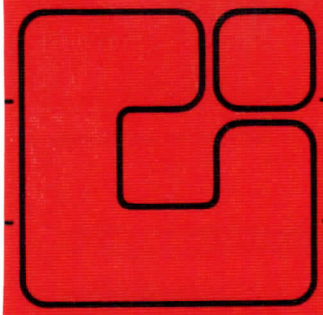


Informatik-
Fachberichte
256

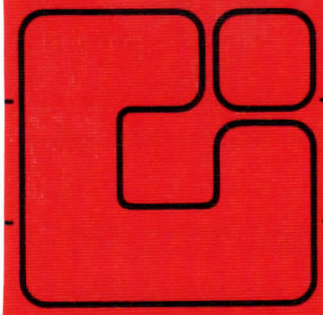
W. Pillmann A. Jaeschke (Hrsg.)

Informatik für den Umweltschutz

5. Symposium
Wien, Österreich, September 1990

Proceedings

Springer-Verlag



Informatik-
Fachberichte
256

W. Pillmann A. Jaeschke (Hrsg.)

Informatik für den Umweltschutz

5. Symposium
Wien, Österreich, September 1990

Proceedings

Springer-Verlag

Informatik-Fachberichte 256

Herausgeber: W. Brauer
im Auftrag der Gesellschaft für Informatik (GI)

W. Pillmann A. Jaeschke (Hrsg.)

Informatik für den Umweltschutz

5. Symposium
Wien, Österreich, 19.-21. September 1990
Proceedings



Springer-Verlag
Berlin Heidelberg New York London
Paris Tokyo Hong Kong Barcelona

Herausgeber

W. Pillmann
Österreichisches Bundesinstitut für Gesundheitswesen
Stubenring 6, A-1010 Wien

A. Jaeschke
Kernforschungszentrum Karlsruhe GmbH
Institut für Datenverarbeitung in der Technik
Postfach 3640, D-7500 Karlsruhe

Veranstalter

Gesellschaft für Informatik (GI)
Österreichische Computer-Gesellschaft (OCG)
Österreichisches Bundesinstitut für Gesundheitswesen (ÖBIG)



Mitveranstalter

Bundesministerium für Wissenschaft und Forschung, Wien
Magistrat der Stadt Wien, MA 22 – Umweltschutz
Senat der Technischen Universität Wien

CR Subject Classification (1987): J.1-3, H.4

ISBN 3-540-53171-8 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-53171-8 Springer-Verlag New York Berlin Heidelberg

Druck- u. Bindearbeiten: Weihert-Druck GmbH, Darmstadt
2145/3140-543210 – Gedruckt auf säurefreiem Papier

Environmental Gaming Simulation Network

Takeshi Utsumi
Global University in the U.S.A. (GU/USA)
A Divisional Activity of GLObal Systems Analysis and Simulation Association in the U.S.A. (GLOSAS/USA)
43-23 Colden Street, Flushing, NY 11355-3998, U.S.A.
SprintMail: [TUTSUMI/ASSOCIATES.TNET] TNET.TELEMAIL
BITNET: utsumi@cunixf.cc.columbia.edu

Philip S. Gang
Educational Philosophy Committee (GU/USA)
Institute for Educational Studies
4202 Ashwoody Trail, Atlanta, GA 30319, U.S.A.
SprintMail: [PGANG/ASSOCIATES.TNET] TNET.TELEMAIL
BITNET: daslink!dasnet!dcjcon!gang@sun.com

ABSTRACT

This paper describes construction of an infrastructure for **global peace gaming** -- specially on the issue of "Development and Sustainable Development" in third world countries. The gaming is to train "would-be decision makers" on crisis management, conflict resolution, and negotiation techniques.

Experience shows that the expertise necessary to participate in **peace games** does not exist in many parts of the world. To help educate future participants, and to promote the cause of peace by enhancing exchanges of education and joint research, **GLObal Systems Analysis and Simulation (GLOSAS) Project** is attempting to create a **Global (electronic) University (GU)** consortium.

This paper provides a brief account of the steps taken over the past dozen years which have led to the development of the **Global University** that is being organized to meet the challenge of the global issues both today and in the twenty-first century.

I. INTRODUCTION

The need to understand economic, social and environmental issues that are being faced in different regions of the planet and the need for peoples of the whole planet to learn to communicate and to cooperate has never been more urgent. Economic, ecological and political issues today are global. Global warming, acid rain, the diminished ozone layer, famine, poverty, deforestation, are economic and political issues and they must be faced in all of their complexity. It is imperative to develop an authentic sense of planetary citizenship and to confront planetary issues that endanger the life of our species and life with which our species is in symbiotic relationship.

