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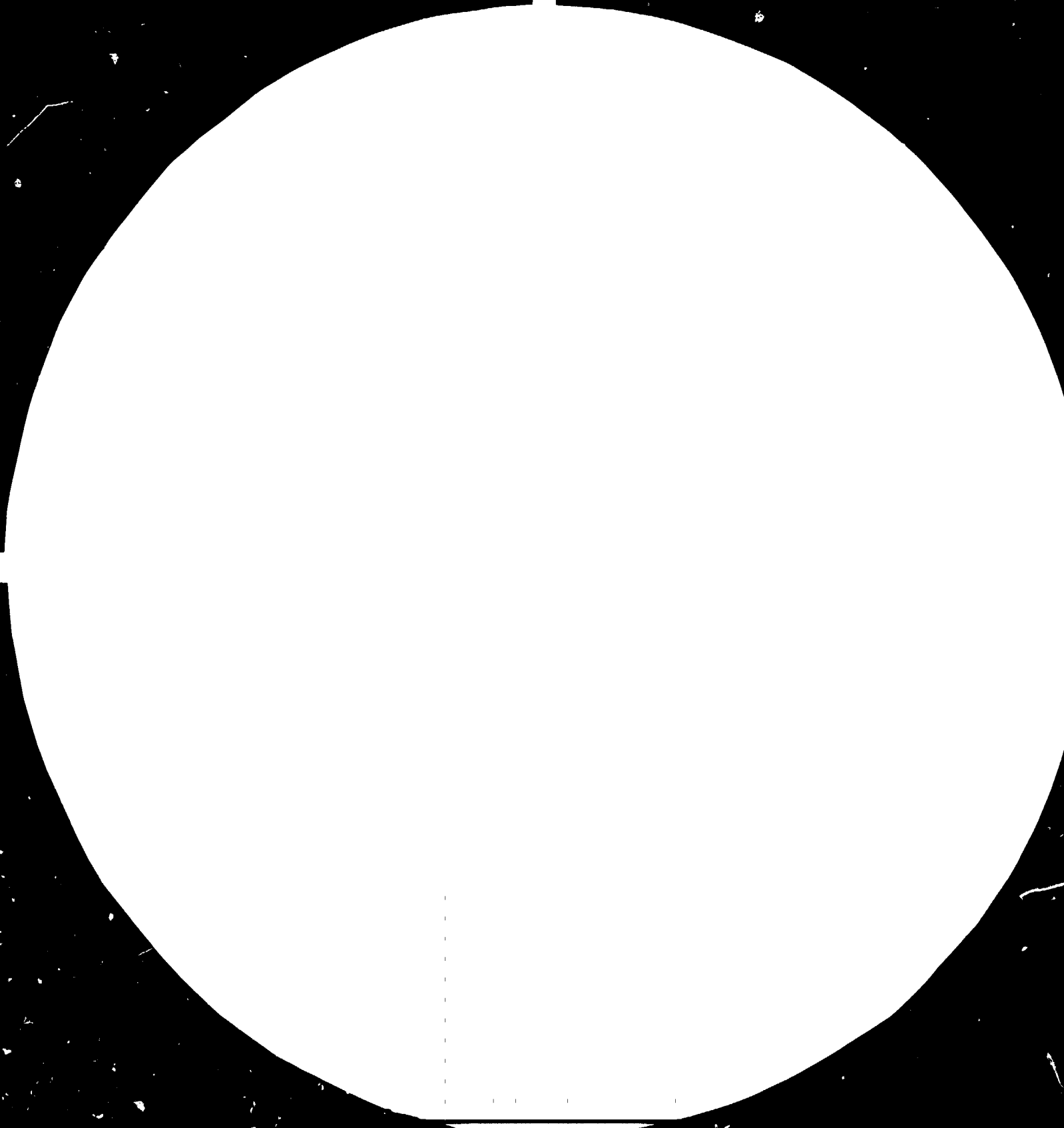
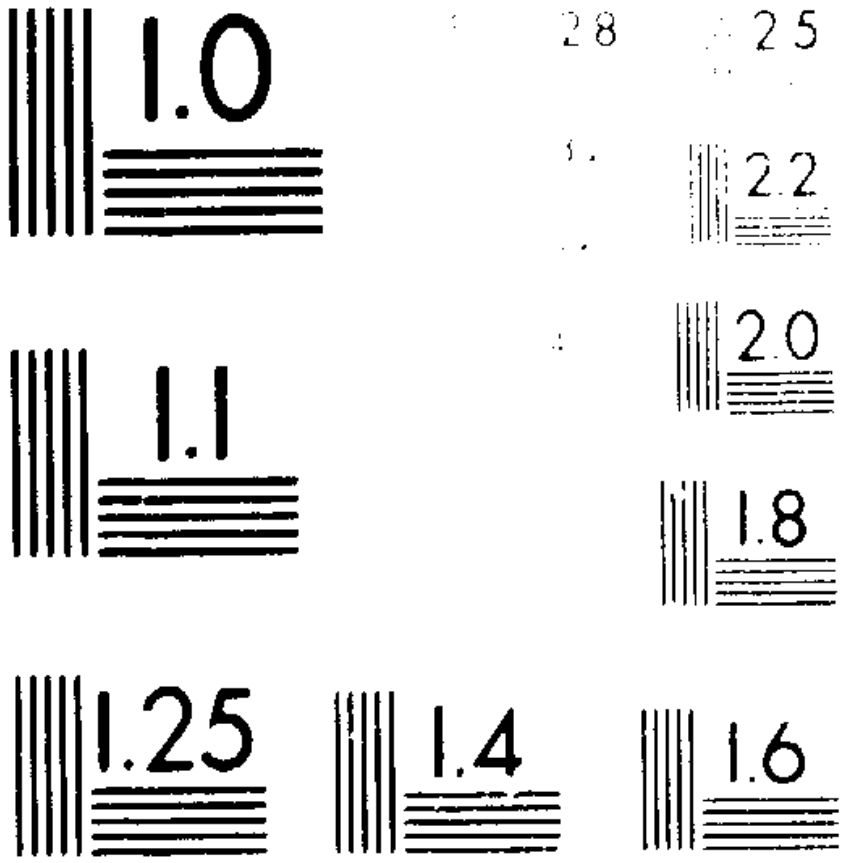
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





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COMPUTERIZED DECISION AIDS FOR INDUSTRIAL MANAGEMENT

DENNIS L. MEADOWS
RP = 510

Final Report on Phase I of UNIDO/IIASA Project
Carried Out Under Contract No. 84/123

at

Resource Policy Centre
Thayer School of Engineering
Dartmouth College
Hanover, NH 03755

and

International Institute for
Applied Systems Analysis
A-2361 Laxenburg
Austria

10

FINAL REPORT ON PHASE I: UNIDO/IIASA Project on Computerized Decision Aids for Industrial Management.

Dennis L. Meadows

RP #510

December 20, 1984

This is a report on the first phase of work carried out at Dartmouth College and IIASA with support of the UNIDO Factory Establishment and Management Div.

UNIDO/IIASA Project on Computerized
Decision Aids for Industrial Management

Table of Contents

UNIDO/IIASA Project on Computerized Decision Aids for Industrial Management

Background and Justification

Over the past several years UNIDO and especially the Factory Establishment and Management Section has received many requests for assistance in demonstration, development, and implementation of computerized decision aids for industrial management. These have come for two principal reasons:

- the technology of microcomputers has developed so far that powerful computers are now very cheap and simple to use. They are now realistically available to industrial ministry staff and to factory managers in most of the industrializing nations;

- the advances in management science and in computer software development have provided excellent management aids in a form that is cheap enough and simple enough to be widely available even in the poorer countries.

Microcomputers, when combined with computer programs that address the common factory management functions (such as inventory control, workforce scheduling, and payroll) can raise the effectiveness and productivity of managers. As a consequence, government/industry officials now see opportunities to compensate for their scarcity of trained personnel. They have been asking UNIDO/FCTY for assistance in selecting and implementing the proper computer systems. UNIDO has been responding to these requests, but developments in the field have been too rapid for any one small group to follow. Further, there is a scarcity of facilities for testing and demonstration of the machines and software that would be most useful to UNIDO's potential clients. Thus, UNIDO initiated the contract with IIASA to supplement its expertise and at the same time acquire the computers and software required to respond to future requests.

The development objective of this project is to increase the expertise of industrial managers and public officials responsible for allocating financial and personnel resources within industry. This will be achieved by:

- assembling a set of computerized training tools that can compensate for the lack of trained industrial management personnel in the developing nations.

- adapting these tools for use on very inexpensive, portable microcomputers suitable for the area.

The UNIDO/IIASA project was designed to have two phases, the first ending in December 1985

Immediate Objectives of Phase I

- Hold the first seminar/workshop to introduce management personnel from the developing world nations to the industrial management programs prepared by UNIDO/IIASA.

- Begin work on three pieces of the overall project:

1) develop and operate within UNIDO a microcomputer software center that would permit UNIDO to assess and distribute the most effective, computer-based industrial management tools to the developing world.

2) establish a small, but comprehensive, software library on programs for management decision-making processes that could be provided to the software centers that are being promoted by UNIDO around the world. IIASA will specify the generic functions to be addressed by these programs, for example inventory management, payroll, quality control, and so forth. UNIDO will select optimal examples of programs in each area and IIASA will re-program one of these packages to demonstrate how software can be implemented on an array of machines in the UNIDO microcomputer center.

3) Set up a UNIDO/IIASA consulting team that could work on developing and adapting management programs for use in UNIDO projects.

- Hold advisory meetings to prepare for Phase II.

- Submit 2 reports, which comprise the rest of this document.

1) the results of the first seminar indicating the range of equipment and software specified by workshop participants. This document will also provide preliminary feedback on the training techniques that have been developed by UNIDO/IIASA to convey management decision aids to clients unfamiliar with the use of computers.

2) the source of information to be used in compiling the mailing lists for the surveys of software and professionals.

Report on the UNIDO/IIASA Seminar Workshop on Microcomputer-based Tools for Management Training and Support

The UNIDO/IIASA seminar was held in two consecutive sessions: September 1-7 in Balaton Fured, Hungary and September 10-14 in Csopak, Hungary. The first meeting involved 39 computer specialists and managers from 15 countries. The second session involved 35 specialists from 15 countries. Only $10,000 in UNIDO funds had been set aside in the Phase I budget to support these meetings, but generous gifts from the Hungarian Ministry for Industry covered all room, board, and administrative expenses for the conference participants.

The first session was used to demonstrate a variety of microcomputers and computer-based training tools for use by managers. The second was used to critique the tools used in the first session and to identify future directions for the UNIDO/IIASA project. Participant lists for the two conferences are attached as appendices #1 and #2 to this report.

Microcomputer Specifications

From discussions of the participants, we finally identified six principal criteria to be used in selecting the microcomputers that should be installed in the UNIDO demonstration facility. To serve the needs of UNIDO the computers must be:

- relatively inexpensive, between $200 and $4000, including the display screen, printer, and memory,
- manufactured in many different countries,
- widely sold,
- widely serviced and inexpensive to maintain,
- supported by a diverse array of software, and
- available with at least 10K of random access memory.

We identified six computers that meet these criteria.

1. SHARP PC-1261 combined with the CE-125 printer and cassette tape recorder,
2. SINCLAIR Spectrum,
3. COMMODORE 64,
4. NEC PC-8201A,
5. APPLE IIe, and
6. IBM PC (or suitable PC compatibles).

