

**To:** Santa Fe David Dunn

**From:** Gottfried Mayer-Kress

**Number of Pages:** 6, including this sheet

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**Remarks:**

Hi, this is the current draft of our EarthStation project. I received David's proposal and it looks great (will there be dolphin and whale sounds?). I am pretty sure that I will be able to raise the funds for the low option. How about the Vasulkas' Iraq/Linz video?

I get economical arms expenditure data from a professor here at UCSC about how much is spent etc. I also most likely get direct satellite images about the smoke cloud.

Let me know when you get this, I tried to send a fax before, but it didn't work.

Regards, Gottfried

**Date:** Thu Mar 14 00:56:55 1991

ARS *electronica*:

**Out of Control** 10-13-Sep-91, Linz, Austria:

**Installation: *EarthStation*** (*working title*), Tue Mar 12 1991

The following is an updated description of the features:

**(I) Interactive graphic representation of the state of the earth**

Virtual reality interface (Fractal Boxes by Gideon May) for interactive exploration of complex relationships between the different data bases. Here some short description of this element: We start in the master box which contains a floating globe, the map of the earth on the far wall, text information on the left wall, and a schematic representation of the network of constituents of Gaia on the opposite wall. We can move freely in this room and enter the globe, revealing the complicated network of structures which have to work together to provide with a life sustaining environment. These factors are organized in a hierarchical structure and represented as a self similar (fractal) nested set of 3 dimensional boxes. Each box carries a label on its outside, indicating the contents (text, graphics, photo images) and has text, images, and diagrammatic information on its inside wall with information about the specific issue. Also, each box contains a characteristic sound environment, played through the computer network simultaneously on the NeXT computer in hifi stereo quality. The diagram on the inside wall represents the location of the user in the sense of a "subway map". On this diagram the viewer will be able to identify the problems areas directly related to the problem (s)he is currently viewing. This can uncover counter intuitive long-range connections. These boxes within boxes can be entered through the walls and the whole process repeats on a lower level up to the complexity limits of the data base.

Live images from NASA/NOAA satellites of atmospheric data (CO-2, Ozone, Cloud-top/Ocean/Land temperatures)

Overlay of geographic information systems population, economical, political, and military data (from Earthwatch, World Resources Inst, WHO, Batelle, CityCorp, Reuter, CIA), special focus on global implications on the gulf war: spread of the smoke clouds as seen from satellite and as experienced on ground, statistics on economic, agricultural consequences

The geographic display will be interactive (on SGI and/or NeXT platforms using different types of software packages) in the sense that we have a color-coding of the different areas on the globe according to a specific topic, e.g. intensity of recent political conflicts as indicated by numbers of news items in a selection of media (SCOLA news, say). By pointing and clicking into an area of this we can extract graphical, sound, and video information on this specific topic at this specific geographical location.

Statistical analysis and correlations of atmospheric data based on LinkWinds (Bud Jacobson, JPL) and other software for the Iris

Display of functional networks connecting different areas relevant for the global system

Synthetic sound representation (audification) of global parameters from these data

Drug statistics: economic implications, impact on health care, and social/legal systems

## **(II) Representation, simulation, and visualization of nonlinear dynamical models of global systems**

Display results from large scale super computer simulations of global circulation models (C. Keller, G.Glatzmaier, IGPP, C. Hanson, LANL)

Display of results from adaptive mesh simulations on the CM-II of Los Alamos National Laboratory, special graphics interface is available for the IRIS VGX with stereo goggles (, J. Fowler, LANL)

Simulation of global models for special atmospheric events (e.g.: El Nino model by Geoff Vallis, UCSC)

Simulation and representation of 9-dimensional Lorenz model simultaneously as evolving distribution of spatial variables and as abstract chaotic attractor representation (3 visual variables + 9 sonic representation of the dimensions) (MIDI based code currently developed by Greg Kramer, New York, B. Hotchkiss, LANL, implementation for multi media SGI by Gideon May)

