

Systems & Systematic Design

Tracing the Evolution of Design Methodology
at the Institute of Design 1965 - 2010

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Institute of Design

Illinois Institute of Technology

Chicago, Illinois

3rd Annual **IIT Archives Lecture**

October 28, 2010

Post-WWII Design Education The Available Models

An Analysis by Jay Doblin

- *Beaux Arts*
The traditional art school model
- *Purism*
A top-down model directly transmitting ideals
- *Experimentalism*
A bottom-up model resynthesizing individual exploration and experience
- *Commercialism*
The uniquely American market-oriented skills training model

1945 - 1955

Post-WWII European Design Education A German "new Bauhaus"

HfG Hochschule für Gestaltung Ulm

- *Bauhaus successor school in Ulm.*
Key founders: Max Bill, Inge Scholl and Otl Aicher

"Design problems of the industrial society of the future"

- *Faculty and student statistics:*

Staff Instructors:	21
Workshop Leaders and Technical Instructors:	10
Guest Instructors:	216
Visiting Lecturers:	12 +
Total Student Enrollment:	640



1953 - 1968

Background

Post WW-II European Design Education A German "new Bauhaus"

HfG Hochschule für Gestaltung Ulm

- *Illustrious faculty, including:*

Max Bill	Konrad Wachsmann
Josef Albers	Herbert Ohl
Johannes Itten	Horst Rittel
Walter Peterhans	Bruce Archer
Tomàs Maldonado	Gui Bonsiepe
Otl Aicher	Herbert Lindinger
Frei Otto	Karl Gerstner
Hans Gugelot	Abraham Moles
- *Search for a new educational balance*

Craft <i>vs</i> Technology	Science <i>vs</i> Design
Theory <i>vs</i> Practice	Art <i>vs</i> Science



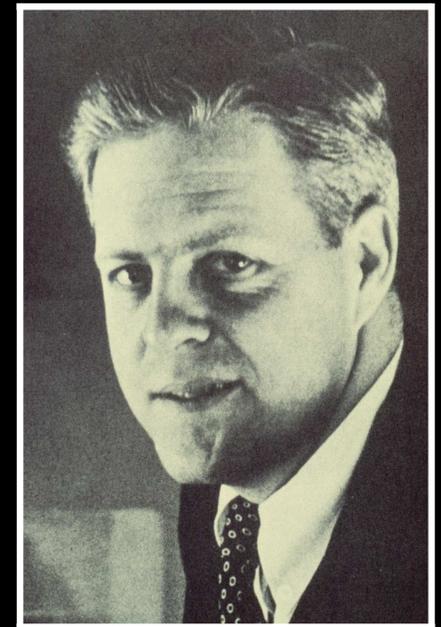
1953 - 1968

Background

Design Education – IIT Institute of Design Altering Course

Contributing Influences

- *ICSID Vice Presidency 1960-61*
International Council of Societies
of Industrial Design
- *Review of 23 schools 1963*
Federal Republic of Germany
- *Presidency IDEA 1963-64*
Industrial Designers Education
Association (USA)



Information-based Design

Design based on research, systematic methods
and the information obtained with them

1955 - 1965

Background

Design Education – IIT Institute of Design

Design Methods

A New Course in the Application of Design Methods

- *Alexander's Method*
Architect Christopher Alexander (Harvard, UC Berkeley):
design problems as graphs
- *Systems Engineering Projects*
Mechanical Engineer Dwight Baumann (and others at MIT):
cross-discipline teams and project-oriented teaching
- *Computer Software*
Alexander and Marvin Manheim (MIT):
HIDECS2 and HIDECS3 computer programs