All six of these machines were demonstrated at the seminar, and these are the microcomputers that will be used as the reference group for the project. Thus they are also the computers that should be included in the UNIDO microcomputer demonstration center. The combined set of software available for these machines includes well over 20,000 programs. Appendix #3 to this report includes descriptive materials on these machines.

Even though the above machines represent the great majority of all microcomputers sold anywhere on the globe over the past three years, there are some countries where none of these machines is available and where some other computer, perhaps one produced domestically, is more prevalent. To make the results of the UNIDO/IIASA project also useful in those countries, we have adopted a set of software standards that will extend the utility of the final programs beyond the family of six reference machines.

Software Requirements

Participants at the meeting indicated six criteria that should be employed in selecting software adopted for use in the UNIDO/IIASA project. The programs we use should be:

- easily converted for use on many different computers,
- conceptually straightforward, so that programmers with minimal skills can convert the UNIDO/IIASA programs to suit local conditions,
- available in the public domain for free or subject to purchase at minimal cost,
- easy to understand, in their essentials, by those with no prior programming experience,
- readily adaptable to a variety of the common industrial management functions, and
- compact enough so that they can be implemented even on the smallest member of the reference computer set, the SHARP PC-1261.

These criteria dictated the selection of two programming environments, one provided by the family of BASIC interpreters or compilers and the other provided by the spreadsheet machine language program.

BASIC is the world's most widely used computer language. Virtually every microcomputer is provided with a BASIC interpreter. While there are minor differences among the widely-used versions of BASIC, it is quite straightforward to convert a BASIC program that runs on one machine into a BASIC program that is suitable for another. BASIC is also conceptually simple to use, and even programmers with modest skills can understand a BASIC listing developed by another programmer and modify it for his or her own purposes.

Spreadsheets are the most widely sold form of microcomputer program. For example, there are over 50 spreadsheet packages available for the IBM-PC. Appendix #4 is the chapter on spreadsheets from the PC World 1985 Annual Review of Software. It lists the many advantages of spreadsheets for users unfamiliar with computer programming, and it illustrates the array of available programs with descriptions of twenty different spreadsheets.

The following list of spreadsheet attributes is taken from that chapter by Andrew T. Williams:

> "An electronic spreadsheet is the automated counterpart of an accountant's pad or ledger sheet. . . Spreadsheets apply their problem-solving capabilities to the gamut of business situations, from reports and budgets to forecasts and profit-and-loss statements.
>
> Three elements are behind the overwhelming popularity of the electronic spreadsheet as a business tool. First, the screen layout of columns and rows . . . present(s) a format familiar to even the most reluctant computer novice. Second, there's a direct connection between the words, number, or formulas you place in the cells (of the spreadsheet) and what appears on the screen. . . constructing an electronic spreadsheet is concrete rather than abstract. Finally, the spreadsheet gives you instant feedback. BEcause you can see each entry on the screen as it's entered, you can correct it immediately if it's wrong.
>
> In addition, a spreadsheet program automatically calculates a formula or a function, then displays the results. You can change assumptions as often as you like in order to quickly answer "what if" questions."

I would add that the spreadsheet requires only a logical mind and familiarity with algebra. No elaborate programming languages are required to use it. The basic spreadsheet program is tailored for use in a specific application by creating a template, a set of numbers, formulas, and labels that fit into the cells of the spreadsheet matrix. Templates have already been developed to deal with a wide variety of factory management tasks. One principal objective of Phase II will be to survey the available spreadsheet templates, identify those that are related to tasks of interest to UNIDO, and then adapt the best of them for use on the six reference microcomputers.

Our development work will be done on the IBM-PC (hence the urgent importance of securing a computer of this sort for use at UNIDO by the Factory Establishment and Management section.) We will use the spreadsheet incorporated in Lotus 1,2,3 to create the basic family of templates. Then each template will be reduced in complexity to fit the progressively smaller computers in the reference set.

The second principal objective of Phase II will be to create the UNIDO facility, the documents, and the training techniques that can permit the selected templates to be widely disseminated. Microcomputer-based instruction will be used in this connection, and it is with the teaching tools that we will employ the second software standard, BASIC. All the tutorials, games, and models that are developed for use in the training program will be written in BASIC. Important in the design of these tools will be the feedback received from the first session of the workshop we organized in September 1984.

Preliminary Feedback on the Training Techniques

The second workshop, scheduled for summer 1985, will provide us with much more feedback on the best techniques for use in disseminating the materials developed under the auspices of the UNIDO/IIASA project. However, we did experiment with a variety of different teaching techniques at the September 1984 meeting. To obtain feedback that would be helpful to us in the second phase of the project, we distributed a questionnaire with six questions:

- What is the nature of your work?
- What was the most valuable part of the workshop for you?
- What was the least valuable part?
- What one change or addition would most improve the workshop?
- Please describe in what way, if any, you intend to use the concepts, materials, or techniques of this workshop in your own work.
- In your home country, for what sort of audience do you think a workshop like this is most appropriate?

Appendix #5 is a summary of the responses to these six questions given at the end of the workshop by the participants.

Sources of Information for the Surveys

An early objective in Phase two will be to conduct two surveys. The first examines literature sources to identify firms that supply suitable templates. From analysis of those sources we will develop a catalogue of available spreadsheets and templates for the six reference microcomputers. The second surveys development professionals to identify the most important functions that should be addressed by the spreadsheet templates we adopt and the most important features we should incorporate in the templates adapted for the UNIDO/IIASA project.

The list of the firms receiving the software survey will be compiled from software catalogues for each of the six computers. This will give a sample of about 100 recipients.

The list of professionals who will receive the questionnaire about priority functions to be addressed within the area of factory management will be drawn from the consultant rosters of UNIDO, UNDP, the World Bank, AID, and the IDRC in Canada. An example of the materials to be used in this part of the study is the book, Consultants Available to Developing Countries. This report, prepared and distributed by UNIDO's Project Personnel Recruitment Section lists about 200 outstanding individuals along with their areas of specialty. Working in close collaboration with UNIDO staff, we will select 100 individuals from this and related publications.

Appendix 1: Participant List for the First Session of the Workshop

ADLER, Karen
Institute for Economics and Reseach
Federal Institute of Technology
Weinbergstrasse 35
CH-8006 Zurich
SWITZERLAND
Tel:(01) 471 55

ADLER, Thomas
Director
Transportation Systems Group
Resource Policy Center
Thayer School of Engineering
Box 8000
Dartmouth College
Hanover, NH 03755
USA
Tel: (603) 646 3551
Telex: 7103 661 828 dana

BOSSEL, Hartmut
Environmental Systems Research Group
University of Kassel - GhK
Moenchebergstrasse 19
D-3500 Kassel
FRG
Tel: (0561) 8042519
Telex: 99572 ghkks d

BÖSSEL, Rika
Am GalgenKoppel 6
D-3501 Zierenberg
FRG
Tel: (05606) 8241

BREZNAI, Peter
Department of Decision Analysis
National Management Development Center
Budapest, 1476
Koenyves Kalman krt. 48/52
HUNGARY

De KLEIN, J.P.G.
Department of Forest Management
Agricultural University of Wageningen
P.O. Box 342
6700 AH Wageningen
THE NETHERLANDS
Tel:(8370) 82541
Telex: 45015 blhwg nl

De VRIES, Bert
Director
Center for Energy and Environmental Studies
State University of Groningen
Postbus 72
9700 AB Groningen
THE NETHERLANDS
Tel: (050) 118052

DJAROVA, Julia
Dept. of Quantitative Methods and Modelling in Management
Institute of Social Management
Pionerski Put 2i
Sofia 1635
BULGARIA
Tel: 551008
Telex: 22832

GERNERT, Hans
Department of Business Sciences
Humbolt-University, Berlin
Spandauer Strasse 1
1020 Berlin
GDR
Tel: 2168343

KOS, Zdenek
Faculty of Civil Engineering
Technical University of Prague
Thakurova 7
16629 Prague 6
CZECHOSLOVAKIA

KRISHNAYYA, J.G.
Executive Director
Systems Research Institute
17-A Gultekdi
Pune 411037
INDIA
Tel: (312) 470323
Telex: 145 422 syst in

MEADOWS, Dennis
MEADOWS, Donella
Integrative and Special Studies
International Institute for Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (02236) 715 21 ext.540
Telex: 079137 iiasa a

after September 16, 1984:
Resource Policy Center
Thayer School of Engineering
Dartmouth College
Box 8000
Hanover, NH 03755
USA
Tel: (602) 646 3551
Telex: 7103 661 828 dana

NAUMIENKO, Elzbieta
Department of Information Systems
University of Lodz
Rewolucji 1905 r Street, 39
90-214 Lodz
POLAND
Tel: 331 332

NIELSEN ,Johan
Head of Section
National Agency of Environment Protection
Strandgade 29
DK-1401 Copenhagen K
DENMARK

ORDAZ, Enrique
Belgrad Rakpart 9. FSZ. 1.
H-1056 Budapest
HUNGARY

home address:
Carolina 117
07020
Mexico D.F.
MEXICO
Tel: (905) 7810213

OSTROWSKI, Roman
Deputy Director
Systems Research Institute
Polish Academy of Science
ul. Newelska 6
01-447 Warsaw
POLAND
Tel: 368150
Telex: 812 397

PEREZ-VENERO, Alex
United Nations Industrial Development Organization
Vienna International Center
P.O.Box 400
A-1400 Vienna
AUSTRIA
Tel: (0222) 2631 3862
Telex: 135612

RACSKO, Peter
Computing Center
Eotvoslorand University
Elite Szamitokozpont
1117 Budapest
Bogdanffy u. 10/B
HUNGARY
Tel: (1) 451 976 ext.52

RAJKAI, Kalman
Department of Soil Science
Research Institute for Soil Science and Agricultural Chemistry
Hungarian Academy of Sciences
Budapest, 1022
Hermann O. ut 15
HUNGARY
Tel: 354 924
Telex: 227 223 AGROK H

RIEGER, Laszlo
Department of Agricultural Economics
Karl Marx Universisty of Economics
Budapest, 1093
Dimitrov ter 8
HUNGARY
Tel: 175 068

SANDEN, Per
Department of Water in
Environment and Society
Linkoeping University
S-58183 Linkoeping
SWEDEN
Tel: (013) 281000

SANDS, Debbie
SANDS, Jonathan
Agriculture Department
Food and Agriculture
Organization
Via delle Terme di Carcalla
00100 Rome
ITALY
Tel: (06) 5797 3525

SINTUNAWA, Chirapol
Faculty of Environment
and Resource Studies
Mahidol University-Salaya
25 Phutthamonthon 4,
Nakornchaisri
Nakornpathom 73170
THAILAND
Tel: 66-2-413 2931 ext.74
Telex: 84868 chontex th

STACHOWITZ, Jan
Deputy Director for Scientific
Activity
Institute for Management
Science
Polish Academy of Science
ul. Chrzanowskiego 17
41-902 Bytom
POLAND
Tel: 832 818112
Telex: 033 286 IOK

STARR, Gerald
Integrative and Special Studies
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (02236) 715210
Telex: 079137 iiasa a

after September 16, 1984
Resource Policy Center
Thayer School of Engineering
Dartmouth College
Hanover, NH 03755
Tel: (602) 646 3551

STAVE, Krystyna
Integrative and Special Studies
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (02236) 715210
Telex: 079137 iiasa a

after September 16, 1984
Resource Policy Center
Thayer School of Engineering
Dartmouth College
Box 8000
Hanover, NH 03755
USA
Tel: (602) 646 3551

SZIRMAI, Zoltan
Institute for Thermal Energy
Systems Engineering
Technical University Budapest
Budafoki ut 4
H-1111 Budapest
HUNGARY
Tel: (1) 453 195

