips in USA @ 2 days each	2,701	6,661	7,840	1,208	0	512	0	0	0	\$1,720	\$18,922
Meals/cher	0	6,721	0	0	0	0	0	0	0	80	\$6,721
CIT Personnel	0	720	88	0	0	0	0	0	0	80	\$808
<b>TOTAL DOMESTIC SUBSISTENCE</b>	<b>2,701</b>	<b>14,102</b>	<b>7,928</b>	<b>1,208</b>	<b>0</b>	<b>512</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,720</b>	<b>26,451</b>
<b>TOTAL TRAVEL</b>	<b>42,902</b>	<b>147,907</b>	<b>52,470</b>	<b>3,847</b>	<b>144</b>	<b>868</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4,855</b>	<b>248,138</b>

15-Nov-89 CONTRACT: USAID IRSIT COMPUTER  
 09:28 PM CONTRACT NO: 664-0334-C-00-6034-00  
 CONTRACT PERIOD: 8/1/86-12/31/89  
 REPORTING PER: 8/1/86-10/31/89

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CATEGORY	PROJECT YEAR 1	PROJECT YEAR 2	PROJECT YEAR 3	PROJECT YEAR 4 QUARTER #1			PROJECT YEAR 4 QUARTER #2			TOTAL PROJECT YEAR 4	LIFE OF PROJECT EXPENDITURES
	ACTUAL COSTS 8/1/86-7/31/87	ACTUAL COSTS 8/1/87-7/31/88	ACTUAL COSTS 8/1/87-7/31/88	ACTUAL COSTS 8/31/89	ACTUAL COSTS 9/30/89	ACTUAL COSTS 10/31/89	ACTUAL COSTS 11/30/89	ACTUAL COSTS 12/31/89	ACTUAL COSTS 1/31/90	TOTAL PROJECT YEAR 4	TOTAL EXPENDITURES 8/1/86-12/31/89
<b>5. OTHER DIRECT COSTS</b>											
<b>A. NLJE OFFICE</b>											
BBA Insurance @ 4.25% (Moses)	0	0	0	0	0	0	0	0	0	\$0	\$0
BBA Insurance/CIT Personnel @ 4.25%	0	0	0	0	0	0	0	0	0	\$0	\$0
Outside Clerical (605)	6,765	19,628	2,015	0	0	205	0	0	0	\$205	\$26,613
Outside Clerical/Moelcher (605)	0	1,015	0	0	0	0	0	0	0	\$0	\$1,015
Meeting Expenses (608)	1,146	3,669	1,616	990	0	0	0	0	0	\$990	\$7,421
Communications (610)	13,355	32,356	30,809	1,771	2,902	1,200	0	0	0	\$5,873	\$82,393
Communications/Moelcher (610)	0	2,394	2,090	0	0	0	0	0	0	\$0	\$4,484
Communications/CIT (610)	0	425	78	0	0	0	0	0	0	\$0	\$703
Communications/Procurement (610)	0	0	0	0	0	0	0	0	0	\$0	\$0
Telecommunications Network (610)	152	183	0	0	0	0	0	0	0	\$0	\$335
Postage/Delivery (611)	4,857	6,262	15,428	277	2,459	1,454	0	0	0	\$4,190	\$30,737
Postage/Delivery/CIT (611)	0	772	11	0	0	0	0	0	0	\$0	\$783
Photocopy (612)	1,360	4,260	5,968	102	550	232	0	0	0	\$2,884	\$12,472
Photocopy/Moelcher (612)	0	322	0	0	0	0	0	0	0	\$0	\$322
Photocopy/CIT (612)	0	400	0	0	0	0	0	0	0	\$0	\$400
Subscriptions (613)	65	9,605	(1,772)	182	20	0	0	0	0	\$1202	\$8,100
Expendable Supplies (614)	5,038	5,026	6,764	868	91	112	0	0	0	\$1,071	\$17,879
Expendable Supplies/CIT (614)	0	5	0	0	0	0	0	0	0	\$0	\$5
Expendable Supplies/Procurement (614)	0	0	0	0	0	0	0	0	0	\$0	\$0
Recruitment Advertising (614)	1,920	521	0	0	0	0	0	0	0	\$0	\$2,441
Misc Expenses (615)	824	1,230	920	263	0	0	0	0	0	\$263	\$3,237
Misc Expenses/CIT (615)	0	35	0	0	0	0	0	0	0	\$0	\$35
Misc Expenses/Procurement (615)	0	0	2	0	398	494	0	0	0	\$892	\$894
Legal Fees (618)	0	117	619	0	0	0	0	0	0	\$0	\$736
MOI Rental (624)	2,205	2,792	3,259	37	0	0	0	0	0	\$37	\$8,293
Translation (637)	0	4,349	255	0	0	0	0	0	0	\$0	\$4,604
<b>SUBTOTAL</b>	<b>37,687</b>	<b>95,566</b>	<b>68,042</b>	<b>4,490</b>	<b>6,420</b>	<b>3,697</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>14,607</b>	<b>215,902</b>
<b>B. FIELD OFFICE</b>											
BBA Insurance (Res Expert/Consultants)	1,178	1,542	6,755	0	0	0	0	0	0	\$0	\$9,475
Communications (610)	357	8,231	0	0	0	0	0	0	0	\$0	\$8,588
Postage/Delivery (611)	4	315	0	0	0	0	0	0	0	\$0	\$319
Photocopy (612)	0	0	0	0	0	0	0	0	0	\$0	\$0
Expendable Supplies (614)	334	630	0	0	0	0	0	0	0	\$0	\$964
Rent/Office (616)	0	0	463	0	0	0	0	0	0	\$0	\$463
Translation (637)	0	4,348	24	500	543	61	0	0	0	\$1,104	\$5,476
<b>SUBTOTAL</b>	<b>1,873</b>	<b>15,066</b>	<b>7,942</b>	<b>500</b>	<b>543</b>	<b>61</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,104</b>	<b>25,285</b>
<b>TOTAL OTHER DIRECT COSTS</b>	<b>39,560</b>	<b>110,632</b>	<b>75,984</b>	<b>4,990</b>	<b>6,963</b>	<b>3,758</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>15,711</b>	<b>241,187</b>
<b>SUBTOTAL LINES 1-5</b>	<b>231,990</b>	<b>608,738</b>	<b>392,165</b>	<b>22,032</b>	<b>22,248</b>	<b>16,451</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>60,731</b>	<b>1,293,624</b>
<b>6. INDIRECT COSTS (lines 1-5) @</b>	<b>64,957</b>	<b>170,445</b>	<b>100,209</b>	<b>6,169</b>	<b>6,229</b>	<b>4,606</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>\$17,004</b>	<b>\$352,615</b>