Governmental / Institutional 1 Theater, 3 Transportation Systems

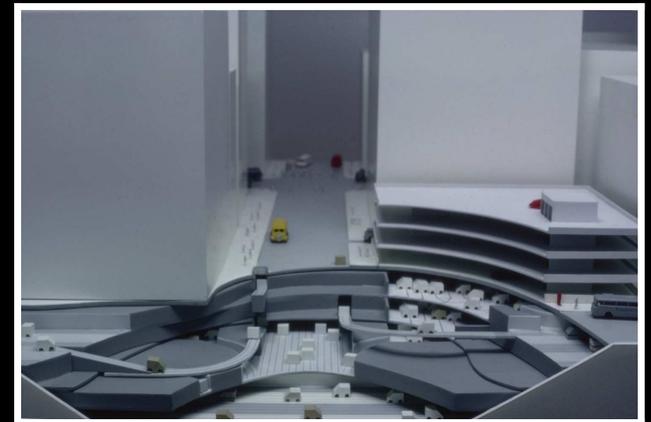
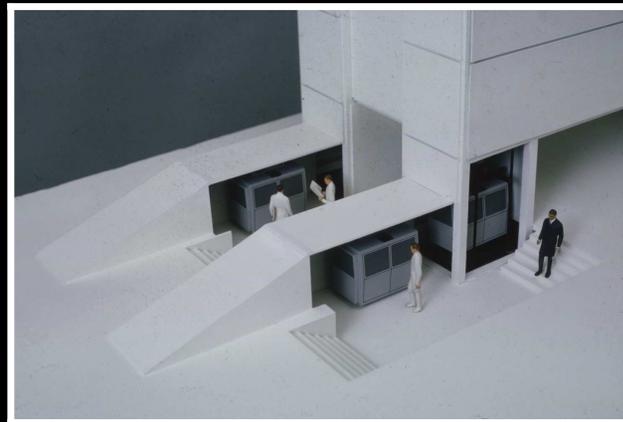
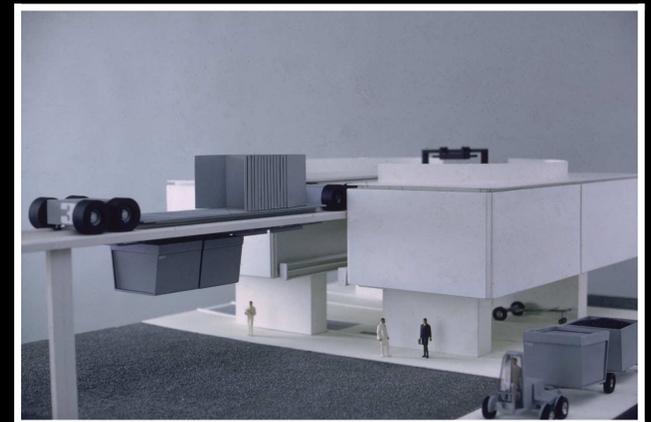
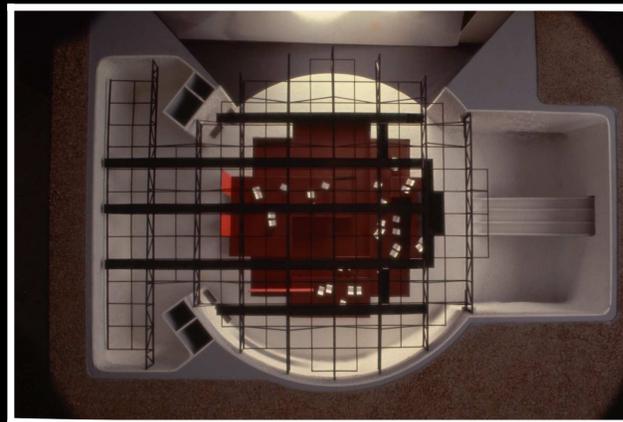
**Laboratory for the
Performing Arts**

**Commodity Trans-
portation System**

**Personal Trans-
portation System**

**Regional Trans-
portation System**

-
- Alexander's method (augmented)
 - Hierarchical condensation algorithm
 - VTCON2 computer program

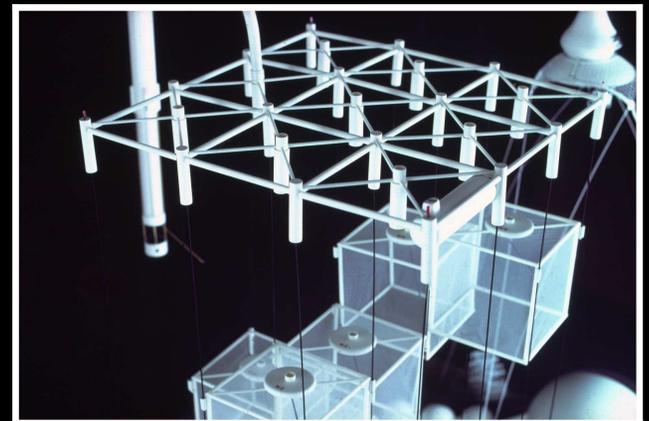
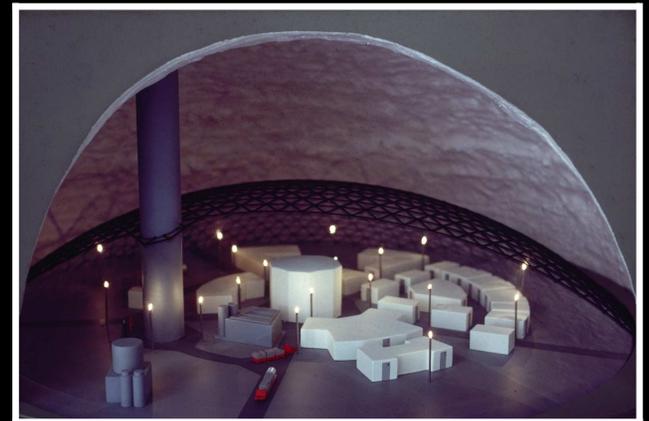
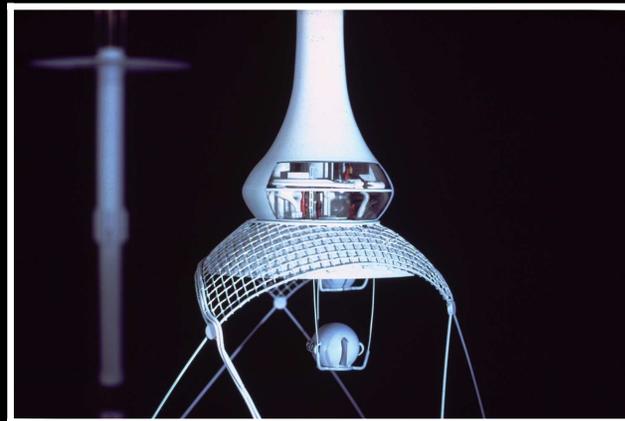