To support the struggle for the preservation of our ecological heritage, we propose to establish a worldwide telecommunications network for education and non-profit purposes, a partnership of universities and businesses; of governmental, non-governmental and community organizations; of students, workers and individual citizens, **Global (electronic) University (GU) Consortium**. **GU** can facilitate existing distance educational enterprises by developing a cooperative and worldwide infrastructure and by bringing the powers and resources of telecommunications to ordinary citizens around the world. The quality of education for those unable to attend conventional universities in disadvantaged countries could be greatly enhanced.

Connections between departments of economics, sociology and political science in various countries are being established to explore conflict resolution and for new world-order alternatives to war, with the use of global teleconferencing. Faculties, researchers, would-be decision-makers, and students of those departments of colleges and universities can be the players of the **global peace gaming**.

II. ENVIRONMENT AND SUSTAINABLE DEVELOPMENT ISSUES

In view of the global environmental change previously unknown to humankind, world leaders are now taking unprecedented actions to bring global sustainable development to the top of the agenda of international affairs. Environmental issues are industrial and energy issues; and are, therefore, economic and political issues which must be handled with wisdom, understanding the diversity of the world cultures on our finite, closed planet.

Development is necessary to reduce the economic inequity that contributes to environmental destruction; and environmental restoration, conservation, and preservation are necessary if development is to be sustainable. If world poverty is to be reduced there must be development; but if sustainable growth is to occur, the environment must be preserved. Economic growth without environmental preservation is global suicide (Utsumi and Clements 1989).

This task is too large for government regulation, aid agencies or development banks alone. Restoration of the environment must engage all citizens of the globe; yet sustainable development is ultimately a local activity. People, not governments, do development and preserve the environment or destroy it. A political system that secures effective citizen participation in decision is required. So global education and knowledge is a prerequisite for human survival on earth. Each country has its own role to play. **GU** therefore seeks

to facilitate communication for the clarification of issues through global study.

III. BACKGROUND

A. **GLOSAS** Project

In 1972, Takeshi Utsumi initiated the **GLObal Systems Analysis and Simulation (GLOSAS) Project** for **global peace gaming** (a term coined by Utsumi in 1971) (Rossman and Utsumi 1986; Utsumi, Mikes, and Rossman 1986). With computer simulations and a combination of advanced telecommunication channels, such gaming will enable experts in many countries to collaborate in finding new solutions to the problems that have heretofore been causes of war.

B. Establishment of Infrastructure

Over the past dozen years, **GLOSAS** played a major role in making possible the extension of U.S. data communication networks to other countries, particularly to Japan. **GLOSAS** helped the expansion of American and Japanese information industries to foreign markets and the deregulation of Japanese telecommunication policies for the use of electronic mail and computer conferencing through U.S.-Japan public packet-switching lines. **GLOSAS** also helped achieve a de-monopolization of Japanese telecommunication industries, thus enabling various private terrestrial and satellite communication service companies to emerge. This easing of restrictions included a statutory provision allowing the entry of foreign enterprises into Japanese telecommunication markets, thus enabled cost reduction of telecommunications; and the European Economic Community (EEC) and Latin American countries have followed suit. Japanese initiatives were a model for the world. The way has thus been paved for the global educational exchange with experiential learning via various telecommunication media in the service of better understanding of global issues.

C. A Series of Demonstrations

GLOSAS/USA has conducted many demonstrations of a "Global Lecture Hall," where participants in several countries can hear, talk, and see the other with inexpensive methods, such as: uplinking to satellites combined with audio and slow-scan teleconferencing, global computer conferencing as well as facsimile for question-and-answer exchanges. The most ambitious demonstration had fourteen sites linked together, from the East Coast of the United States to Korea, Alaska, and Australia, spanning fourteen time zones and two calendar dates! Participating lecturers on "Global Education in the 21st Century" were Robert Muller, Glenn Olds, Hazel Henderson, James Grier Miller, Parker Rossman, and many other prominent distance educators.

Again, a World Future Studies Federation conference in Nagoya, Japan, was connected with Wassily Leontief (Nobel Economic Laureate) of New York University to discuss "Environment and Development" via a slow-scan TV (SSTV) teleconference over ordinary overseas telephone lines.

Such **GLOSAS** projects have clearly demonstrated how people can be linked across various boundaries for discussion, debate, research and political action.

They have also helped foster a participatory spirit and sense of transnational identity among participants and have helped **GLOSAS** discover technical, regulatory, economic and marketing impediments to the creation of a **Global (electronic) University** system, while showing how a global educational exchange via international telecommunications is a feasible endeavor.