### EXHIBIT 3

#### Computer Technology Project Allocation Estimate (in Dollars)

12/31/90

#### IRSIT PROJECT ALLOCATION (LOP 8/1/86-2/28/90)

ITEM	CATEGORY							TOTAL
	AED	IRSIT	INBMI	CNI	CPG	CIT	H.E.	
Home Office(1)	\$505,891	\$0	\$0	\$0	\$0	\$67,309	\$0	\$573,200
Field Office(2)	\$120,920	\$120,674	\$34,656	\$44,860	\$51,559	\$174,983	\$11,963	\$559,615
Consultants(3)	\$10,412	\$102,862	\$30,533	\$39,531	\$45,398	\$154,938	\$10,551	\$394,225
Training(4)	\$0	\$79,188	\$12,010	\$19,000	\$32,400	\$24,408	\$28,000	\$195,006
Equipment	\$0	\$891,036	\$284,484	\$15,025	\$20,027	\$4,400	\$15,694	\$1,230,666
-Hardware	\$0	\$803,995	\$284,484	\$15,025	\$20,027	\$4,400	\$15,694	\$1,143,625
-Software	\$0	\$59,271	\$0	\$0	\$0	\$0	\$0	\$59,271
-Books	\$0	\$19,143	\$0	\$0	\$0	\$0	\$0	\$19,143
-Other	\$0	\$8,627	\$0	\$0	\$0	\$0	\$0	\$8,627
Other(5)	\$44,115	\$101,685	\$25,931	\$34,729	\$43,451	\$119,020	\$16,968	\$385,899
<b>TOTAL</b>	<b>\$681,338</b>	<b>\$1,295,445</b>	<b>\$387,614</b>	<b>\$153,145</b>	<b>\$192,835</b>	<b>\$545,058</b>	<b>\$83,176</b>	<b>\$3,338,611</b>