Spring 1967

Industrial Ocean Resources Development System

Hydrospace

- *Selected schools competition*
ARMCO Steel
 - *Journal article*
Marine Technology Society Journal
-
- Observations, Force-tendency statements
 - Design Implications
 - Decomposition algorithm
 - VTCON3 computer program



Design Education – IIT Institute of Design Undergraduate Curricular Changes

Course Types to Improve Access to New Subjects

- *Theory Courses*
Lecture courses on design theory and methods:
2 credits
- *Minor Application Courses*
One-afternoon workshop courses on specialized design topics:
3 credits
- *Major Application Courses*
Two-afternoon workshop courses on primary design topics:
4 credits
- *Senior Thesis*
Summary complete project with written component:
4 credits

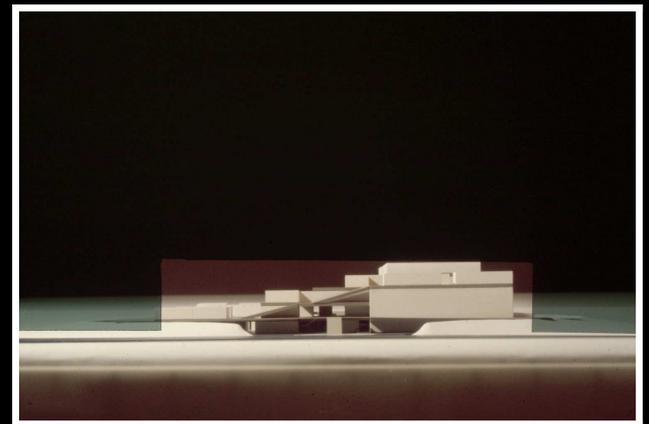
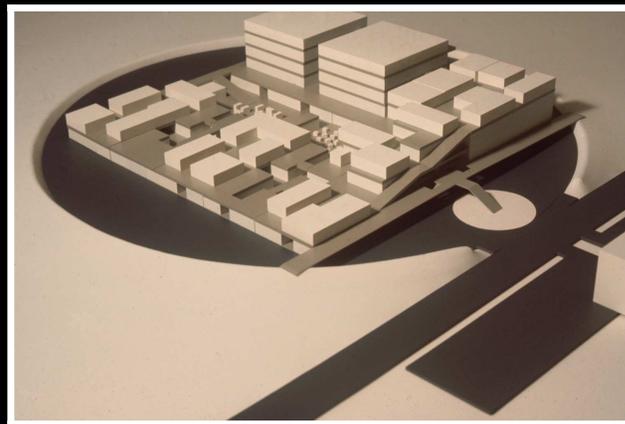
Fall 1968

Institutional Design Education Facility

IIT Institute of Design

- *Funded Grant*
ESSO Foundation

- Problem Element document format
- Interaction measure
- RELATN computer program
- Diagramming following conceptual synthesis
- Cycled planning process