IV. GLOBAL UNIVERSITY

A. Organization

GLOSAS/USA is a non-profit, educational SERVICE organization dealing with the issues of the quality and availability of international educational exchange through the use of computer, telecommunication and information technologies. To help educate future participants of **peace games**, and to promote the cause of peace by enhancing exchanges of education and joint research, **GLOSAS** is attempting to create **Global/Pacific University (GPU)** and **Global/Latin American University (GLAU)** consortia. These, along with a **Global/Indian University** (Charp 1988), can become part of a true **Global University**. These three strong network regions are determined partly by geography, cultural history and by the footprints of communication satellites. Similar consortia are being created in Canada, Japan, Australia, Sri Lanka, and other countries. The **GU**, in each country and region, may consist of a federation of consortia, each invited to have an authorized, cooperative, and collaborative relationship with the **GU/USA**.

GU will facilitate global telecommunications to make possible the exchange of information, experience, and educational opportunities for all the world's learners. The goal is to empower under-served people of third world countries by giving them access to the educational excellence of other countries. The **GU** will come into existence in three ways: working with the existing educational delivery systems; creating an educational infrastructure to identify needs and courses to be offered; and serving as a coordinating, financial, and promotional organization. Member schools of the Association of Christian Universities and Colleges in Asia (ACUCA) indicated their interest in working with **GU/USA**. The Latin American Network for the Development of Distance Education (REDLAED) with more than 100 members of prominent colleges and universities, has decided to give highest priority to four topics: Environmental problems, literacy, women's issues, and teacher training. **GLOSAS/USA** is requested to provide their activities with inexpensive international telecommunication networks. ACUCA and REDLAED can become the core of **GPU** and **GLAU**, respectively.

B. Educational Philosophy

One goal: restoring the environment and resolving the economic and political crisis depend on public understanding, the development of a conservation ethic, and public discussion based on accurate information to identify and clarify local priorities of environment and development. **GU** intends to transcend cultural barriers and to encourage the development of a global society, by coordinating educational programs of universities, business corporations, professional associations, government agencies, and voluntary agencies. It is hoped that a balance between many such structures can help preserve true academic freedom and cultural diversity.

C. Benefits

As a new global educational institution, the **GU** can offer courses by satellite and other advanced telecommunication media to help bring quality education to serve students anywhere in the world where it did not exist before. By participating in **GU**, institutions that currently are limited to one country will be able to extend their services to learning centers and learners in regions where there may be a shortage both of trained faculty and of resources in technical and other fields of study. Quality international education from universities can be provided to students in almost any location who, because of constraints on time, resources, or available options, are unable to go to other countries to study at regularly scheduled campus-based classes. Students could access with a far greater variety of educational philosophies, courses and instructional styles than they could ever encounter on single campus.

A university, of course, is much more than courses. Efforts are being continued in **GLOSAS** to facilitate international research electronically. The vast amount of electronic collaboration on research projects, from continent to continent, is another evidence of the emergence of the "global electronic university" quite beyond and outside the efforts of all organizations and agencies. The exchange of knowledge among/between countries can make major contributions to world peace, helping to ease frictions, to promote joint research and development and mutual exchange and understanding. An example of such joint effort was our global gaming simulation reported below.

V. ELECTRONIC DELIVERY SYSTEM

GU will seek to provide at nominal cost a "technology package" for participating colleges, universities, community associations, and local governments to use for accessing educational resources via various telecommunication media. For example, a joint effort of **GU**s in various countries/regions to lease international telecommunications lines and/or satellite transponders will make it possible for members of **GU** to obtain discounted telecommunications costs. Consortia in any country can thus unite their strengths so that international information and educational exchange can readily become attainable. Some other examples are:

(1) Computer Conferencing Systems. Electronic mail or computer conferencing (such as the Electronic Information Exchange System [EIES] of the New Jersey Institute of Technology, etc.) can become the basis of communication among students and instructors on a global basis. In contrast to electronic mail, EIES provides interactive dialogue among participants independent of time and space constraints. Their dialogue can be retrieved at any time from almost anywhere on the world. Thereby, all participants, however far apart they may be, "congregate as in a room." Or it can be considered as a shared file cabinet for them to use as they participate in various projects. EIES has been used to offer education to Singapore, Scandinavia, and middle eastern countries with teachers in Tokyo, Venezuela, and elsewhere around the globe.

(2) Packet-Radio and -Satellite Systems. The Big Sky Project in the state of Montana uses packet-radio for transmission of audio, text and ani-

mated color graphics in a 50 miles range. The packet-satellite technique, developed at the University of North Texas, has already been tested for the connection of personal computers linked together in Texas, Florida, Hawaii, American and Western Samoa, and Tonga via NASA's Applied Technology Satellite (ATS) free of charge.