NOTES:

- (1) AED Office in Washington, D.C., support for consultants, training, and equipment.
- (2) Field Office at IRSIT, Tunis, Tunisia, support for projects, consultants, and management.  
Allocation based on estimated field office support time provided.
- (3) Includes Consultant Fees, Travel Costs, Other.
- (4) Training includes both participant and invited guest costs.
- (5) Other includes indirect expenses and fees to a project. Most direct charges are allocated to AED. Allocation to sub-projects based on direct costs.

## EXHIBIT 4

### Computer Technology Project Allocation Estimate (by Percent)

12/31/90

#### IRSIT PROJECT ALLOCATION (LOP 8/1/86-2/28/90)

ITEM	CATEGORY							TOTAL
	AED	IRSIT	INBMI	CNI	CPG	CIT	H.E.	
Home Office(1)	15.2%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	17.2%
Field Office(2)	3.6%	3.6%	1.0%	1.3%	1.5%	5.2%	0.4%	16.8%
Consultants(3)	0.3%	3.1%	0.9%	1.2%	1.4%	4.6%	0.3%	11.8%
Training(4)	0.0%	2.4%	0.4%	0.6%	1.0%	0.7%	0.8%	5.8%
Equipment	0.0%	26.7%	8.5%	0.5%	0.6%	0.1%	0.5%	36.9%
-Hardware	0.0%	24.1%	8.5%	0.5%	0.6%	0.1%	0.5%	34.3%
-Software	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%
-Books	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%
-Other	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Other(5)	1.3%	3.0%	0.8%	1.0%	1.3%	3.6%	0.5%	11.6%
<b>TOTAL</b>	<b>20.4%</b>	<b>38.8%</b>	<b>11.6%</b>	<b>4.6%</b>	<b>5.8%</b>	<b>16.3%</b>	<b>2.5%</b>	<b>100.0%</b>

NOTES:

(1) AED Office in Washington, D.C., support for consultants, training, and equipment.

(2) Field Office at IRSIT, Tunis, Tunisia, support for projects, consultants, and management.

Allocation based on estimated field office support time provided.

(3) Includes Consultant Fees, Travel Costs, Other.

(4) Training includes both participant and invited guest costs.

(5) Other includes indirect expenses and fees to a project. Most direct charges are allocated to AED. Allocation to sub-projects based on direct costs.

**VII. PROCUREMENT AND PROCEDURES**

## VII. PROCUREMENT AND PROCEDURES

Approximately 35 percent of the Tunisia Computer Technology Project was committed to equipment and material support necessary to establish IRSIT, to support various pilot projects, and to assist with the building of the technical infrastructure. Because of the phased manner in which the project itself developed, AED and IRSIT developed a highly customized approach to supporting procurement. The approach accommodated the need to bring together project possibilities within the existing Tunisian economy, the necessary trained manpower, the other financial resources typically provided by the Tunisian government, and the necessary consulting assistance. Procurement activities were performed over virtually the entire life of the project. It was believed that this approach to procurement would assist IRSIT to build on its gathering strengths, and also ensure that individual pilot projects received exactly the equipment necessary for their efforts, as opposed to simply drawing from a pool of possible equipment. A certain portion of the funds for computer software, computer hardware, instructional materials, course supplies, and specialized test equipment was expended to ensure that the equipment, once purchased, could be maintained by the recipient. (See Appendix H for a summary and supporting list of procured items.)