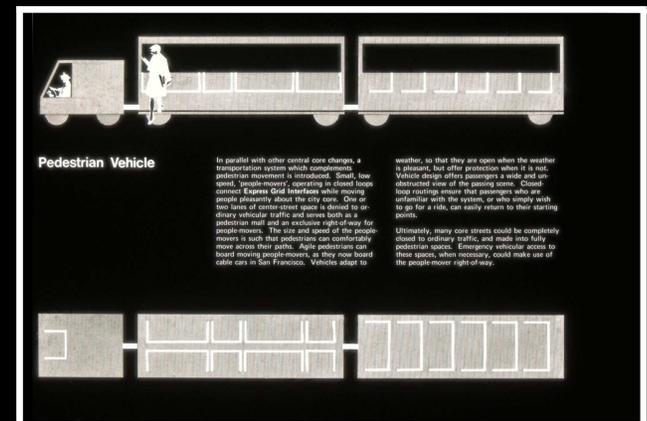
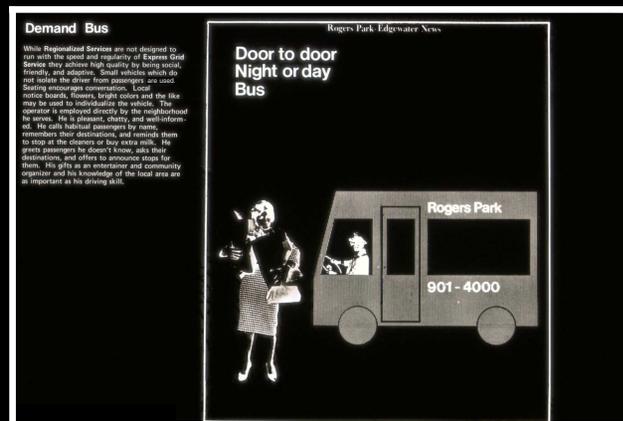
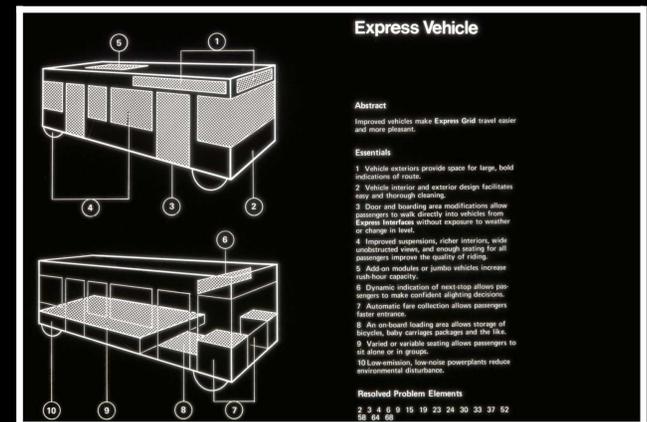
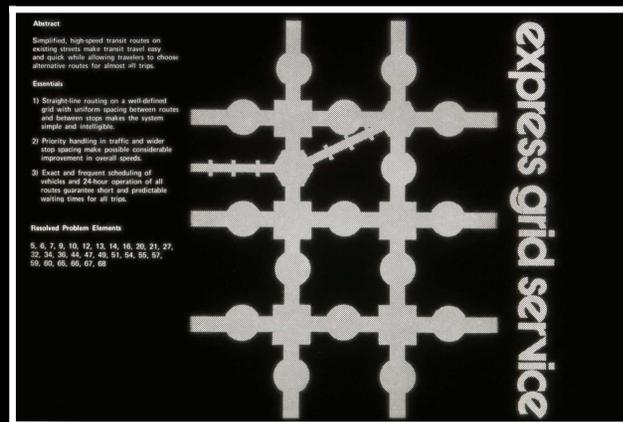


Summer 1969

Governmental Surface Transportation System for Chicago

Getting Around

- *Multi-discipline "Urban Systems Project"*
- *Demonstration Project Grid cities*
- Integration of design / non-design disciplines
- Planning course / communication course handoff
- Multi-media communication



Spring/Summer/Fall 1970

Design Education – IIT Institute of Design Product Design Curricular Refinements

Graduated Development of Complexity

- *Products*
5th semester major course:
products as artifacts with emphasis on form and functionality
- *Environments*
6th semester major course:
products in environments with emphasis on human factors
- *Systems*
7th semester major course:
products in systems with emphasis on systematic design