(3) Slow-Scan TV (SSTV) Teleconference Systems. A slow-scan (or freeze-frame) TV unit is now at the International University of Japan (IUJ) -- thanks to NHK's donation. It can be used for real-time demonstrations between American and Japanese schools, and for other joint research in various fields. Such connections with SSTV can be an effective supplement to distance education with electronic mail or computer conferencing, the so-called "Virtual Classroom" or "Global Classroom."

(4) Full-Color, Full-Motion Video Teleconference Systems. Although the uplinking charges to international satellites from the United States are not too expensive, the downlinking cost is currently prohibitive due to the various PTT (Post, Telegraphy, Telephony) agencies which regulate the charges for information received into a country. **GLOSAS/USA** is currently working toward deregulating Japanese telecommunication policies for the use of receive-only antennas to receive signals directly from INTELSAT satellites for educational and non-profit purposes. Once this policy is cleared, we can expect inexpensive U.S.-Japan educational exchange. This is precisely what a million students of the Chinese TV University do, in the People's Republic of China, with their 5,000 receive-only antennas. We hope that other countries will follow the Japanese suit.

VI. GLOBAL PEACE GAMING

The **global peace gaming** of **GLOSAS** is a computer gaming simulation to help decision makers construct a Globally Distributed Decision Support System for positive sum/win-win alternatives to conflict and war. The idea involves interconnecting experts in many countries via global Value Added Networks (VANs) to collaborate in discovering new solutions for world crises such as the deteriorating ecology of our globe and to explore new alternatives for a world-order capable of addressing the problems and opportunities of an interdependent globe (Mische 1988, 18).

A. Ground Works

This is possible because, as mentioned above, **GLOSAS** has so far accomplished the extension of U.S. data communication networks to overseas countries, and subsequent deregulation of telecommunication policies for the use of electronic mail and computer conferencing for asynchronous communication between instructors and students; two-way slow-scan TV teleconferencing via inexpensive audio grade overseas telephone lines; many demonstrations of "Global Lecture Hall"; one-way, inexpensive video teleconferencing via INTELSAT satellite; initiative to establish **Global University** network system which can provide players for **global peace gaming** from around the world.

B. Systems Analysis for Environment and Development Issues

This provides an infrastructure foundation for systems analysis for environment and development issues. The Gaia Hypothesis postulated by J. E. Lovelock proposes that the physical and chemical conditions of the surface of the earth, of the atmosphere and of the oceans has been and is actively made fit and comfortable by the presence of life itself. Our globe, our planet, may be alive and if we let it die we may die with it. This is in contrast to the conventional wisdom which held that life adapted to the planetary conditions as it and they evolved their separate ways.

Now that the waste products of human life on our planet are changing the comfortable fit, the principle of life is to recycle, and to reuse. The principle of death is to throw away into the air, into the sea, into rivers and into lakes poisons, chemical wastes that are not biodegradable and that return to us in the food we eat, the air we breathe and the water we drink.

Global peace gaming can apply new methodologies for delivering the global and ecological paradigm in education to incorporate empowerment strategies for human responsibility, and with gaming strategies based on Gaia hypothesis (Gang 1989). Through a systemic approach, materials will demonstrate how all of the components of Gaia can work together in perfect harmony to clarify humanity's role as part of the interconnected web of life -- a tremendous potential for constructing computer simulation models.

C. Previous Demonstration of Global Gaming Simulation

Of several demonstrations organized by Takeshi Utsumi, the largest and perhaps most successful was held at the "Crisis Management and Conflict Resolution" conference of the World Future Society in July, 1986. Nearly 1500 persons took part, in New York, Tokyo, Honolulu, and Vancouver. Parker Rossman was principal collaborator; Fred Campano of the United Nations wrote a game scenario, and Akira Onishi of Soka University supplied his FUGI model of the world economy.

For communication, the demonstration used the EIES for computer conferencing; slow-scan video; graphic image telecommunication; and audio. Large screen projectors showed text and images to the audiences. The FUGI model, with economic statistics and some political and social data from 140 nations, had been used by the United Nations and various governments for economic forecasting. In the demonstration, questions of U.S.-Japan trade were explored by teams of negotiators in New York and Tokyo. The teams included William Nordhaus, Lester Thurow, and Keith Johnson.

Several hypothetical policies were examined. One question raised by Donald Straus was the effect of raising military expenditures in Japan to the American level while lowering those of the USA to the present Japanese level. Simulation predicted that the balance of trade would thus be even by the year 2000, with necessity of cooperation, rather than competition, of both countries in the future.