TAKACS, Tibor
Central Institute for
Development of Mining
Budapest, 1027
Varsanyi I. u. 40/44
HUNGARY

TODORO, Dimiter
Vice Director of the
Computer Center
Ministry of Forestry and
Forest Industry
St. Autin I, #17
Sofia
BULGARIA
Tel: 872059

TODD, John
TODD, Nancy
TODD, Susannah
President
Company of the Stewards
Ten Shanks Pond Road
Sippewissett, Falmouth, MA 02540
USA
Tel: (617) 5488161

TÖTH, Eva
TOTH, Ferenc
Integrative and Special Studies
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (02236) 71521 ext.505
Telex: 079137

VALYI, Istvan
Bureau for Systems Analysis
State Office for Technical
Development
P.O. Box 565
H-1374 Budapest
HUNGARY
Tel: (1) 187 998
Telex: 225840 reibp h

VECSENYI, Janos
Department of Decision Support
Bureau for Systems Analysis
Budapest, 1374
Post Box 565
HUNGARY
Tel: (1) 187 021

WILSON, Shirley
Integrative and Special Studies
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (02236) 71521 ext.200
Telex: 079139 iiasa a

ZAMORI, Szofia
Bureau for Systems Ana ysis
State Office for Technical
Development
P.O.Box 565
H-1374 Budapest
Hungary
Tel: (1) 187 213
Telex: 225840 reibp h

ZAMORI, Zoltan
Technical University of
Budapest
H-1111 Budapest
Muegyetem rkp. 3/9
Hungary

Appendix 2: Participant List for the Second Session of the Workshop

ADLER, Thomas
Director
Transportation Systems Group
Resource Policy Center
Thayer School of Engineering
Box 8000
Dartmouth College
Hanover, NH 03755
USA
Tel: (603) 646 3551
Telex: 7103661 828 dana

ALCAMO, Joseph
Acid Rain Project
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (2236) 71521 ext.345
Telex: 079137 iiasa a

ARBATOV, Alexander
Institute for Systems Studies
9 Prospekt 60 - letija Oktiabria
Moscow 1190
USSR
Tel: (95) 135 4488
Telex: 411354 dmnts

BOSSEL, Hartmut
Environmental Systems Research
Group
University of Kassel - GhK
Moenchebergstrasse 19
D-3500 Kassel
FRG
Tel: (0561) 8042519
Telex: 99572 ghkks d

BUDOWSKI, Gerardo
CATIE
Turrialba
COSTA RICA
Tel: 566021
Telex: 8005 catie cr

CZOTTNER, Piroska
Department of International
Relations
Hungarian Oil and Gas Trust
Schonherz A. u.18
H-1117 Budapest
HUNGARY
Tel: (1) 664 299
Telex: 22-4762

DAVIS, Joan
Swiss Federal Institute of
Water Resources (EAWAG)
CH-8600 Dubendorf/Zurich
SWITZERLAND
Tel: (1) 823 5072/or 5010
Telex: 53817 empa

De VRIES, Bert
State University of Groningen
Postbus 72
9700 AB Groningen
THE NETHERLANDS
Tel: (50) 118052

FUTO, Ivan
Institute for Coordination
of Computer Techniques
H-1011 Iskola u.8
P.O.Box 224
Budapest
HUNGARY
Tel: (1) 260 000 ext.136

HAFKAMP, Wim
Institute for Environmental
Studies
Free University
P.O.Box 7161
NL-1007
Amsterdam
THE NETHERLANDS
Tel: (31) 548 ext.3813
Telex:

CSAKI, Csaba
Dean
Department of Agricultural
Economics
Karl Marx University of
Economic Sciences
IX Dimitrov ter 8
H-1093 Budapest
Tel: (1) 188 076
Telex: 224 186 mkke h

HOGAN, Ian
Energy Studies Unit
University of Strathclyde
100 Montrose St.
Glasgow G40L2
Scotland
UK
Tel: (41) 552 4400 ext.3306

JASEBI, Tamas
Institute for Thermal Energy
Systems Engineering
Technical University Budapest
Budafoki ut 4
H-1111 Budapest
HUNGARY
Tel: (1) 453 195
Telex: 22-5931 muegy h

JERVAN, Hilde
Resource Policy Group
Segveien 21
N 0458 Oslo 4
NORWAY
Tel: (2) 3702-80

KAPOLYI, Laszlo
Minister for Industry
Martirok utja 85
H-1024 Budapest
HUNGARY
Tel: (1) 069 134
Telex: 22442 bd

KRISHNAIYA, J.G.
Executive Director
Systems Research Institute
17-A Gultekdi
Pune 411037
INDIA
Tel: (212) 470323
(home 212-63930)
Telex: c/o Dr Rao
145 333 mccl in

MARNOS, Zsolt
Bureau for Systems Analysis
State Office for Technical
Development
Martinelli ter 8
P.O.Box 565
H-1374 Budapest
HUNGARY
Tel: (1) 187998
Telex: 225840 reibp h

LENGYEL, Laszlo
Department for Development
of Infrastructure
Hungarian Planning Office
V., Roosevelt ter 7/8
H-1051 Budapest
HUNGARY
Tel: (1) 322 100 ext.149

LENGYEL, Laszlo
National Authority for
Energy Economics
Ministry for Industry
Martirok utja 85
P.O.Box 96
H-1525 Budapest, II
HUNGARY
Tel: (1) 350 161

LOVEI, Laszlo
Department of Industry
National Planning Office
V., Roosevelt ter 7/8
H-1051 Budapest
HUNGARY
Tel: (1) 326 107

MEADOWS, Dennis
MEADOWS, Donella
Integrative and Special Studies
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (2236) 71521 ext.540
Telex: 079137 iiasa a

after september 15, 1984
Resource Policy Center
Thayer School of Engineering
Dartmouth College
Box 8000
Hanover, NH 03755
USA
Tel: (603) 646 3551
Telex: 7103 661 828 dana

LANG, Istvan
Acting Secretary General
Hungarian Academy of Sciences
V., Roosevelt ter 9
H-1051 Budapest
HUNGARY
Tel: (1) 127 069
Telex: 224139 mta bd

MAYER, Niels
Physics Laboratory III
The Technical University of Denmark
Building 309 C
DK-2800 Lyngby
DENMARK
Tel: (2) 881611
Telex: 37529 dthdia dk

NORGARD, Jorgen
Physics Laboratory III
The Technical University
of Denmark
Building 309 C
DK-2800 Lyngby
DENMARK
Tel: (2) 881611

SINTUNAWA, Chirapol
Faculty of Environment and
Resource Studies
Mahidol University
25 Phutthamonthon 4, Salaya
Nakornchaisri,Nakornpathom 73170
THAILAND
Tel: 4132931-5 ext.379

ORDAZ, Enrique
Belgrad RKP. 9 FSZ. 1
H-1056, Budapest
HUNGARY

home address:
Carolina 117
07020 Mexico, D.F.
MEXICO
Tel: (905) 781 0213

SZIRMAI, Zoltan
Institute for Thermal Energy
Systems Engineering
Technical University Budapest
Budafoki ut 4
H-1111 Budapest
HUNGARY
Tel: (1) 452 192
Telex: 22-5931 muegy h

PITROVANOV, Serge
Institute for Systems Studies
9 Prospekt 60 - letija Oktiabria
Moscow 119034
USSR
Tel: (95) 1356 073
Telex: 411354 dmnts

TOTH, Ferenc
Integrative and Special Studies
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (2236) 71521 ext.505
Telex: 079137 iiasa a

POPOV, Todor
Director
Research Laboratory "Problems
of the Food Complex"
Blvd. Dragan Zankov 8
Sofia 1121
BULGARIA
Tel: (2) 665 869

VALYI, Istvan
Bureau for Systems Analysis
State Office for Technical
Development
P.O.Box 565
H-1374 Budapest
HUNGARY
Tel: (1) 187 310

QUESADA, Carlos
CATIE
Turrialba
COSTA RICA
Tel: 56 64 31 ext.285
Telex: 8005 catie cr

WILSON, Shirley
Integrative and Special Studies
International Institute for
Applied Systems Analysis
A-2361 Laxenburg
AUSTRIA
Tel: (2236) 71521 ext.200
Telex: 079137 iiasa a

RABAR, Ferenc
Deputy Head of Section
Department for Development
of Methodology
Hungarian Planning Bureau
V., Roosevelt ter. 8
H-1051 Budpest
HUNGARY
Tel: (1) 122 837

Appendix 3: Descriptive Materials on the Reference Microcomputers

COMMODORE

**Commodore Business Machines, Inc.,
1200 Wilson Dr., West Chester, PA 19380,
(215) 491-9100**

COMMODORE 64

Take a close look at the Commodore 64. It's easy to mistake it for Commodore's other popular-selling computer, the VIC-20, since they share the same case and keyboard layout. But turn a Commodore 64 on, and the similarities end there. Not only does the 64 have 64K of RAM but also a sophisticated, sixteen-color, high-resolution graphics program, music, and business software capability that makes it the perfect choice for a starter or second system.

The 64 uses many of the same peripherals and software originally designed for the Commodore PET and the VIC-20, including the C 1525 or 1526 printer and the VIC modem. New for the Commodore 64 is the VIC-1541 single-sided disk drive. This "intelligent" drive, with its own microprocesor to help free up the computer's main processing chip, can store 170K on a single disk. This is 30K more than an Apple drive.

Though the Commodore 64 is primarily a home unit, it can be used for business as well. A series of business-oriented programs has been announced by Commodore, including an electronic spreadsheet, a finance/budget program, an electronic calendar, a simple database program, telecommunications software, and a word processor. In addition, a CP/M adapter is available to allow the machine to run nearly all of the more than three thousand programs written for CP/M-based machines.

SPECIFICATIONS

Microprocessor: 6510

Internal memory: 64K RAM.

External memory: Optional 5¼-in. floppy disk with 170K per drive, maximum of 4 drives allowed per system.

I/O ports: Program or game cartridge slot, 2 game controller ports, TV/audio/video connectors, serial port (for disk drives or printer), port for modem or cartridge.

Character display: 25 rows by 40 columns.

Graphics display: 320-by-200-pixel high-resolution graphics mode with 16 colors; 8 separately controllable "sprites" (picture cells) of 21 by 24 dots each.

Keyboard: 66 keys, including 44 uppercase and lowercase programmable software keys.

Sound: User-controllable music synthesizer with 3 choices and 9-octave range.

Real time clock: Built-in.

Basic system price: Approx. $200 to $225 (not including printer, disk drive, or monitor).

Hardware options: Data cassette recorder, 170K floppy disk drive, dot matrix printer, RS-232C interface cartridge, IEEE-488 interface cartridge, VIC modem, Z-80 upgrade cartridge.

Software options: BASIC (included), Logo, Pascal, Pilot, etc.; Easycalc, Easyplot, Easyfinance, Easyschedule, Easyfile, Easyscript, music, graphics, and game programs.

Service: Service is available through over 600 authorized dealers, seven regional centers, and Commodore's Customer Service Division.

REVIEW

Few computers can boast the variety of applications that can be handled with the Commodore 64. Pop a game cartridge into the machine and the 64 acts like a sophsiticated arcade computer; call up BASIC and write a new home finance program; plus in the optional CP/M module, and you're off and running with *WordStar* or any of more than three thousand other business-oriented software packages; connect the computer to your hi-fi, press a few keys, and the 64 plays brilliant, concert hall music.