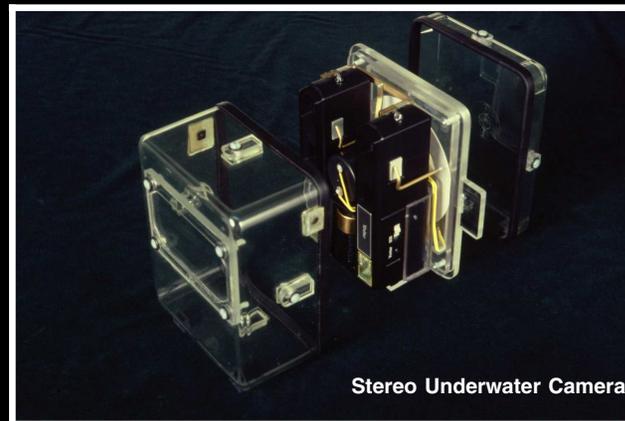
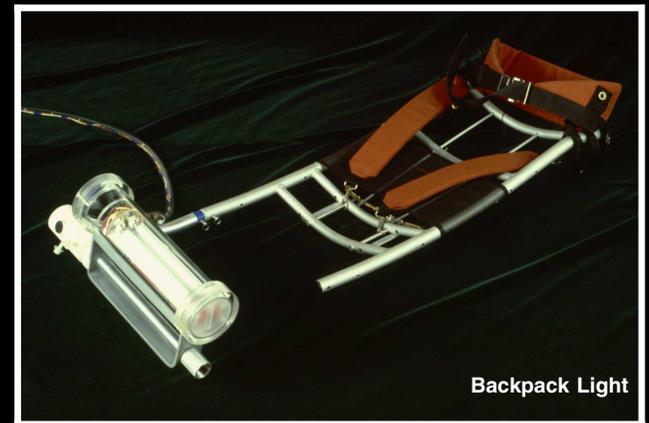
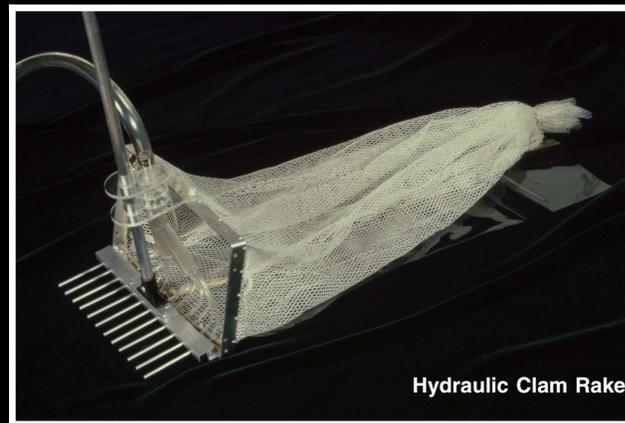
Project

Governmental / Institutional Ocean Surveying/Monitoring/Collecting System

Living Sea Project

- *Design for Home Production*
**Self-Produced
Research Tools**

- "Structured Planning"
- Constraints, Objectives, Directives
- Functions, Function Structure
- Action Analysis
- Design Factors

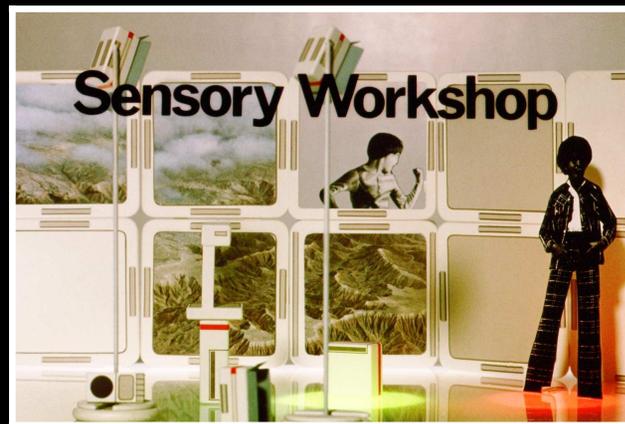


Fall 1977 / Spring 1978

Institutional / Commercial K-5 Educational Support Systems

Sensory Workshop

- *1st Prize Education Category*
ICSID 1st International Student Competition



Playscape

- *3rd Prize*
International Rehabilitation Engineering Design Competition



Commercial Sports Store Customer Service System

Kinetics

- *2nd Prize*
Walker Group
Interior Design
Competition,
New York



- CHART1 computer program

Fall 1981

Commercial

Multi-climate, Multi-culture Housing System

House of the Future

- *Grand Prize*
1st International
Osaka Design
Competition
 - *Book*
House of the
Future
-
- INFORM computer
program
 - Report format

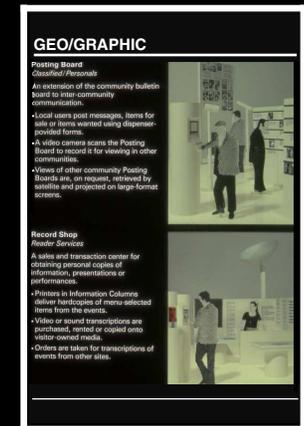


Fall 1982

Governmental / Institutional World's Fair Social Interaction System

Geo/Graphic

- **Demonstration Project**
Alternative Model for a Chicago Bid



- Planning team handoff to designing team

Fall 1984 / Spring 1985

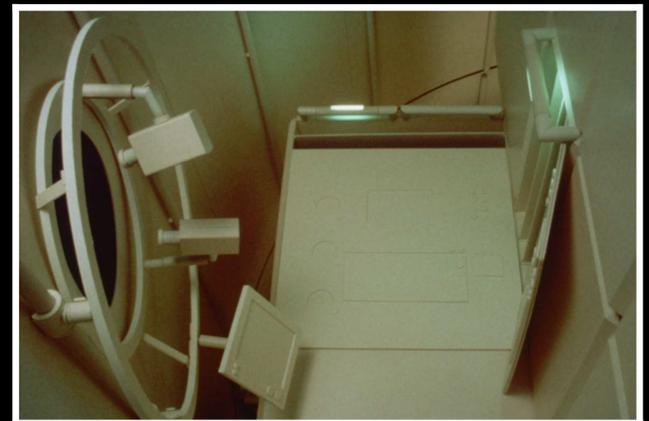
Institutional Habitat Utilities and Logistics System