D. Projects with Globally Distributed Gaming Simulation

(1) U.S.-Japan and Around the Pacific Rim

The establishment of a U.S.-Japan Shadow Cabinet was proposed to **GLOSAS/USA** by Soppei Nakayama, Special Advisor of the Industrial Bank of Japan and the founder of the IUJ, to ease the two countries' trade and economic frictions by daily electronic conversations among their echelons. This project may include the construction and use of a Distributed Decision Support System as splitting the U.S.-Japan integrated econometric and input/output model to pertinent researchers of both countries. This project may also be extended for similar gaming among Asian and Pacific countries.

(2) Latin American Countries

The countries of Latin America and the Caribbean have experienced environmental deterioration, ecosystem destruction and species loss. The United Nations Development Program (UNDP) decided to support developing countries' efforts to articulate a point of view on the interface between environment and development, poverty, and the sustainable management of natural resources.

The UNDP plans to establish a "Latin American Environmental NGO Network," a subproject of their "Environment and Development" Project. It is to strengthen the non-governmental organizations (NGOs) to address critical issues of environment and development in support to Latin American Government efforts and priorities. It will support cooperative problem-solving by facilitating dialogue and exchange of information among NGOs, government agencies, private businesses, academic institutions and the general public.

The specific objectives **GLOSAS/USA** proposed to the UNDP are: (1) to organize the operation of telecommunication networks for sharing experiences and reporting regional issues; (2) to build databases on environmental issues in distributed mode; (3) to implement training and educational courses; and (4) to construct a "Globally Distributed Decision Support System" with distributed interactive computer gaming simulation system for problem analysis, policy formulation, and assessment, which will be used for training of "would-be decision makers" on conflict resolution and negotiation.

These are to be done with distributed computer conferencing, database and simulation systems among several Latin American countries -- **globally distributed peace gaming simulation** focusing on environmental issues. The several systems will be interconnected to form a "global neural computer network" (a term coined by Utsumi in 1981) in such a way that the total system will act as if a single system with parallel processing of those sub-systems in individual countries.

(3) Distribution of FUGI model

The aforementioned FUGI world economic forecasting model has now been incorporating various sectors of resources, population, environment, energy, etc. **GLOSAS** has a basic agreement with Akira Onishi to distribute the submodels of those sectors to individual countries where they belong, as soon as **GLOSAS** and **GUs** can accommodate them.

E. Technological Outlines of Distributed Gaming Simulation

(1) Need of Open Modelling Network

A major difficulty standing in the way of the further improvement of global modeling is that of gathering data that some countries considered proprietary. The advocated solution was to have each nation develop a model of its own country in which sensitive data could be used, but "hidden" -- only inputs from other national models, and outputs to the global model, would be needed. Obviously there would have to be a global "shell" that would establish requirements for the characteristics of the national models, and to develop that would indeed be quite an undertaking, but it should entail difficulties at least an order of magnitude smaller than those presented by gathering data from foreign countries concerned about their national security. Furthermore, many nations already have national models which could possibly be modified to fit the global shell (McLeod 1990).

A comprehensive model of global resources, ecology and economy is needed for the rational management of ecology and for economic cooperation between nations and economic blocs. As a solution to the dilemma between the need for a unified model and a diversity of views and the special interests of diverse groups, we propose a public Open Modeling Network (OMN) which will consist of models developed by local experts interconnected by global VANs (Utsumi, Mikes, and Rossman 1986).

(2) Globally Distributed Computer Simulation System

The complementary models written by experts of various disciplines and countries, with their preferred simulation languages, methodologies and geographically dispersed dissimilar computers will be interfaced and executed interactively and cooperatively, as parts of the total simulation required. A "distributed" computer system with databases and simulation submodels will be implemented by interconnecting subsystems in individual countries via telecommunication to act jointly as a single system. In this way NGOs, rather than a single group of experts, can directly communicate with their colleagues in other regions of the world, thus providing credibility and accuracy for the databases and models which will be updated and maintained autonomously by them.

(3) Interconnection of Dissimilar Computers and Models

For **peace gaming** on energy, resources and environmental (ERE) systems, architectures for linking heterogenous computers were outlined in the reference (Utsumi and DeVita 1982) with the use of protocols of the International Standards Organization's (ISO) Open Systems Interconnection (OSI) reference model (the palindromic acronym ISO-OSI) over global public data communication networks, and with the use of Transmission Control Protocol (TCP) and Internet Protocol (IP) over Internet network which interconnects over 150,000 computers in academic, research and government fields around the world. The reference also described communication procedures through multi-party gaming simulation.

Because of inevitable time difference among participants scattered around the world, it is necessary to devise asynchronous scheduling for the parallel exe-

cution of distributed simulation submodels, with the use of rollback mechanism based on the Time Warp method (Utsumi, Mikes and Rossman 1986).