Indeed, the Commodore 64 has a lot going for it, and it is a perfect choice as a starter or second system. But there are a few more things you need to know about the 64 to make a wise purchasing decision.

While the Commodore 64 can share many of the hardware add-ons for the VIC-20, it can't use many of its program cartridges. The internal workings of the two machines are too different. In addition, since the lower-case character and graphics generators in the 64 interact with one another, you can't have lower-case characters and graphics on the same screen.

Even with these peculilarities, however, the Commodore 64 shines as an above-average computer. Its low cost, large computing power, and the reasonable price of its peripherals and software (disk drive and monitor, $225 to $250 each; printer, $300 to $350) make it an ideal choice for home or office use.

IBM

International Business Machines, Building 227, PO Box 1328, Dept. 8M3, Boca Raton, FL 33432, (800) 447-4700

IBM PERSONAL COMPUTER

The IBM Personal Computer is loaded with many, if not most, of the best features heretofore available on personal computers—and a few all its own. It features color graphics, upper- and lowercase letters, expandable memory, a 16-bit microprocessor, three levels of BASIC, a Program Editor, and excellent user manuals. Since IBM sees two distinct markets for this computer, business and home, it "unbundled" the system, meaning that each component is purchased separately, allowing the user to configure a system to suit his or her needs. Applications software is also rapidly arriving on the market, making the IBM Personal Computer a practical choice for business.

SPECIFICATIONS

Microprocessor: Intel 8088.

Internal memory: 256K RAM, expandable to 640K; 40K ROM.

External memory: 360K, 5¼-in. floppy disk drive.

I/O ports: None (optional).

Video output: None

Keyboard: Detached, adjustable; 83 keys; numeric keypad; cursor control; 10 programmable function keys.

Software included: Cassette BASIC, tutorial diskettes.

Special features: Built-in speaker, 5 expansion slots, disk drives (optional) that fit inside main cabinet.

Basic system price: Minimum working system with 256K RAM, keyboard, and 360K diskette drive, $1,995. Monochrome display adapter/printer adapter (for 80-column by 40-line format, plus connector for RF generator, and printer port), an additional $250. Monochrome video display, $275. 12½-inch color monitor, $680.

Typical system price: With 256K RAM, keyboard, 360K diskette drive and adapter, and monochrome display and adapter, $2,520.

Hardware options: Color graphics board (RGB) or composite video output, 40 columns by 24 lines or 80 columns by 24 lines, 16-color, $300; disk drive adapter, $125; 5¼-in double-sided, double-density floppy disk drive (360K), $425; 64-256K memory expansion card, $265, 64K RAM, $100; RS-232 serial (communications) interface, $100; game control adapter, $45; binary synchronous communications adapter, $240.

Software options: VisiCalc, $200; Easy Writer, $175; MultiPlan, $250; Extended BASIC, $40; Pascal, $300; Peachtree Accounting Package, $595 per module; binary synchronous 3270 emulation, $700; UCSD p-System Support, $50; Professional Editor, $130; Strategy Games, $30; Word Proof, $60; Mailing List Manager, $195; VisiCalc 1.2, $200.

Sales and service: Computerland Stores and Sears Roebuck Business Stores have been appointed as authorized dealers. All dealers must qualify as authorized repair centers. IBM Product Centers will also handle the Personal Computer. A 90-day warranty is issued. Extensions and annual maintenance contracts are available.

REVIEW

The keyboard and system unit design of the IBM Personal Computer are unique and provide for enormous flexibility. The keyboard is attached to the unit by a six-foot cable and can be placed on the user's lap or an adjacent table top. The system unit is high styled, compact (only 20 inches wide, 16 inches deep, 5½ inches high), and weighs only twenty-one pounds. As the user faces it, there are a speaker in the left front corner, adjacent to the memory; disk drives in the right front corner; and expansion slots in the rear left corner. This efficient design facilitates installation of adapter boards. The number of expansion slots is of some concern, since the basic unit lacks I/O ports (except for disk). However, independent sources are already producing multifunction boards that can combine several applications on one circuit board. Also, high-density memory boards are becoming available to allow expansion of the system to a full 640K, utilizing only one expansion slot. However, buyers must be careful to configure the system carefully, or it may be necessary to purchase an additional expansion box from an independent source to accomplish a desired application.

IBM chose Microsoft to write its basic software, PC BASIC, which is available in several forms (since standard "cassette BASIC" lacks many features advanced users need). It also chose Microsoft to develop the IBM Disk Operating System, called MS-DOS, which is rapidly becoming a standard for computers using 8088 or 8086 microprocessors. This is a decided advantage for the IBM user as software from second sources becomes abundant. IBM itself is releasing software at a rapid rate.

IBM has set the standard for the industry with its Personal Computer. And the word *PC* has become synonymous with IBM, both making buyers feel secure.

APPLE IIe

It's a little-known fact that the Apple II of 1982 is internally a very different unit from the first Apple II of 1977. There have been thirteen major design changes in the Apple II over this five-year period, although at first sight the machine seems about the same. The company decided to keep the same case size and shape. But a closer look at the later model reveals a much more sophisticated personal comp[u]ter priced very close to the Apple II. The most obvious difference is the keyboard. With only fifty-three keys, the Apple II lacks several important function keys and requires odd placement of some regular characters. The IIe has sixty-three keys and a full typewriter-style keyboard that is essentially identical to the Apple III without a numeric keypad. It also has programmable function keys. The 6502 microprocessor comes with 64K RAM (versus the Apple II's 48K). An extra 64K of memory is optional on a plug-in board, though the machine can't be considered a 128K unit because it can't function using all 128K memory during any one operation.

SPECIFICATIONS

Microprocessor: 6502.

Internal memory: 64K RAM, 16K ROM.

External memory: Disc II 140K 5¼-in. floppy disk drive.

I/O ports: 7 expansion slots, video and memory expansion slot.

Character display: 40 columns by 24 lines; 80 columns by 24 lines optional.

Graphics display: Low-resolution, 16 colors, 40 x 48; high-resolution, 16 colors, 280 by 192.

Keyboard: 63 keys, all 128 ASCII codes, upper- and lower-case, auto-repeat feature, programmable function keys.

Standard software: Applesoft BASIC language.

Basic system price: $895.

Hardware options: 80-column card, $125; extended 80-column card including additional 64K RAM, $295; Disk II with controller and DOS, $545 (without DOS, $395).

Software options: Pascal, $250; Apple Writer II, $195; Quick File II, $100.

Sales and service: Apple's AppleCare Carry-in Service extends the original warranty to 12 months, renewable yearly. The plan covers parts and labor, unlimited repairs on covered components, and protects a system (e.g., Apple IIe, Disk Drive II, and Monitor III) for $12.95 per month. The service is available through more than 1,400 authorized Apple dealers in the U.S. and Canada.

REVIEW

The Apple II has few if any surprising features that make it stand apart from similarly priced personal computer systems. It's actually just a logical extension of the Apple II, with the features that long-time Apple II users had been calling for.

Unfortunately, Apple decided not to offer an eighty-column display, the standard for word processing, as a standard feature for the IIe. This is probably attributable to the fact that many people

use their Apples with home TVs, which don't have enough resolution to display eighty columns of text. The good news is that adding eighty columns to the IIe is neither difficult nor expensive. Apple offers two options, an eighty-column expansion board for $125 (well below the price of comparable accessories for the Apple II), and an eighty-column board with an additional 64K of memory for $295.

The keyboard is slightly sloped with a fine touch that's as good or better than many personal computers costing much more. Keyboard additions include separate cursor control keys and a TAB key, especially useful for word processing. There are also "open Apple" and "closed Apple" keys that can be used as programmable function keys, allowing the operator to program into one keypress functions that would require several keystrokes. On the lower left-hand corner of the keyboard is a CAPS LOCK key.

The back of the case has twelve pop-off plastic covers on both horizontal and vertical slots for accessory boards. The slots have been designed to accept the DB connectors that are becoming a standard of the computer industry.

On the other side are a video socket, a place to connect a cassette recorder, and something new—a socket for connecting a joystick or controller for playing games. The nine-pin connector won't take existing Apple II controllers since the design is different, although users can still plug in old-style controllers inside the case.

When the purchaser pops the cover off the IIe's case, he'll be in for a surprise. Although the familiar 6502 microprocessor, identical to the Apple II, is still there, the IIe has less than one-fourth the number of integrated circuits (chips) that the Apple II had. This is because circuit technology has packed more and more circuitry into smaller and smaller packages. There are two chips—custom-designed by Apple engineers—replacing eighty chips of the Apple II. There are a couple of advantages to using fewer chips: First, much less heat, the bane of electronic circuitry production, and second, easier servicing.

The IIe comes standard with 64K RAM, which most sophisticated programs require as a minimum. An extra 64K of memory on a plug-in board is an option, though for various technical resons, the IIe doesn't become a 128K machine. The line of seven familiar accessory slots for plugging in accessory circuit boards has been reduced by one, although all Apple II cards work with IIe. The addition is a special-purpose video output slot designed for extra memory and the eighty-column option.

The PC-1261 Guides You Through Every Step—

Easy Simulation Program

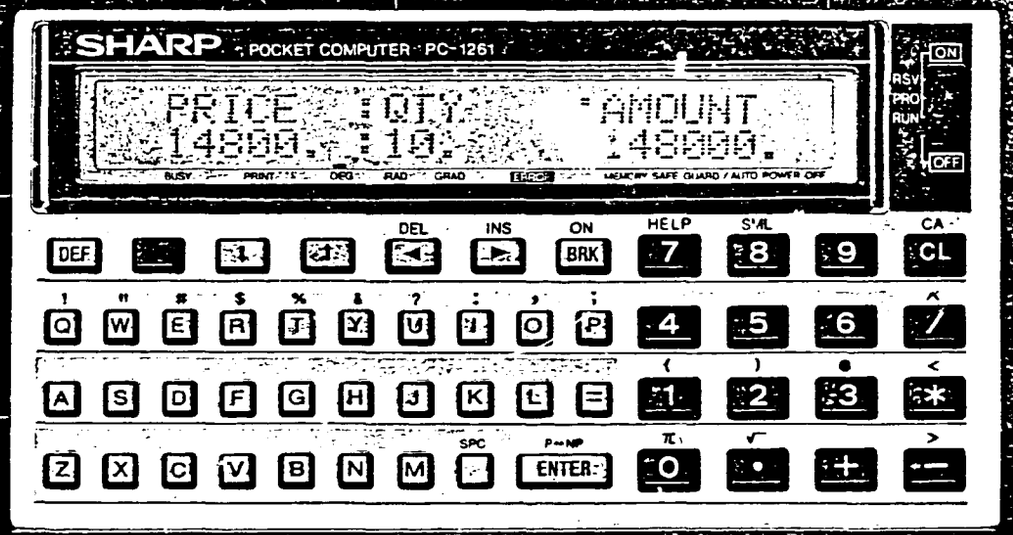
A new dimension in pocket computing. The built-in Easy Simulation program helps you make numerical computation programs easily. In these programs, input an equation simply and directly in plain English—you don't have to use BASIC commands. In addition, the program has eliminated the complex steps needed for changing individual values in a programmed calculation; simply use the cursor to insert new values and results will vary accordingly.

Large Dual-line 24-digit Liquid Crystal Display

You can display both upper and lower case letters on the 2-line 24-digit LCD. You now get more information readout for greater computing control and convenience.

HELP Function

Whether you're new to computers or not, you'll appreciate the PC-1261's HELP function. Just press the SHIFT and 17 keys for display of BASIC commands and usages, error messages and error locations (pointed out with the cursor), and ASCII codes for hexadecimal notation.