Space Station

- *Commissioned project*
NASA /
Johnson Engineering
Company

- Defining Statement forms

- Abstraction ladder synthesis

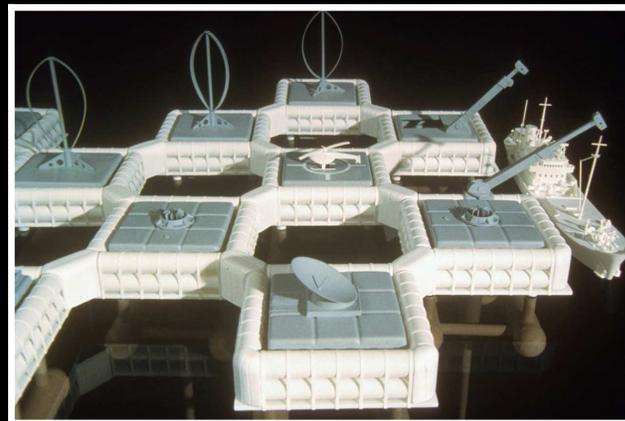
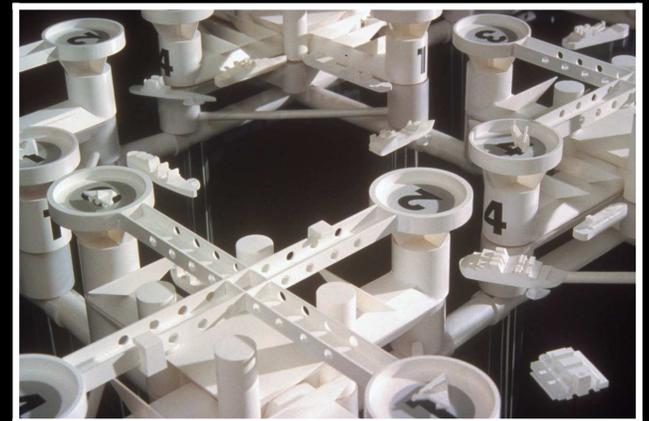
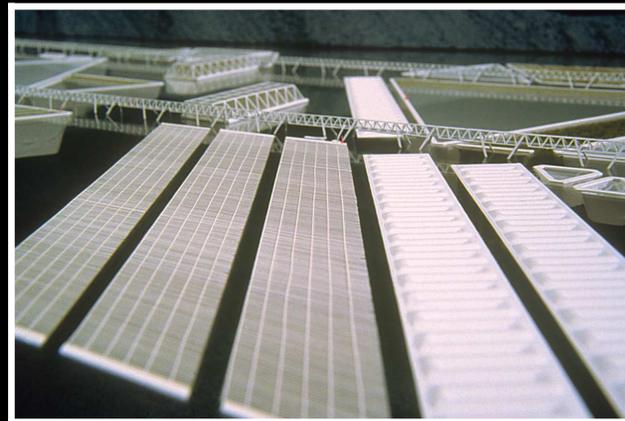


Fall 1985

Institutional / Industrial Ocean-deployed Resource Extension Systems

Aquatecture

- *Grand Prize*
3rd International
Osaka Design
Competition
- *Selected Concept*
ID International
Design Review



- Multiple project
integration

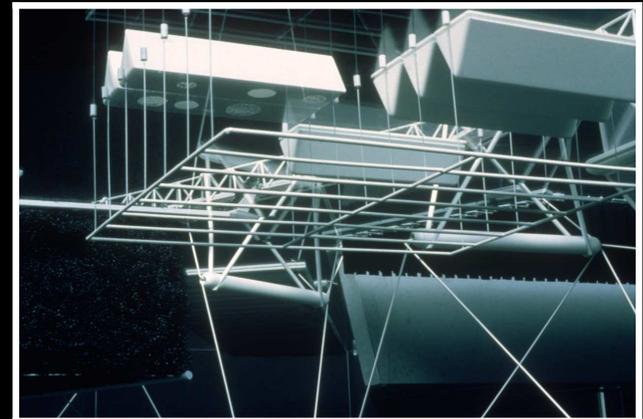
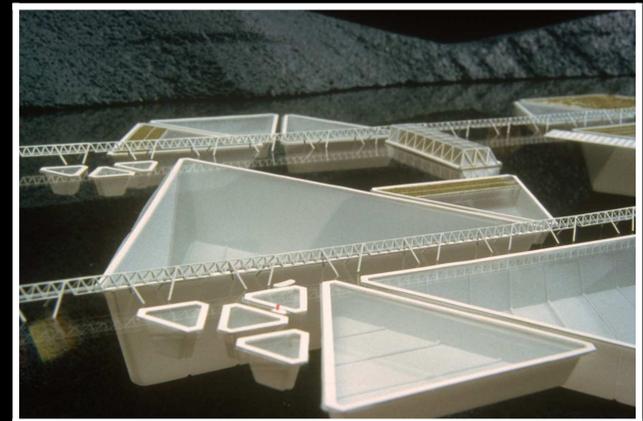
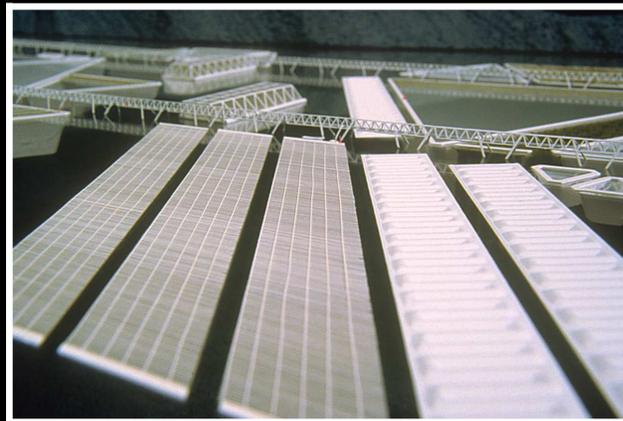
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Fall 1986