(4) Postulated Example

The outline of the hierarchical structure and distributed components of the integrated interactive **peace gaming** simulation system for the energy, economics, foreign trade, etc. on the United States and the Japanese sides was depicted as in Figure 1 (Utsumi 1974). Each block in the figure represents dissimilar computers of the public VANs in those countries. Those computers include simulation models designated in each block. All models will be executed simultaneously and concertedly via satellite and terrestrial telecommunication links.

The world dynamics model here will provide a common area through which the information of variables will be exchanged among the models of both countries. Accordingly, the flow of petroleum from oil producing countries will be regulated by their own decisions as well as by decisions made by game players (pseudo-decision-makers) of both countries. The information of petroleum flow will be cascaded down from the foreign trade model to the petroleum industry model, which will be supplemented with a petrochemical industry model. The communication linkages are also shown in the figure. These include (1) display units for showing simulation results to experts and pseudo-decision-makers in each field, and (2) display units for information exchange among them with the computer conferencing system.

After the simulation progresses for a time period, results will be shown on the display units. For example, suppose if pollution in Japan exceeded a certain allowable level, say, around 1977 on Figure 2 (Utsumi 1974), the Japanese expert watching it on his display unit will stop the entire simulation. All participants, wherever they are located, will then try to find, with the use of the conferencing system, a consensus on a new set of pseudo-alternative-policy parameters which will be executed until a new crisis appears, say, around 1984 on the figure. The process will be repeated for rational policy analysis basing on "facts and figures" with international cooperation of experts in both countries.

(5) Use of Global Gaming

The purpose of an interactive gaming mechanism is to help finding appropriate alternative policies by establishing consensus among participating parties. It is suggested here that globally distributed computer simulation be tested interactively with man (game player) in-the-loop for inserting pseudo-policy-parameters to the models whenever necessary, during the execution of simulation. This is the so-called "**peace gaming**" simulation (Utsumi 1977) similar to the "war games" practiced by military strategists (Schram, et al 1971). Global modelling and simulation studies have been conducted by various groups and institutions since early 1970s for enhancing the usefulness of international modelling (and policy-making) activities. However, with the advent of global VANs and standard interface protocols for interconnecting various dispersed, dissimilar host computers, the potential exists for ensuring the coordination of international efforts by providing more frequent communications and an environment for shared development, enabling more credible simulation study than ever before.

It is now possible to combine existing technologies to make sophisticated and more holistic explorations of various scenarios for solving global social problems. Many small computers in different countries can be interconnected, through globally distributed network processing, and information processing, into modeling and simulation instruments for playing "**peace games**" on the scale of Pentagon war games (McLeod 1987).

F. Scenarios of New World-Order Alternatives

Twenty-five international organizations, with Global Education Associates as principal coordinator, are initiating Project Global 2000 to write, publish, promote and use global-frame monographs. Their purpose is to re-conceptualize security and sovereignty within the context of ecological and economic interdependence. They believe that ecological, economic, and military security are only facets of the integral security that should be the goal of all people. The Project's goal is to develop a common framework for analysis and public policy development to resolve such global-scale problems as ecological degradation, Third World debt, world hunger and poverty, international drug-trafficking, and interstate conflict. The monographs will hopefully provide **global peace gaming** with basic scenarios.

VII. CONCLUSION

Global education via telecommunication media is the way of the future toward the twenty-first century, the Age of Knowledge, laying a social infrastructure for global citizenship of the global village. Developments in global electronic education can transform education at all levels around the world, and can enrich and transform human society.

GU is an evolutionary concept with no global precedent. It can now take shape gradually through parallel steps and many kinds of initiatives in many regions, encouraging a sense of universally shared responsibility, a spirit of participation, and of genuine collaboration, in an enterprise truly global in scope.

Seen in a global context, the proposal of a global university consortium may be understood as one of the ways that mankind is responding to the critical challenges that confront us at this time in the history of humanity. Global education is a major key to sustainable survival. The world is "shrinking" in the electronic sense and all people and all educational programs are becoming increasingly interconnected and more and more dependent upon one another. With this interconnection, however, there comes the potential for escalating regional conflicts, so the need for global education with **global peace gaming** has never been greater. Senator Fulbright once said that learning together and working together are the first steps toward world peace.

The time is ripe for global education. Technology is now available. What we need now are people who are eager to face the challenges of our time and to forge ahead toward the twenty-first century education.

VIII. REFERENCES

Charp, S. 1988. "Editorial." T.H.E. Journal, 8 August.

Gang, P. 1989. "Educating for Human Responsibility." Private note.

McLeod, J. 1987. "TAK is TICKING." Simulation, December, 1987: 273-4.

McLeod, J. 1990. "Toward Internationally Distributed Models." Simulation, May, 1990: 295.