### A. PLANNING AND APPROVAL

Since IRSIT's inception in August 1986, control and monitoring of equipment outlays within IRSIT was deemed an essential aspect of project execution. To this end, any group within IRSIT or any pilot project desiring support equipment was required to make a request in writing, specifying exactly how the equipment supported a project, an agreed-to project objective, and then indicating the range, often in functional terms, of the type of equipment necessary to support that effort. Wherever possible, it was requested that specifications be in functional terms (in the case of a computer, for example, so many million instructions-per-second capacity, or so much storage capacity) to allow for the greatest procurement flexibility. This ensured both a fair, competitive, and price-sensitive environment.

Following a review of the request for equipment by an Activity Director, a formal order was placed, as noted in Exhibit 5, which was then reviewed and ultimately approved in writing. If the item was over \$500, approvals in writing were obtained by the Director of IRSIT, the Director of CNI, the Resident Expert provided by AED, and finally, the Project Officer at USAID. Often times, given the pace of development and particularly in later stages of the project, two or three orders per week would be submitted via this approval procedure.

In the case of extremely large procurements--specifically the VAX 6320 minicomputer which cost in total \$289,000--the entire procurement activity was conducted in Tunisia by the Resident Expert and IRSIT staff, with the external assistance of AED, IRM/USAID, and USAID/Washington. In this case, the procurement was conducted strictly according to USAID requirements, and adherence to such was strictly monitored by the AED Procurement Expert, and contractual terms approved by USAID/IRM.

#### **B. COMPETITIVE PROCUREMENT**

In 1988, following a review of the project procurement approach originally involving a subcontractor, AED, USAID, and the Computer Project leadership agreed that an AED staff Procurement Expert would be essential to make the procurement cycle as efficient as possible, to ensure the responsiveness of equipment support to project needs, and to improve the cycle of investigation and response. Accordingly, the procurement subcontract was terminated, and in 1988, Mr. Bruce Clark was brought on full-time status with AED to handle the procurement activities. His activities directly supported the requests made and noted in Exhibit 5, and followed the following cycle:

- 1) A review of the equipment requisition form for completeness and clarity.
- 2) Lacking any of the above, request for clarification and/or elaboration. (This was supported by a LAN-based E-Mail system between AED/Washington and IRSIT in Tunisia).
- 3) A determination of possible vendors for items indicated, with attention given to use of generic equipment where possible.
- 4) In all cases a minimum of three written bids from qualified suppliers reviewed and referenced.
- 5) Review of the procurement action itself by senior AED contracts personnel.
- 6) Receipt of procured items and initial checking for quality, specification, and any apparent damage.
- 7) Preparation of the necessary export documents.
- 8) Checking for appropriate USAID markings.

- 9) Shipment to Tunisia at typically one of two locations--IRSIT, or in some instances related to the operations of INBMI, to the INBMI location. IRSIT personnel then cleared shipments through Tunisian Customs with a USAID "Attestation de Duoune."
- 10) Verification of receipt and completeness of the order with IRSIT or INBMI.
- 11) In very rare instances, return of equipment that may have been damaged in transit, or ensuring that cost-effective repairs were accomplished.

#### C. RECORD-KEEPING

Given the increasing volume of procurements involving over 2,000 items, within the first 18 months of the project, AED computerized the processing of shipments and implemented the use of project-specific Purchase Orders. A computerized database contains all relevant information related to the procurement and subsequent disposition of the equipment itself. Approximately every three months, a report was generated by AED Procurement indicating the status of events according to the U.S. perspective, and noting the items in transit, which typically took anywhere from three days to two weeks to arrive in Tunis. (See Exhibit 6.) The Resident Expert and Staff Assistant at IRSIT spent considerable time clearing the various shipped items through Customs in Tunisia. This frequently involved direct trips to the Customs clearing shed, resolution of Customs formality, and coordination of the USAID "Attestation de Duoane," copies of which are maintained at IRSIT.