Institutional / Industrial Ocean-deployed Resource Extension Systems

Aquatecture Floating Fields

- *Grand Prize*
3rd International
Osaka Design
Competition
- *Selected Concept*
ID International
Design Review



-
- Multiple project
integration

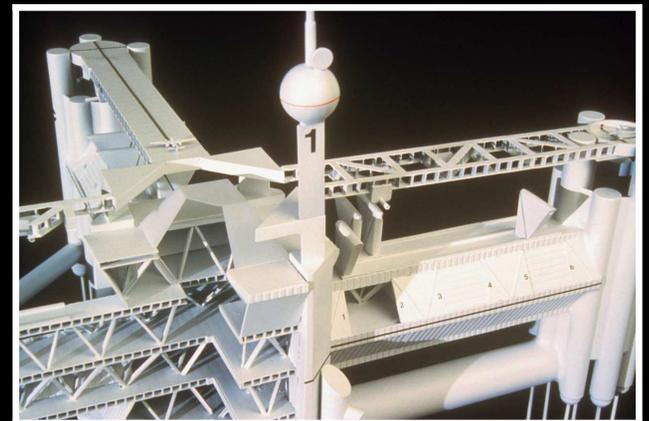
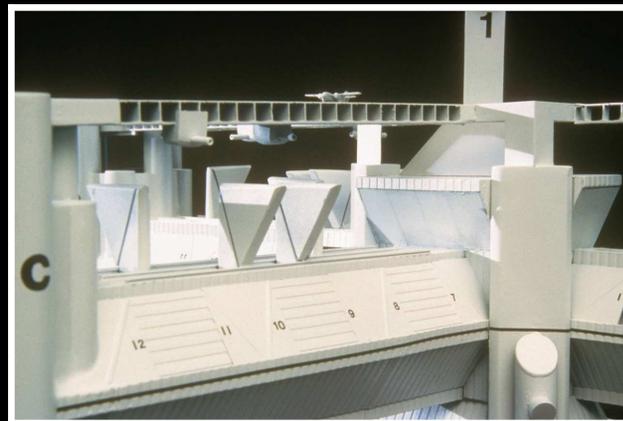
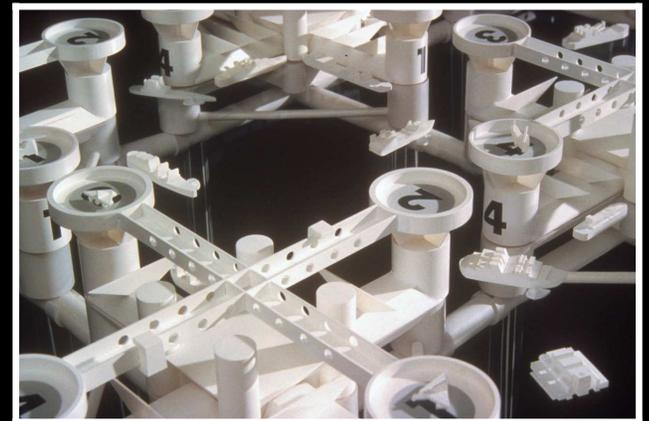
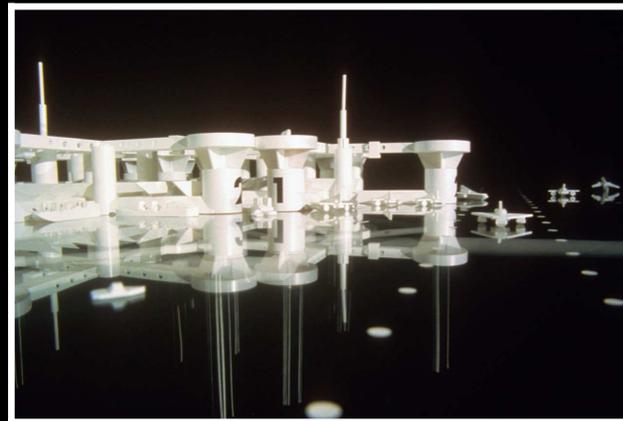
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Fall 1986