Mische, G. 1988. "Partners for World-Order Alternatives." Breakthrough, 9 (1-3): 18

Mische, G. 1989. "GEA Report." Breakthrough, Winter/Spring: 89

Rossman, P., and T. Utsumi. 1986. "Waging peace with globally-interconnected computers." In Challenges and Opportunities: From Now to 2001, ed. H. F. Didsbury, Jr. Bethesda, MD: World Future Society.

Schram, S., H. Marks, W. Behrens, G. Levin, and J. McLeod, et al. 1971. "Macro-System Simulation." Panel Discussion Session at the 1971 Summer Computer Simulation Conference (SCSC) (Appeared on pp. 1491 to 1502 of 1972 SCSC Proceedings).

Utsumi, T. 1974. "Joint US/JAPAN Project on Global Systems Analysis and Simulation (**GLOSAS**) of Energy, Resources and Environment (ERE) Systems." Proceedings of the Conference on Energy Modelling and Forecasting, Berkeley, California, June 28 to 29: 121-144.

Utsumi, T. 1974. "Japan Petrochemical Industry Model for the **GLOSAS** Project." Proceedings of SCSC, 318-325.

Utsumi, T. 1977. "**Peace Game**." Simulation, November: 135.

Utsumi, T., and J. DeVita. 1982. "**GLOSAS** Project." Computer Networks and Simulation II, ed. S. Schoemaker, 279-326. Amsterdam: North-Holland Publishing Co.

Utsumi, T., P. O. Mikes, and P. Rossman. 1986. "**Peace games** with open modeling network." Computer Networks and Simulation III, ed. S. Schoemaker, 267-98. Amsterdam: North-Holland Publishing Co.

Utsumi, T., and M. Clements. 1989. "Proposal for **Global/Pacific (electronic) University**." Paper presented at the Pacific-Basin Conference of World Future Studies Federation/"Linking Long-Range Visions to Short-Range Decisions in the Pacific-Basin Networking Community," Nagoya, Japan, November 20-23.