Enlarged 10.4KB RAM

The PC-1261 has memory enough to keep up with your needs and skill as you use longer, complex programs. You get more computing versatility for a wider variety of applied programs.

Greater BASIC Command Flexibility

Expanded BASIC command functions consisting of two-letter variables, variable arrays (two-dimensional arrays), and line numbers from 1 to 65279 give greater data input flexibility.

Additional Features

- Ultracompact and light for true pocket portability
- 8-bit CPU for fast data processing
- 18 reservable/definable keys for convenient data input
- PASSWORD function
- "beep" sound function

System Option

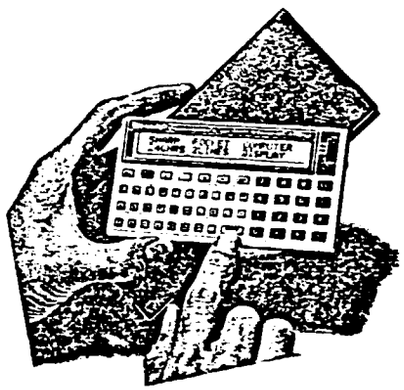
CE-125 thermal printer/ microcassette tape recorder

A quiet, 24-digit thermal printer and a microcassette tape recorder for storing programs and data are combined for upgraded computing. Together, the PC-1261 and the CE-125 make a book-sized computer system.

CE-126P thermal printer/ cassette interface

A quiet, 24-digit thermal printer. Programs and data can be stored through the built-in cassette interface when connected to the CE-152 cassette tape recorder.

For Simpler Operation and Faster, Accurate Results.



Showing You the Way...

Are you hesitant about purchasing a computer because you're worried about BASIC operating techniques? Have you ever been confused while programming because of complicated key operation? Computer use would be greatly simplified if you could confirm just what's going on with a glance at the display.

Now the Sharp PC-1261 pocket computer solves these problems. It's a friendly little computer that can put you on the right track towards practical computing.

Take a look at the PC-1261's HELP function. It will be appreciated by both first-time and experienced users because it (1) displays a list of BASIC commands and usages, (2) gives error messages which let you know error types and locations, (3) displays ASCII codes* table.

The Easy Simulation program also makes operation easier by freeing you from the inconvenience of long, repetitive key operation. Unlike present pocket computers, the PC-1261 avoids repeating steps to change individual values in programmed equations. Now you can use the cursor to simply change values in any equation, quickly and easily. You can even use everyday English to set up a numerical computation program.

Because of the large 10.4KB RAM and expanded BASIC command capability, you don't have to worry about outgrowing the PC-1261. The two-line LCD gives more data readout, helpful in long calculations.

Any way you look at it, pocket computing has come of age for everybody with the Sharp PC-1261.

Easy Simulation Program

Use the Easy Simulation program function for changing individual values in a continuing programmed equation for fast, convenient calculations. If you need the calculation printed out, attach the optional CE-125 printer/tape recorder and operate the PC-1261 in the PRINT mode.

EXAMPLE:

PRO mode

*AMOUNT=PRICE*QTY [ENTER]

```
*AMOUNT=PRICE*QTY
```

RUN mode

*AMOUNT [ENTER]

```
PRICE   :QTY      :AMOUNT
_
```

14800 [ENTER]

```
PRICE   :QTY      :AMOUNT
14800.  :_
```

10 [ENTER]

```
PRICE   :QTY      :AMOUNT
14800.  :10.      :148000.
```

(new quantity can be entered with the cursor)

```
PRICE   :QTY      :AMOUNT
14800.  :■0.      :
```

20 [ENTER]

```
PRICE   :QTY      :AMOUNT
14800.  :20.      :296000.
```

HELP Function

Use the HELP function if you get lost and need an explanation of your error or if you just want a display of control data and operating procedures.

1) When you see an ERROR sign on the LCD display press [SHIFT] and [7] keys and the **Error Message Function** explains the type of error and locates it on the display with the cursor.

```
10:A=5/ 0 +3
CALCULATION ERROR
```

2) The **Reference Function** displays BASIC commands and their correct usage. For example, when you press the [L], [SHIFT] and [7] keys, BASIC commands with the initial L are displayed.

```
LEFT$   LEN     LET
LIST    LIST#   LLIST
```

Further, if you need to know how to use LEN for example (one of the commands with L), just press the [L], [E], [N], [SHIFT] and [7] keys and you'll get the necessary information.

```
X=LEN   A$
X=LEN   (A$+""SHARP"")
```

3) When you press [A], [S], [C], [I], [I], [SHIFT] and [7] keys, the **ASCII Table* Function** displays ASCII codes* used in hexadecimal notation. In this example a=&61, g=&67, o=&6F, etc. (The display can be scrolled with the [▼] and [▲] keys.)

```
  0123456789ABCDEF
6 : abcdefghijklmno
```

Expanded BASIC Commands

The expanded BASIC commands give you more input flexibility as your skills increase. These expanded input commands allow the PC-1261 to continue responding to your growing needs as you apply longer and more complex programs.

*The PC-1261's character codes are in accordance with ASCII codes which include ¥, %, etc.

Specifications

Model	PC-1261
Number of calculation digits	10 digits (mantissa) + 2 digits (exponent)
Calculation system	According to mathematical formula (with priority judging function)
Program language	BASIC
Capacity	Program memory: 9,342 steps Reserve memory: 48 steps Easy Simulation area:128 steps
Stack	For data: 8 stacks For function: 16 stacks For subroutine: 10 stacks For FOR-NEXT statement: 5 stacks
Calculation	Four arithmetic calculations, power calculation, trigonometric and inverse trigonometric functions, logarithmic and exponential functions, angular conversion, extraction of square root, sign function, absolutes, integers, and logical calculations
Editing function	Cursor shifting (▶, ◀) Insertion (INS) Deletion (DEL) Line up and down
Memory protection	C-MOS battery back-up
Display	2-line 24-digit alphanumeric dot matrix liquid crystal display
Component	C-MOS LSI, etc.
Power supply	Lithium cell (CR-2032) × 2, approx. 300 hours
Power consumption	0.03W
Operating temperature	0°C~40°C (32°F~104°F)
Dimensions	135(W) × 70(D) × 9.5(H)mm 5-5/16"(W) × 2-3/4"(D) × 3/8"(H)
Weight	115g (0.25 lb.)
Accessories	Hard cover, cell (CR-2032) × 2, template
Options	CE-125 thermal printer/microcassette tape recorder, CE-126P thermal printer/cassette interface

BASIC LANGUAGE SPECIFICATIONS

Command	RUN, NEW, LLIST, PASS, LIST, CONT, TR ON, TR OFF, MEM,
Statement	INPUT, PRINT, LPRINT, PAUSE, USING, WAIT, CURSOR, CLS, IF...THEN, STOP, GOTO, ON...GOTO, GOSUB, ON...GOSUB, RETURN, FOR...TO...STEP, NEXT, END, DIM, LET, REM, DATA, READ, RESTORE, BEEP, AREAD, CLEAR, RANDOM, DEGREE, RADIAN, GRAD
Operation	+, −, ✱, /, (,), >, <, >=, <=, <>, =, ^, AND, OR, NOT, &
Function	SIN, COS, TAN, ASN, ACS, ATN, LN, LOG, EXP, DEG, DMS, RND, SGN, ABS, INT, PI(π), LEFT$, RIGHT$, MID$, ASC, VAL, LEN, CHR$, STR$, SQR (√)
Variable control	A~Z, A$~Z$, two-dimensional arrays applicable
Cassette control	CSAVE, CLOAD, CLOAD?, MERGE, CHAIN, INPUT#, PRINT#
Other	INKEY$, „ „ „ "
Easy Simulation program	LIST#, LLIST#, EQU#, MEM#, NEW#

CE-125 Specifications

PRINTER

Type	Thermal printer
Printing digits	24 digits
Printing speed	Approx. 0.8 line/second
Printing paper	Thermal printing paper Width; 58mm (2-9/32"), Diameter; 18mm (23/32")

TAPE RECORDER

Type	Monaural microcassette tape recorder
Track system	2-track, 1-channel monophonic
Tape	Microcassette tape
Tape speed	15/16" ips. (2.4cm/sec.)
Input terminal	3.5ø matching impedance under less than 1kΩ

GENERAL

Power source	Rechargeable Ni-Cd battery Approx. 2,000 lines (when using printer only) Approx. 4 hours (when using cassette tape recorder only) AC adaptor (EA-23E)
Power consumption	2.5W
Operating temperature	0°C~40°C (32°F~104°F)
Dimensions	205(W) × 149(D) × 23(H)mm 8-1/16"(W) × 5-7/8"(D) × 29/32"(H)
Weight	550g (1.2 lbs.)
Accessories	Carrying case, microcassette tape × 1, AC adaptor (EA-23E), paper roll × 3, cassette cable, cotton swab, instruction manual

CE-126P Specifications

Type	Thermal printer/cassette interface
Printing digits	24 digits
Power source	AA dry battery (UM3) × 4, approx. 2,000 lines
Power consumption	3W
Dimensions	140.5(D) × 116(W) × 23(H)mm 5-17/32"(D) × 4-9/16"(W) × 29/32"(H)
Weight	280g (0.62 lb.) with battery
Accessories	Paper roll × 3, cassette cable, EA-23E AC adaptor (option)

*Design and specifications subject to change without notice.

SHARP
SHARP ELECTRONICS CORPORATION
10 Sharp Plaza, Paramus, New Jersey 07652

Distributed by:

Appendix 4: Spreadsheet Chapter from the 1985 PC World Software Review

Spreadsheets

Andrew T. Williams

More than any other kind of software, electronic spreadsheets have convinced the business community that personal computers are powerful business tools and not just the playthings of hackers and hobbyists. An electronic spreadsheet is the automated counterpart of an accountant's pad or ledger sheet, a blank electronic blackboard divided into rows and columns to create a vast field of cubbyholes called "cells." The blackboard can be used to determine relationships and solve problems involving numbers. Spreadsheets apply their problem-solving capabilities to the gamut of business situations, from reports and budgets to forecasts and profit-and-loss statements.