Virtual reality interface for interactive exploration of sensitivities and instabilities of nonlinear models, existing code allows the user to fly through the attractor under the time evolution of the nonlinear differential equations. Space-ball based controls allow the user to perturb the differential equations and experience the modified time evolution against a backdrop of the original attractor. The program shows the Lorenz attractor from an outside view (present in a screen window to indicate PhaseSpaceShip's current and past (through comet-tail representation) position). It also shows a perspective through the front window of the PhaseSpaceShip as it flies along the attractor, slider controls (which can be replaced by SpaceBall controls) are shown in sketch 5 and can be used to actively control the path of the system. Simulations will also be available which will demonstrate the power (and limitations) of "auto pilots", equations for optimal control of chaotic attractors (A. Huebler).

Demonstration of machine learning and genetic algorithms based on John Hollands eco model with an improved graphics user interface developed by Simulation Laboratories.

Phase space analysis of simulations of multi-dimensional Richardson models of international arms races (code written by Judy Challenger for Iris)

Simulation of non-linear economic models of learning agents ( B. Arthur, SFI, Stanford Univ)

Simulation and visualization of artificial life ecologies of C. Langton, SFI, LANL

We also plan to have computer games like "SimEarth" of Maxis and "Balance of Power" and "Balance of the Planet" by C. Crawford available on Macintosh computers.

***Participants:***

**Gottfried Mayer-Kress**, UC Santa Cruz, Santa Fe Institute, Center for Nonlinear Studies:  
Coordination, design, mathematical models, chaotic attractors

**Gideon May**  
Computer Graphics, Phase Space Ship, Fractal Boxes, drug use statistics

**Gregory Kramer**, Clarity  
Audification, Sound Synthesis

**Jenifer Bacon**  
Graphic Design, Network Representation

**Tom Affinito**, UC Santa Cruz  
NeXT multi-media applications

**John Chachere**, UC Santa Cruz  
Data Base Visualization

**James Kalin**, Simulation Laboratories  
contracts, management, SimToolKit proto type

## ***Consultants:***

### SFI

- B. Arthur, economic model
- C. Langton, artificial life, CellSim
- G. Cowan, complex systems
- J. Holland, adaptive computation, eco-model
- B. Sawhill, audification

### LANL

- D. Campbell, nonlinear dynamics
- G. Doolen, nonlinear dynamics, lattice gas
- J. Fowler, CM-2 visualization
- C. Keller, global change simulations
- G. Glatzmaier, global circulation models
- C. Hansen, visualization of global circulation models
- B. Hotchkiss, audification
- R. Pecherer, object oriented databases
- R. Phillips, MediaView
- A. Keller, international security models

### UCSC

- R. Abraham, Ozone, cellular dynamical systems, MPP
- D. Lewis, nonlinear dynamics
- M. Koebbe, Recurrence graphs
- J. Challinger, Richardson model, simulation
- P. Hughes, scientific visualization
- D. Kaun, Economics, Military Budget
- B. Larkin, Politics, far east situation
- G. Vallis

### UCB

- J. Crutchfield, nonlinear dynamics, video

### LucasArts

- Sara Roberts, interactive Laser Disks

### SGI

- D. Paradise, ecological applications
- P. Broadwell, computer graphics
- J. Takai

### UIUC

- A. Huebler, chaos control

### NASA-Ames

- J. Scargle, general contact to NASA Ames global change activities
- R. Stephen Hipskind, satellite data

R.B. Chatfield, atmospheric chemistry and dynamics  
J. Jordan, Ozone data base, visuals

JPL

B. Jacobson, LinkWinds

InterNetwork

Payson Stevens, Hypercard stack, foto library

Maxis

W. Wright, SimEarth

World Resources Inst

E. Rodenburg, general data bases

Self Representing:

Patrice Boyle

Brad DeGraf, multi media for SGI, Earth Observation Data

David Dunn, bio-habitat sound samples

Steina & Woody Vasulka, Laser-disk, ecological implications of gulf war, Linz connection