Figure 1

Structure
of
Integrated Models and Communication Network

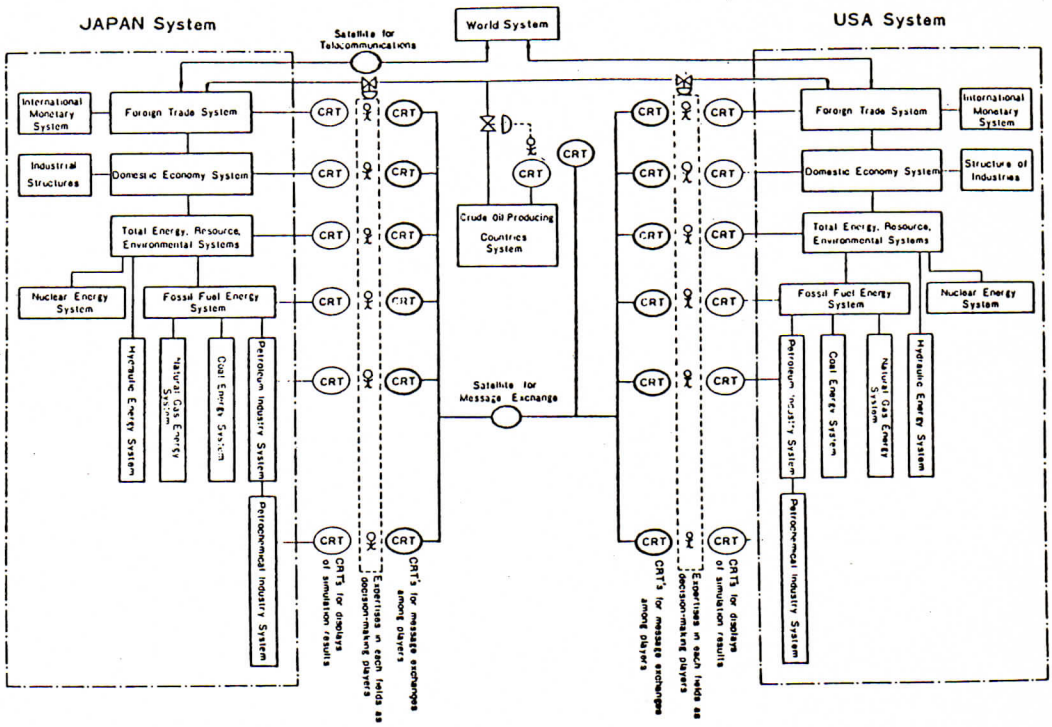
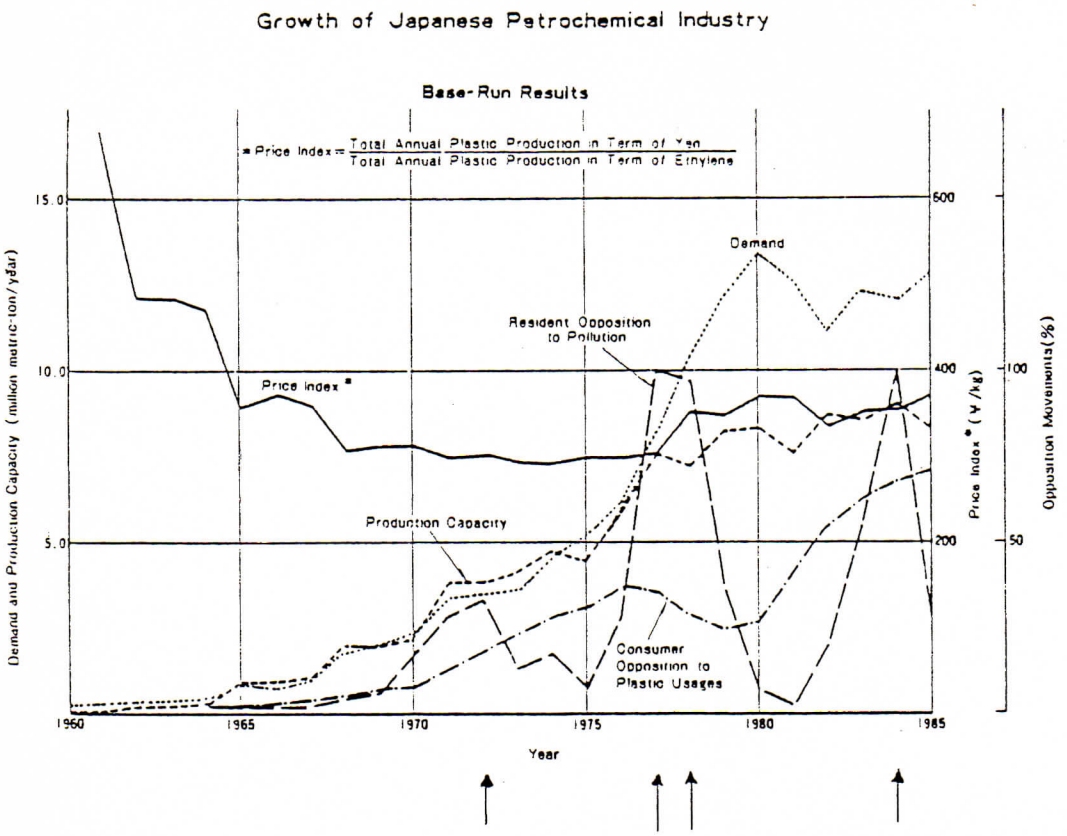


Figure 2



Interact with simulation runs at these points to obtain group consensus and feed new policy paramters for subsequent executions.

AUTHOR BIOGRAPHIES

Takeshi Utsumi, Ph.D., P.E., is President of Global Information Services, a firm which assists businesses in various countries, and especially Japan, to access computer information via global Value Added Networks (VANs). He is Technical Director of the **GLOSAS/Japan** Association, responsible for using advanced computers, telecommunications, systems analysis, and simulation technology to seek solutions to world wide problems. Among his over a hundred related scientific papers are many presentations, for example, to the Summer Computer Simulation Conferences which he created and named. He is a member of Japanese and American societies for computer simulation, as well as other scientific groups, and is now completing a technical book in the area of this proposal.

Philip S. Gang, Ph.D., is an author and leading international proponent for holistic approaches in education. He is Director of The Institute for Educational Studies and has extensive experience as an international lecturer, workshop leader, consultant and school head. Gang has been instrumental in organizing a world-wide network of global-holistic educators. He is Associate Director of the US-USSR Global Thinking Curriculum Project. The focus of Gang's work is to provide people with the knowledge and experiences that empower them to take responsibility for the welfare of our planet. His book, "Rethinking Education: OUR PLANET, OUR HOME," is being used throughout the world to assist people in developing deep ecological awareness and recognizing humanity's responsibility to our planet. Gang serves on the advisory boards of the Joyful Child Press, the Heartland Peace Institute and the World Community Foundation. He is a Contributing Editor for Holistic Education Review. He has been active in creating a Global Empowerment seminar for young adults and has been an advisor to the Partners Project, a plan to develop an earth curriculum for secondary students all over the world. Gang has presented his work at national and international conferences in many countries. In the summer of 1990 Gang was invited by the Soviet Academy of Pedagogical Sciences to present his work at a special conference focusing on "Ecology and Education" in Irkutsk, Siberia. Leading educators from all over the Soviet Union and Eastern Europe were present.