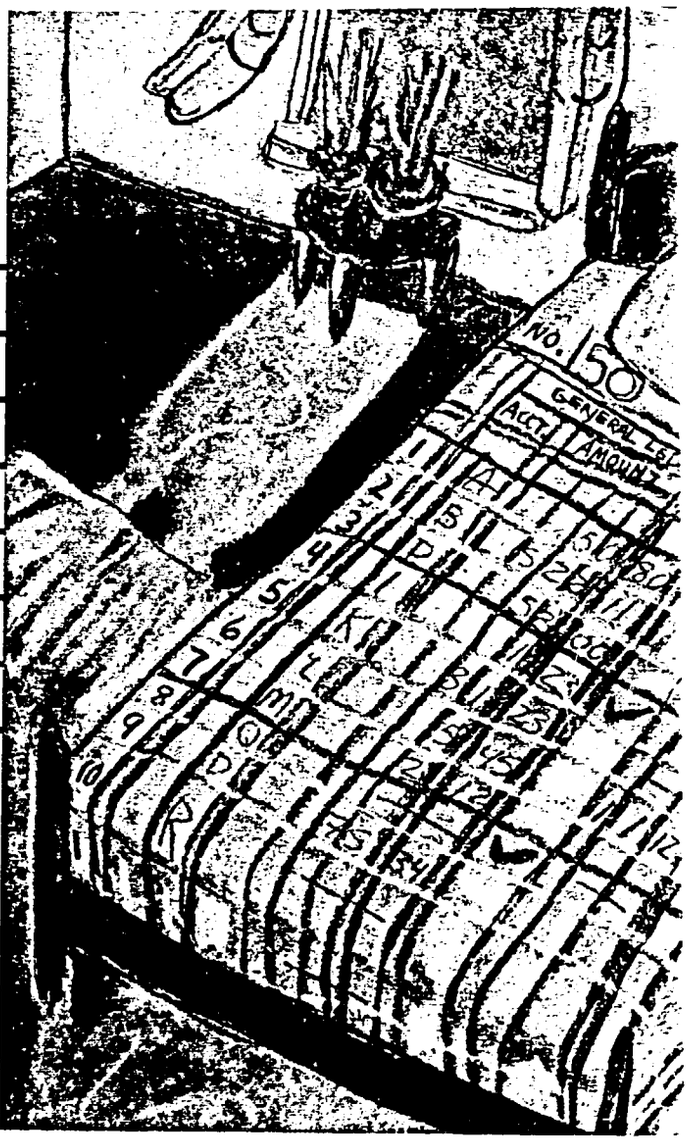
Three elements are behind the overwhelming popularity of the electronic spreadsheet as a business tool. First, the screen layout of columns and rows closely resembles the design of the spreadsheet's manual counterpart, presenting a format familiar to even the most reluctant computer novice. Second, there's a direct connection between the words, numbers, or formulas you place in the cells and what appears on the screen. Put another way, constructing an electronic spreadsheet is concrete rather than abstract. Finally, the spreadsheet gives you instant feedback. Because you can see each entry on the screen as it's entered, you can correct it immediately if it's wrong.

In addition, a spreadsheet program automatically calculates a formula or a function, then displays the results. You can change assumptions as often as you like in order to quickly answer "what if" questions.

Every electronic spreadsheet contains a set of commands (such as Copy, Move, and Format) to construct and modify data. A spreadsheet program usually offers a menu of letters or words from which you select commands and make the choices needed to complete a specified command. You also need commands to move the worksheet cursor around the screen. Because an electronic spreadsheet exists entirely within the PC's memory, the program must provide a way to generate printed copies and save files for later use.

The typical spreadsheet program includes a library of functions that perform routine computations such as adding a set of numbers, finding an average, or determining the largest or smallest number in a range. More sophisticated programs calculate standard deviations and variances; financial functions such as net present value, internal rate of return, and mortgage payments; and functions that display the current date on a worksheet and permit you to do calculations involving dates.

To improve the clarity and professional appearance of a spreadsheet, a program should offer a variety of easy-to-use format options. Spreadsheets should be able to display currency denominations, negative numbers in parentheses, and numbers as integers to a specified number of decimal places. Programs should also include formats that align labels to the left, right, or center of a cell. The better programs provide "soft" cell boundaries, which allow text to extend beyond the border of a cell (useful when entering long labels).



Many spreadsheets feature timesaving keyboard programs (variously called macros, typing alternatives, or execute commands) that allow you to devise and execute a given sequence of keystrokes, thus automating repetitive tasks. Keyboard programs can also be created to perform a complex series of commands without the risk of error.

You might also want to look for a spreadsheet program capable of translating files created by other programs (such as *dBASE II*) into spreadsheet files. Some programs can also import standard text files created by a word processing program directly into an electronic spreadsheet. Other programs can assign names, in words, to ranges or sets of cells. This naming feature lets you construct comprehensible formulas and specify ranges, such as print ranges, that are defined once but are used repeatedly.

Today's electronic spreadsheets have evolved far beyond the first simple version of *VisiCalc*. Two trends now dominate the field, typified by *1-2-3* and *SuperCalc 3*. Both spreadsheet programs have been augmented with data management and graphics capabilities. Compared with a package such as *Symphony*, which integrates many tasks, these programs are easy to learn and use. Still, they offer all the commands, functions, and conveniences anyone using a spreadsheet would want.

The other trend is toward the "program family" that promises upward compatibility. Spreadsheets created with a simpler program in the family can be used with its more sophisticated members. In addition, commands and procedures learned for the less complex program work just as well with the heavy-duty members of the clan. The *SuperCalc* family and the Lotus duet are examples of this emerging direction in software.

The development of program families is particularly important now that prices of entry-level software are decreasing. As more manufacturers follow suit, it will be easy to purchase a program with the features you require today and then move up as your needs expand. Stand-alone spreadsheet packages haven't been forgotten, either; they're packing more features and flexibility even as they drop in price. And that's good news for anyone with a personal computer.

Andrew T. Williams is a Contributing Editor for PC World. *His latest books include* The Know How Guide to SuperCalc 1, 2, and 3 *and* 1-2-3 From A to Z.

Multiplan

With its data sorting feature, *Multiplan* can be used as a simple data base manager as well as a 255- by 63-cell worksheet. Spreadsheets can be linked, allowing automatic updating of one spreadsheet by another. *Multiplan* provides for varied formatting of the display and reports, and includes window commands that show multiple windows in color. The program features help menus, protected cells, individual column widths, and print options. List price: $195. Requirements: with DOS 1.10 64K, one disk drive; with DOS 2.00 or 2.10 128K, one disk drive.
Microsoft Corp.
10700 Northup Way, Box 97200
Bellevue, WA 98009
800/426-9400, 206/828-8088
Alaska and Washington

"Multiplan *is easy to learn, easy to teach, and requires fewer keystrokes than* VisiCalc *or* 1-2-3 *to accomplish a given function.*" Laurence Wingerter, Jr., San Antonio, Texas

"Multiplan *is a powerful program, and I wouldn't use anything else. However, it is very slow when more than one screen full of columns is used. External Copy and Use are unique and useful, but there is no provision for a global unlink.*" Ken Gardner, Laguna Niguel, California

ScratchPad Plus

Featuring a virtual memory system, *ScratchPad Plus* allows unlimited window splitting and flexible grid dimensions (up to 999 units in either direction). Other program features include consolidation and merge functions, title locking, and built-in sum, sine, cosine, tangent, and square root functions. List price: $195. Requirements: 128K, one disk drive.
SuperSoft, Inc.
P.O. Box 1628
Champaign, IL 61820
217/359-2112

Ezvisi

A *VisiCalc* accessory, *Ezvisi* converts direct (random) files into *VisiCalc* format and produces a *VisiCalc* model. The program reads fields selectively into columns and generates a reusable program. List price: $70. Requirements: 64K, one disk drive, *VisiCalc*.
Miracle Computing
313 Clayton Ct.
Lawrence, KS 66044
913/843-5863

VIS/Bridge/Sort, VIS/Bridge/Report

A *VisiCalc* accessory, *VIS/Bridge/Sort* sorts the rows or columns of *VisiCalc* spreadsheets. You can sort all or part of a worksheet, using up to five rows or columns as sort keys. Sorts can be in alphabetic or numeric and in ascending or descending order, and all expressions and references are preserved. *VIS/Bridge/Report* is designed to improve the report-printing capabilities of *VisiCalc* and provides all the capabilities of the advanced version of *VisiCalc*. List price: *VIS/Bridge/Sort* $89, *VIS/Bridge/Report* $79, Requirements: 64K, one disk drive, *VisiCalc*.
Solutions, Inc.
13 State St.
P.O. Box 989
Montpelier, VT 05602
802/229-0368

Peachtree Connection

You can make spreadsheet templates for *VisiCalc, Multiplan,* or *1-2-3* with *Peachtree Connection*. The program reads *Peachtree General Ledger* data disks and builds a comprehensive data base. Templates are preformatted to include report titles, column headings, and total and subtotal formulas. List price: $175. Requirements: 64K; two disk drives; *Peachtree General Ledger; VisiCalc, Multiplan, BPT,* or *1-2-3*.
Sofstar, Inc.
1330 S. Killian Dr. #2
Lake Park, FL 33403
305/848-7054

Viz-a-con

You can consolidate a series of spreadsheets into multilevel summaries with *Viz-a-con*, which combines multiple "pages" of data from a model, sums the corresponding cells, and uses the labels from a format file. *Viz-a-con* makes summations over periods of time or consolidations by organizational divisions such as departments or companies. Information from up to 4000 reports with similar spreadsheet parameters can be consolidated without replicating the model in memory or building formulas to sum the cells. List price: $139.95. Requirements: 64K; one disk drive; *VisiCalc, 1-2-3, Multiplan,* or *SuperCalc*.
Abacus Associates
6565 W. Loop South #240
Bellaire, TX 77401
713/666-8146

Viz-a-merge

Designed to cut and paste sections of spreadsheets, *Viz-a-merge* automatically forms new reports and reorganizes existing ones. *Viz-a-merge* combines sections, rows, columns, or single cells based on your answers to a series of questions. Information from up to 1500 reports can be merged during one session. A math option allows addition, subtraction, multiplication, or division of the data being "pasted" into a report. You can set up a system of individual reports based on any number of models. List price: $139.95. Requirements: 64K; one disk drive; *1-2-3, VisiCalc,* or *Multiplan*.
Abacus Associates
6565 W. Loop South #240
Bellaire, TX 77401
713/666-8146

PlannerCalc

A spreadsheet with English syntax for program operations, *PlannerCalc* lets you add comments to program commands and perform calculations using conventional mathematical logic. The program includes 25 worksheets for home, business, and professional applications such as personal budgeting, calculating mortgages, and lease-versus-purchase analysis. List price: $99. Requirements: 128K, one disk drive, DOS 2.00 or later version. Also distributed by IBM.
Comshare
5901-B Peachtree-Dunwoody Rd. #275
Atlanta, GA 30328
404/391-9012

Plan 80

A financial modeling system, *Plan 80* uses English prompts and names instead of numbers to address rows and columns. Spreadsheet functions include table lookup, consolidation, and "what if" analysis. Financial functions include depreciation, net present value, amortization, internal rate of return, and accelerated cost recovery. *Plan 80* adds, subtracts, multiplies, divides, and performs trigonometric and IF ... THEN ... ELSE functions. List price: $295. Requirements: 128K, two disk drives.
Digital Marketing Corp.
2363 Boulevard Circle #8
Walnut Creek, CA 94595
800/826-2222, 415/947-1000

"Very good product, especially at the price. Allows complex consolidations, linking, and 'Master' models and row files, reducing duplicate file models for slight variations on report formats. It also has good documentation." Walter F. Travers, Canoga Park, California

Target Financial Modeling

Using English syntax for program operations, *Target Financial Modeling* offers a report writer, variable column width, multiple model consolidation, automatic formula replication, and forward referencing. It has a maximum size of 1000 by 5000 cells. The program includes on-line help and lets you build models that prompt for data during calculations. List price: $325. Requirements: 128K, one disk drive.
Comshare
5901-B Peachtree-Dunwoody Rd. #275
Atlanta, GA 30328
404/391-9012

CalcStar

A 255-row, 127-column spreadsheet program with column and decimal width variation, *CalcStar* offers conditional logic and advanced math capabilities. An automatic forms mode lets you designate a specific cell pattern for the cursor to follow. Data can be printed in text file format and merged or edited with *WordStar*. *CalcStar* provides business forecasting functions, password protection, and a choice of up to six colors for custom formatting. List price: $195. Requirements: 128K, two disk drives.
MicroPro International Corp.
33 San Pablo Ave.
San Rafael, CA 94903
415/499-1200