Within a year of the beginning of the project, IRSIT, and to some extent INBMI, had developed an equipment log, a computerized equipment inventory, and a table of items which were used to track and monitor procurement activities and also used to develop maintenance schedules and requirements. Approximately once every six months an equipment verification based on shipping documents was conducted to ensure that records at IRSIT remained essentially parallel with AED's records. The Tunisian counterparts then took responsibility for ensuring the integrity of subsequent disposition of the equipment. Additional effort was expended on ascertaining, on a periodic basis, that the equipment was in direct use.

#### D. ADDITIONAL CONSIDERATIONS

From the beginning, project personnel were extremely aware of the necessity of maintaining sensitive electronic equipment in an

appropriate environment. Such equipment constituted the bulk, both in terms of volume and value, of items shipped to IRSIT. During this project, care was taken to ensure the proper environmental support. Surge protectors were used extensively. IRSIT itself, with GOT funds, invested in building-wide power conditioning equipment, and of course the VAX 6320 minicomputer was fully protected with the necessary HVAC support, as well as power conditioning. The project team jointly gained a great deal of experience in determining which investments in environmental safeguards were cost effective, and which became unnecessary as the Tunisian infrastructure itself improved.

IRSIIT, over time, developed a reasonable spare parts inventory. The project ensured that a trained and staffed maintenance section was available for IRSIT personnel and pilot projects after the first year of the project, and that a record was kept of operations and equipment failure. These records helped highlight patterns in sufficient time within the project to take necessary remedial actions. As one example, even though highly reliable hard-disk drives were purchased for virtually all microcomputers, there were, nonetheless, occasional failures which incapacitated several computers. Accordingly, spare hard-disk drives were made available as part of the spares inventory, and periodically replaced during the life of the project. In addition, certain critical components (such as IBM-PC/AT Lithium batteries), necessary for virtually all the equipment, were stocked to ensure that projects were not unduly disrupted because of nonfunctioning equipment.

#### **E. OWNERSHIP PROVISIONS**

Recognizing that all purchased goods and services were meant to support the Government of Tunisia, ownership of all equipment purchased under this project was immediately transferred to IRSIT and the Government of Tunisia. An "Attestation de Duoane," provided by USAID, noted on a shipment-by-shipment basis that all imported items were a gift from the Government of the United States to the Government of Tunisia. Accordingly, at project close-down, there was no need to shift equipment ownership as occurs in some projects. In addition, all home office computers supporting this project were paid for by AED overhead funds. Hence, no project funds were expended for home office equipment in support of the project.

ARC/Info Training video tapes	
PC Starter	\$250
PC Overlay	150
PC Plot	150
PC Edit	150

**Total:                    \$700**

To be purchased from Environmental Systems Research Institute, Redlands, California.

**3. Calcomp model 5825 Color Printer. kit of spare parts and consumables.**

(As quoted in FAX to AED (Ref #189-71) dated January 5, 1989 to AED/Washington.)

-Calcomp 5825 color printer with 220 VAC power supply (\$40,425).

-Maintenance kit of spare parts.

PCB-CPU	#692800-6	\$1098.90
PCB-Stylus switchcard	#621250-0	788.70
PCB-Shoe switch	#647740-0	709.50
PCB-Media Position	#660010-0	668.80
PCB-I/O Controller No. 1	#703860-7	1140.70
PCB I/O Controller No. 2	#651780-9	836.00
ASSY-EPP Toner Pump	#678360-9	688.60
PCB-908K Controller	#700230-6	1879.90
PCB-Bit/Slice Procr No 3	#707830-6	2169.20
PCB-Peripheral Contrl	#710690-9	1309.00

Total: \$11,289.30

Less 10% per FAX of 28 March, 1989

**Grand Total: \$10,160.37**

-10 month supply of consumables:

1 carton (2 500 foot rolls) of vellum (VDR-5-24) \$415

2 bottles of clear mix toner \$56

1 bottle each of the following replentisher

Black (RP58B)	\$52
Cyan (RP58C)	\$52
Yellow (RP58Y)	\$52
Magenta (RP58M)	\$52

**Total: \$672**

**Total price: \$51,264.37**

To be purchased from Budde International, Anaheim, California.