PlanStar

A financial modeling program, *PlanStar* offers financial analysis and forecasting beyond basic spreadsheet capabilities. The program uses English calculation commands rather than formulas, consolidates up to 1000 spreadsheets per project, and has a capacity of over 32,000 cells per spreadsheet. Data is stored separately from worksheets, eliminating replication of entries. Financial functions include net present value, internal rate of return, amortization, and moving averages. *PlanStar* allows arithmetic calculations between spreadsheets, generates up to 14 reports for any spreadsheet, and produces graphs such as bar charts and line plots. The program writes text files for use with *WordStar*, accepts input from data files, and reads DIF files. List price: $695. Requirements: 128K, two disk drives.
MicroPro International Corp.
33 San Pablo Ave.
San Rafael, CA 94903
415/499-1200

Virtual Planner

Functioning as a general-purpose spreadsheet calculator, *Virtual Planner* provides mathematical capabilities including exponentiation, standard deviation, minimum and maximum selection, and net present value computations. Data and formulas can be entered into single or multiple locations with one command. Conditional statements such as IF ... THEN ... ELSE can be used in a model, and the program handles text across multiple columns. Multiple formats for 50 reports can be defined from a single worksheet. Reports can include, exclude, or duplicate any row or column in the matrix. *Virtual Planner* generates both bar and cluster graphs from values in the worksheet. List price: $295. Requirements: 192K, two disk drives.
SOLVation, Inc.
150 Flanders Rd.
Westborough, MA 01581
617/366-6621

Medallion Spreadsheet

A financial planning tool, *Medallion Spreadsheet* offers 48 mathematical functions, including net present value, internal rate of return, and linear regression. The spreadsheet has up to 200 rows and 100 columns. The program allows split-window viewing, merges worksheets, handles variable column widths, sorts by row, and produces bar graphs. Reports include cash flow comparisons, expense statements, depreciation schedules, tax tables, balance sheets, income statements, and analyses of sales, loans, unit price and volume, and growth rate. List price: $195. Requirements: 192K, two disk drives.
Timberline Software
7180 S.W. Fir Loop
Portland, OR 97223
503/644-8155

Appendix 5: Summary of Participant Responses on the Workshop Evaluation Questionnaire

3. What is the nature of your work?

Resource modeling (economic and system dynamics). System consultant.

Teaching, research.

Environmental systems analysis.

Organic gardening.

Teaching mathematical and computer-based methods for managers and research work on this topic.

Research and teaching on optimal, though sustainable use of forests.

Energy and environmental systems research and teaching; management.

An implementation of numerical methods and methods of system analysis in the management and training of managers (top level).

Dozent, lecturing graduate and post-graduate students; running training courses for senior management.

Writer, editor, communicator.

Research and teaching of water resources systems.

Applied Systems Analysis, Research, Design and Teaching on Informetics in LDCS.

Anthropology - small farm system analysis - agricultural development policy.

Teaching programming languages and modeling methods.

General economics of environment, including resource discussions.

Research on the evolution of the cooperative agriculture of Hungary.

Deputy Director of research institute, Researcher and Advisor to Environmental Commission.

UN Ind. Dev. Officer.

Research and teaching mathematical ecology.

Studying soil-water-plant systems; the water dynamics in it.

Environmental protection. Metal contamination. Modeling.

Systems analysis/Agricultural modeling.

Teaching;research;service.

Graduate student in System Dynamics and Resource Policy.

Graduate student in computer modeling, policy design and analysis.

Institute for T_____ Systems Engineering as a u_____ eng.

Applied mathematics in economics.

Ecological development/Third word.

Models for forest harvest, linear programming, leontieff-models.

Agricultural/Environmental modeling.

Industrial Engineering.

4 What was the most valuable part of the workshop for you?

The concise summary and package of material that I can use in my own country, professional contacts. To see how participants reacted to aspects of workshop.

Integration of variety of resource systems, using of gaming as learning tool.

Integrated view - same systems principles demonstrated in many different systems.

The games. They gave me better understanding of structures and events and the amount of time it takes to make changes.

To come to know new training games and the approach to systems by their structures.

To learn the power of games in education to deepen insights in system-structure and behavior, by playing the games and have debriefings.

Playing the games (beer production, deer game, STRATEGEM-1) and (parts of the) introduction and debriefing.

The games for strategic planning - industrial games.

To gain insight into the concepts of systems dynamics, to run games, esp. the complex Strategem-1 game, to exchange experience in developing and running games.

An increased understanding of the mechanics of system dynamics and the potential for application in management and conflict resolution. Also the contacts.

The concept of modeling the world on systems as positive and negative loop with stocks of buffers and delays.

Agri Models, Strategem I, II - learning that such models CAN be built as games; how to present games as teaching devices.

The lectures and exercises and games were all closely integrated. Their union was what made it work. No single part was more valuable that the rest, all were important learning tools.

Presentation of systems which behavior you experience in real life and which internal mechanisms are still mysterious, not only for ordinary people, but also for politicians and top government decision makers.

The basic thinking of system function and loops, especially concerning global resources.

To learn the principles of systems analysis as a tool to approach the understanding of the world.

Games - advanced and in____ed important systems principles; illustration - how a microcomputer may be used.

Exposure to the various models.

W_2, N cycles, watershed model.

To see in work dynamic simulations; to understand their basic rules, loops; to meet experts.

The perspective coming out of the lectures and games.

Professional contacts were equally important as realizing the importance and effectiveness of gaming at conveying complex relationship, concepts.

Games.

Lectures and games demonstrating system behavior.

Interaction with other participants; learning different views, ideas about the needs and applications of systems analysis in resource issues.

The use of gaming in order to make clear some basic structural connections, and the understanding of these.

Having the audience actively take part in the workshop, which was very well organized and prepared.

The development of a epistemology, that in my view has a future. The delineation of behavior, structure and events, the levels and relationship of systems which approach reality and the ability to "see" time - past, present, and future.

The understanding that small simulation models can be very useful instead of very big - which are difficult to run.

The experience with playing games.

The games, which proved that you can have a better idea of systems by them, and that they make you ask questions that might not have come to mind otherwise.

5. What was the least valuable part?

Intro sections on systems and modeling methods, but these are most important for most.

About the sustainable agriculture, data from Germany and USA.

(Parts of the) lectures because they were written down and were too narrowly focused or too disconnected to over-all aims.

Insufficient explanation or instruction in technical areas.

The minerals deflation model (if at all) better say none.

Can't recall not being kept interested.

We didn't have enough time to think the models presented over and over again. The lectures were loaded with information and kept us concentrated all the days long.

The time is too limited to get a real, deep understanding of all the variables used in the model.

Global modeling concepts.

The economic applications.

The microcomputer models, because I have some experience on that.

Small scale models seem poorly developed, in general, the small amount of feedback - too easy to win - gives a simplistic and negative impression of the value of these tools.

Lack of presentations by other people working in Resource Systems.

The goals, stated objectives, were almost too comprehensive for a 5-day

conference. The 5 days were a great introduction to systems concepts.

Some details in certain models were far from my interest - at the moment at least.

Hadn't enough time to read our notes and think them over, as we received them on the first day. It would be useful when participants got them in advance.

All of it was relevant, as I am not a systems dynamist, or a computer expert.

To play games without having a preliminary introduction of the model.

Lectures on the basics of systems dynamics.

6 What one change or addition would most improve the workshop?

A better ice-breaker at the beginning of the conference to better encourage social interaction between participants. Perhaps a facility with a more inviting lounge are could be better. Country on nametag.

More use of computers to demonstrate behavior of very simple systems at the start as lead-in to more complex models.

Better documentation for Stratagem game; brief for reference during the game. Complete notes for <u>all</u> sessions, following same general outline (systems principles - components - specific system - model - results). Workbook to take home.

For non-economists it would be helpful to have some definitions of the vocabulary used in Strategem.

To have a broader and more comprehensive review of new results, including the list of references, publications, names of the best authors on the topic, etc.

To start with a lecture about principles of modeling (and system dynamics) because I myself for instance haven't practical experience on modeling. The importance of loops came out during the week.

A more systematic, concentrated introduction into the possibilities, limits and principles of system dynamics (analysis); adding a session in which you construct/analyse a small system yourself together with 2 or 3 other people, in depth.

To give an instruction for each topic for what sort of audience is most important and which is the way to introduce the topic and the game.

This workshop was mainly concerned with environmental problems. If the participants would come from industry, other kinds of models would be requested as well.

Better definition of the role of aides or supervisors in games - e.g. as advisors, consultants, sources of information.

Film in the middle of the workshop showing the dynamics of the system (In Stratagem-1 not known end of game (the moderator sets it during the game to 40, 45 or 35)). The results of some changes in useful data that are available on the computer can be seen in the film in a continuous way, e.g., showing how the limit becomes erodable, etc. However, it is necessary to start by computer exercises and the film can add the possibilities and will be better understood if it is given after the computer exercies.

More time to study the structure of each game/model before it is played. (Maybe this is not desirable.)

Increasing skills is causal loop diagramming so that we could use those tools to replicate our understanding of the structure after the games. It was still hard for us to verbalize or communicate our understanding of structural relationships.

More time for reviewing models, concepts, etc.

The relation in the model are primarily of physical type, that means that the models are too optimistic because the international and national political restrictions are not in the model. In all of the model the goals of the people, the firms and the political leaders (in all countries) are the same because of the building of the models (games). This point is not specified in the model (or the lessons). I think because of these reasons that the models can be misleading, if they are used to teach decisionmakers the function of the world.
Of these reasons, I think it will be very good to have some lessons on political science in the workshop.

To situate the systems approach within the sets of other analysis tools.

Better understanding of principles of the games in advance (That may provide more possibilities to check my strategy during a game instead to learn its principles).

Have a few managers from the developing world (cross-section).

Problems of system identification on conceptual level, maybe some theoretical background for the Kaibab model.

Something more detailed on the functions of the models.

Of course, there have to be changes in the presentation according to the audience. This workshop in this form will not work for all types of audiences.

MORE WORK ON CAUSAL LOOPS.

Addition - Get together activities for the whole group or small groups.

More roundtable discussions, exchange of participants knowledge and experience with policy implementation.

More emphasis on causal diagramming, use of "non-formalized" causal system perspective.

I think it would be useful and come easier to have a longer introduction before playing a game, in order to have a better understanding for people having different backgrounds than economists.

You should invite to such a workshop also operating managers and not only experts from different institutes. (Or not only managers should be invited, but practical policy makers too!)

It may not be possible in the time, but I would like to learn how to make a model.

It will be very useful (for me!) to have an idea what sorts of applications need simulation or optimization or human decisionmaking.

Reduction of lectures on basics; extension of gaming - have another possibility to play after evaluation, (more) lectures on the issues learned in the games and possibilities to discuss them.

Having more than just one of it a year.

7. Please describe in what way, if any, you intend to use the concepts, materials, or techniques of this workshop in your own work.

Direct use of written material for teaching purposes/reference.

Will be part of research and teaching program at RPC.

In graduate and undergraduate teaching; running 2-3 day seminars for policymakers; adoption of approaches to local and regional management problems in the areas of energy, resources, environment.

I'll try to disseminate these structure-focused approaches, concepts, methods and, of course, to use these games too, in my teaching and research more

First I am going to use a model-game to give students insight on the consequences of cutting decisions in the long-term (compare different methods which are usable) Second, with my colleagues to use the strategem play in workshops which are held on rural development.

1) Introduce one or more games into our 6-month resource environment course (merged with our own models).
2) Induce researchers to construct small models to get insights into their system-under-investigation.
3) Offer to government officials, civil servants, utility managers, etc. to play the game.

1) I think to use the ___ games - Strat. 1,2 in the courses for our managers. I will adopt the games and I'll do some experimenting with them. I'll write you about the results and changes in the games.
2) To create games like these.

The Strategem-1 game will be used in several universities and polytechnics of the GDR. I will use it on the 1984/85 UNEP Course with Technical University of Dresden.

I shall use the concepts to advocate an ecologically benign approach to politics, policy lifestyle, world view in teaching and writing (books, articles, newspaper columns).

I intend to prepare a computerized game on water resources systems with ____ ____ __ ____ in two versions.
Version 1 - simple for teaching purposes (3 hours maximum playing time);
Version 2 - more complicated for a group of researchers I am the chairman of.

1. Will be used in training Systems Analysts.
2. Will be used to begin teaching Systems Dynamics.
3. Will be used with the Western ____ Project at Poona View
4. Will be used in workshops/seminars sponsored by Dept. of Environment.
5. Will be included in trg courses on luprmetics for Government officials at the SRI and also at state and central government training centers.

I think that the basic set of concepts of System dynamics have a very wide application in many kinds of analytic thinking. I would try to teach those concepts and use the games that illustrate them w/students of development policy or with planners. They are critical in the arena of socio-economic change. I would also use them to more effectively implement policy. Analyzing farming system.

Excellent way of communicating people. Perfect organization of lectures - I'm going to use the same technique in teaching. Since I got a full set of materials - I'll be promoting the method of S.D. among students, university staff and state government staff through games rather than just lectures.

I am going to discuss with other persons in what way it is possible to use this material in the state administration and in university, technical schools, also.

I intend to use this material as a complementary tool in my economic research. Also, I want to use it as a teaching tool to make students understand the relationship among structural behavior and events.

They will enlarge concepts and tools for solving problems I face in my research and _____ation activities. They will help me to convince decisionmakers to understand and use systems approch in their d.m. process (I hope.).

For teaching (exposing) managers in the developing world to concepts discussed during workshop. Similar types of workshop will be developed

Gaming is probably the most powerful teaching aid. They help in visualizing the theoretical results in the ecological research.

Adapt the models which are close to my field and try to improve their parts that they be more adoptive. To use them up for demonstration of structure and function of given systems (e.g. scil N) for students and experts, too

I would like to use it for teaching at University. Also, I would like to be able to bring out the perspective to management people, politicians, and media.

I will be trying to encourage planning people of FAO/Rome (Agriculture Dept.) to use causal loops, gaming in development work.

Viewing system in the S.D. approach by using games to gain insights into the problems.

This workshop has helped me improve my ability to explain these concepts to others. Games and models are an excellent, quick way to add an interdisciplinary dimension to the work of many specialists.

I got new ideas for modeling that can be useful in my work, though those models are a bit different.

The main purpose was here to learn as much as possible. To tell the truth, the most useful things I've learned here were in the theory of system, i.e., those things which I've learned about the role of feedback loops, about nature of over____ing-collapse systems, etc. I would have liked to hear more about the creation of systems: what kind of relations are supposed between the different factors, how were these relations calculated, etc. (This was only briefly concerned when you spoke about nonlinearity.)

First, as a way of assessing the economics and structures of countries I work in.
Secondly, as a conceptual basis for natural resource development.
Third, I want to link the design principles of one organization with

systems dynamics models, to create forms that are a synthesis of both

To build some simulation models for the harvest policies.

1) Include the concepts into my own models.
2) Eventually use gaming techniques in conveying results - in addition to plain model results.

With my _____ at the University. Some of the games are applicable in the form they are. Some have to be implemented for ___ _____ _____ I think by trying to keep this high standard __ by the workshop they will be very useful.

8 In your home country, for what sort of audience do you think a workshop like this is most appropriate?

Government policy makers, business school students (and teachers). Business executives. Teachers on all levels.

For workshops: Mid-level managers in sectoral agencies, congressional support staffs (federal, state).
For gaming materials: Very broad audience including college and pre-college students, etc.

Junior and senior policy makers; key people in the media (press, radio, publishing, TV); politicians.

Students

First of all, for the young researchers (like me). I think, it's very important for them to get international practice and personal relations, and, on the other hand, young people can understand the new methods (rather than old ones).

1) Top-level officials in ministries, because they stay after government changes.
2) Politicians.
3) Teachers, lectures.

In rough priority:
1) Government/research people with resource/environment/econ mics interest.
2) Industrial/utility, etc managers.
3) Teachers (university, teaching schools, etc.)

For researchers and managers' trainers.

For scientists who are willing and able to run complex games in all kinds of higher education. The aim of such a workshop could be: to teach people how to run games in order to provide knowledge and awareness of the dynamics of very different real world processes. Therefore it seems to be important to <u>teach the teachers!</u> - because it would not be possible to run

such a workshop together with all peoples being interested.

Teachers, managers of all sorts - industrial, government (at all levels), students.

1) For the graduate course that is scheduled on water resources systems on 1986 (may be 1985).
2) Decisionmakers in the ministry department leader levels.
3) Researchers, students.

Smart civil servants, PhD students, faculty involved in Agro-socio-economic-science faculties.

Students, planners, managers - the basic concepts should be integrated into education at an early level.

University staff; students; top managers and government officials (they often neglect methods or models they don't understand).

Persons in Central Administration (ministry of environment, agency of foreign aid); universities, technical schools.

For social science students; for executives from private sector; for government medium and high level officials.

Research workers and decision makers.

Ministers
|
|
Guard (Army)

Top level managers, environmental scientists, students.

Medium level leaders of bureaus making decisions (e.g. in the Ministry of Food and Agriculture) and some of the lecturers at Universities.

Almost all types of audiences that have any influence could benefit from this type of workshop.

Almost anyone. But most valuable to local policy makers.

Young and potential administrators; graduate students.

Policy makers and policy researchers. So far this message seems to be directed to those we expect to be receptive. How do we teach those whose initial interest is lower?

People with backgrounds in resource analysis and management and some idea of modeling. Anybody can use a clearer understanding of system structure/behavior. In this form, though, the workshop is most effective for people who are already familiar with and receptive to a systems modeling concept.

For the people making the long-term decisions, or for those, who will make these decisions in 15/25 years from now.

Perhaps it would be appropriate for university students. For example, in the University of Economics of Budapest there is a compulsory course for everyone playing a game which is something similar to the distribution one.

I think all types of people and sectors would benefit equally, much like mediation for conflict resolution applies from interpersonal realtions to nations. Personally, I would like to see bioregional groups get a high priority of attention.

Top decisionmakers (and/or) programmers for planning models.

Advisors to decisionmakers right now - but after a certain success these decisionmakers themselves should be the target.

To all kind, if so well done as this one.

Comments.

Need -

Redesign of Strategem-1 description sheets is badly necessary (lay out change);
Debriefing manual;
Description of how to run the game.

Develop a comprehensive workbook, following the general sequence of (most of) the present notes. Text should cover:
- list of principles
- explanation of corresponding generic structure
- system/causal loop diagrams
- real world examples (verbal)
- models thereof
- simulation results
- small basic models to run on your own house computer
- suggestions for similar studies - related systems
- references/literature, etc.

Send literature and a collection of recommended articles (like in the Notebook used here at the workshop) before the seminar. It would be much more effective if participants would have ahead to prepare for it.

A more thorough discussion on the actual impacts/limits/benefits of the S.D. approach and method. (More) insight into interdependencies and the need to know about the whole.
An inspiring tool to get people's attention and energy to deal with resource, etc., systems/problems.
(About Strategem-1.) There may be an inherent 'interventionist bias' in the game, inducing the illusion/arrogance/expectation that some people are governing (managing, mastering) a system for some (mostly implicit) system goals. In the end life is by and for people, who are not to be sustained but are to be enabled to live their sustainable life. (or shift the burden to the (addicted)[STRATEGEM] interventionist). To put it otherwise: many of the people in the world are 'rigidized' into relations without giving them flexibility/freedom/anticipation/resolution or whatever.

I would like to receive all of the next materials about the Games, if it is possible. I think it is possible to hold the next workshop in Bulgaria next year in the summer again.

If it would be of interest for another workshop, I would be glad to present a complex management game that shows how to manage industrial enterprises in GDR, their interdependencies and problems of international trade between the GDR and Great Britain.

1)_____ Was very good. Much better than any course to which I have gone.
2) Teaching. All the instructors were very clear; they also had genuine command over their material, which gave great credibility.
3) First Faculty and Assistants. The Dartmouth staff were very good in that they were there, they were helpful without being pushy or directive. Dr. and Mrs. Todd were an excellent addition to the resources.
4) Use of technology for teaching. Very impressive and instructive how micros and other tools were harnessed.

1) In the gaming and computer simulations more emphasis should be placed on always relating them back to the structure which caused the behavior. The tendency was for attention to slip to behavior and the structure remained mashed in certain occasions - particularly computer simulations.
2) The diagraming provides a vocabulary for talking about structure and dynamic systems - A few exercises for the participants in this vocabulary in the beginning might help them to more clearly perceive and conceptualize the structure in the systems reviewed later. This would have been very useful.
3) Perhaps a little clearer definition of goals and code. Ultimate goal is to learn about system dynamics modeling as conceptual tool? Or, to use that as a means to understand about sustainable agriculture? This seemed to get somewhat confused, although I personally found the balance appropriate.

If it was possible I'd like to participate in the next workshop of this

kind, to be able to:
- -share my experience with playing the games shown here with different audiences in my country.
- -learn more about methods, concepts and models of sustainable resources.

I think, that in respect of the topic of the conference, which was to teach people to think in terms of interrelated mechanisms resulting with very surprising behavior, you manage to get the best people in the world to do this job. Prof. D. & D. Meadows and Prof. H. Bossel did it in a perfect way and made us participants not only think about reality in this new way, but also willing to promote this method itself and the methods used during the workshop, back in our countries, to convince other people that this is the way to understand the reality better we do now.

I think that having a time spaced for the presentation of a positive experience just as John Todd's would be very useful to see an actual result. Also teaching at high school level in developing countries is very important for creating a more analytical mind.

Thank you for providing this opportunity.

The workshop was organized on a very high level.

Thanks for the invitation!

As mentioned before - I would like less flow diagraming more causal loops. I also think that one make of computer for all models would be better, less confusing. ALL games should be immediately debriefed by asking participants (as a group or as individuals) to write causal loop diagrams of the systems.

Models and games in this workshop will be modified/adjusted to that situation and environmental condition in order to explore solution to existing resource and environmental problems in Thailand.
The concepts, materials, and techniques acquired from this workshop will be used to organize similar workshops, seminars or teaching conferences for government officials of different ministries.

These concepts, materials and techniques will also be used in graduate courses in sustainable resource systems at Mahida University as well as other universities in Thailand.
Thai case studies in resource management and problems will be used to bring these techniques to appropriate people in government sectors and private sectors.

Some comments on Strategem-1:

1) The high equilibrium conditions given on the score sheet provide an only one set of desirable results. They seem to distract people from thinking about structure and behavior.
2) The game board still needs work, somehow the relationships between sectors need to be made more graphically clear.
3) The initial conditions are confusing for the players to set up. How about a neatly printed cardboard sheet, for each table with the equations clearly shown on one side and the set-up procedure on the other side.
4) I have observed over the past few months, that people whose first language is not English and those from non-western countries have the most trouble getting started with the game. The written descriptions need much simpler language and possibly graphics.
5) A great spinoff version of Strategem-1 would expand the energy sector into renewable and non-renewable energy types with varying capital lifetimes costs, etc. Other sectors of the game might have to be aggregated in order to maintain a playable level of complexity.

The goals, stated objectives, were almost too comprehensive for a five-day conference. The five days were a great introduction to systems concepts.

I am interested in 'describing' a natural resource based tropical country - e.g. Costa Lada - and I would like it modeled and critiqued.