Dr. Nouredine Ellouze \_\_\_\_\_

Dr. Farouk Kamoun \_\_\_\_\_

Michael Denny \_\_\_\_\_

For USAID \_\_\_\_\_

**Academy for  
Educational  
Development**

**AED**

Purchase Order Number: 1585

Date: 4 April

Vender:

151  
Budde International, Inc.  
Steve Jefferies  
Voice: 714-772-2288  
Fax: 714-772-3805

PO #	ITEM#	QTY	DESCRIPTION	UNIT COST	TOT COST	PROJECT
01585	001	1	CALCOMP MODEL 5825 COLOR PRINTER 220V AC	\$40,425.00	\$40,425.00	2237
01585	002	1	PCB-CPU #692800-6....(SPARE PART ITEM 1)	\$1,098.90	\$1,098.90	2237
01585	003	1	PCB-STYLUS SB #621250-0.(SP PART ITEM 1)	\$788.70	\$788.70	2237
01585	004	1	PCB-SHOE SWCH #647740-0.(SP PART ITEM 1)	\$709.50	\$709.50	2237
01585	005	1	PCB-MEDIA POS #660010-0.(SP PART ITEM 1)	\$668.80	\$668.80	2237
01585	006	1	PCB-I/O CNTR #0703860-7.(SP PART ITEM 1)	\$1,140.70	\$1,140.70	2237
01585	007	1	PCB-I/O CNTR #0651780-9.(SP PART ITEM 1)	\$836.00	\$836.00	2237
01585	008	1	ASSY-EPP TMR PMP #678360-9 (SPRE ITEM 1)	\$688.60	\$688.60	2237
01585	009	1	PCB-908K CNTRLR #700230-6 (SPARE ITEM 1)	\$1,879.90	\$1,879.90	2237
01585	010	1	PCB-BIT/Slice #3 #707830-6(SPARE ITEM 1)	\$2,169.20	\$2,169.20	2237
01585	011	1	PCB-PERIPRL CNTL #710690-9(SPARE ITEM 1)	\$1,309.00	\$1,309.00	2237
01585	012	1	10 % DISCOUNT ITEMS 1-11 TO AED	-\$1,128.93	-\$1,128.93	2237
01585	013	1	CTN (2 500 FT ROLLS) VELLUM (VDR-5-24)	\$415.00	\$415.00	2237
01585	014	2	BOTTLES OF CLEAR MIX TONER	\$28.00	\$56.00	2237
01585	015	1	BOTTLE OF REPLENTISHER. <i>RP518</i> ...BLACK	\$52.00	\$52.00	2237
01585	016	1	BOTTLE OF REPLENTISHER. <i>RP516</i> ...CYAN	\$52.00	\$52.00	2237
01585	017	1	BOTTLE OF REPLENTISHER. <i>RP517</i> ...YELLOW	\$52.00	\$52.00	2237
01585	018	1	BOTTLE OF REPLENTISHER. <i>RP518</i> ...MAGENTA	\$52.00	\$52.00	2237
				\$51,264.37		

Grand Total

Bill to:  
Academy for Educational Development  
1255 23rd St, NW, Suite 400  
Washington, DC 20037

Ship to:  
(if other than billing address)

Attention: Bruce Clark  
Project Name: IRSIT/Tunisia Project No.: 2237/630

Tax Exempt # 8399-84816-01

1255 23rd Street, N.W.  
Washington, D.C. 20037  
(202) 862-1900  
Telex 197001 ACADEM WSH

By: *Bruce Clark*  
Approved: *[Signature]* 4/4/89