Institutional / Industrial Ocean-deployed Resource Extension Systems

Aquatecture Crossroads in the Sea

- *Grand Prize*
3rd International
Osaka Design
Competition
- *Selected Concept*
ID International
Design Review



- Multiple project
integration

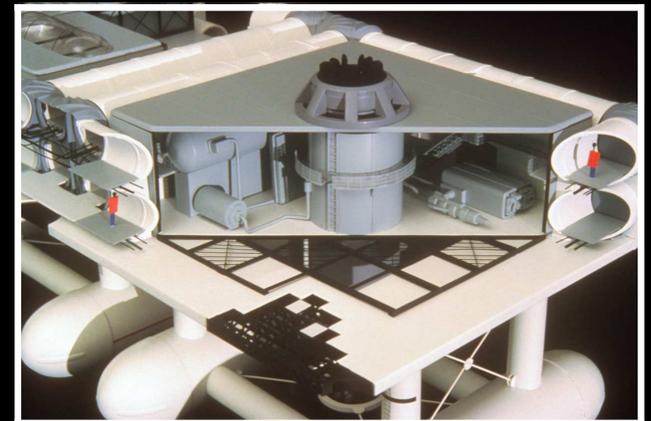
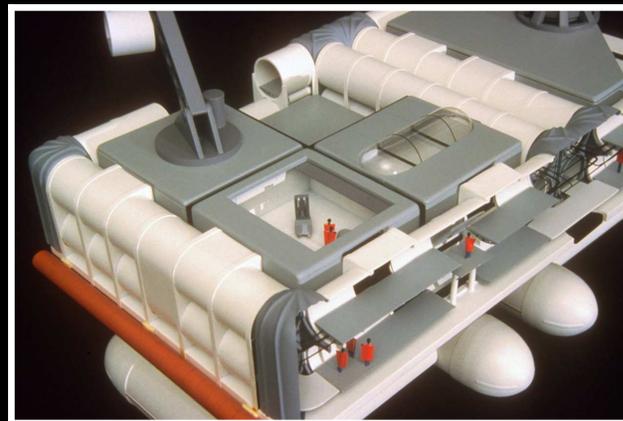
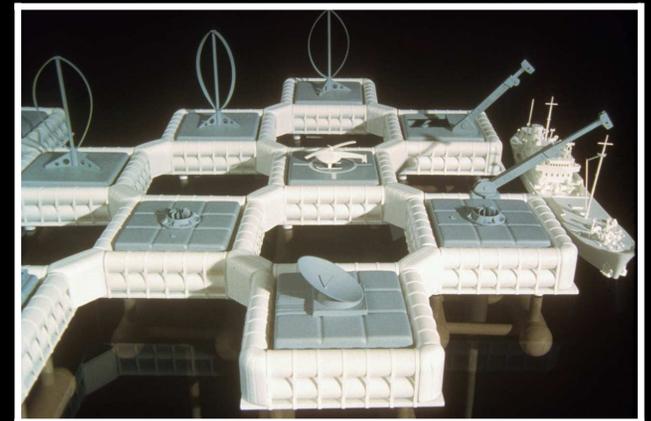
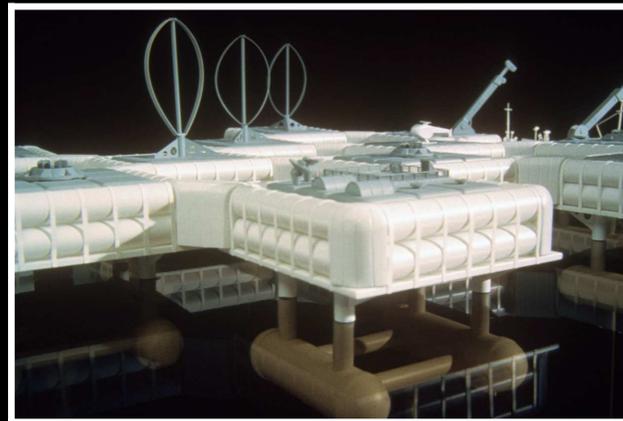
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Fall 1986

Institutional / Industrial Ocean-deployed Resource Extension Systems

Aquatecture Patterned Energy

- *Grand Prize*
3rd International
Osaka Design
Competition
- *Selected Concept*
ID International
Design Review



- Multiple project
integration

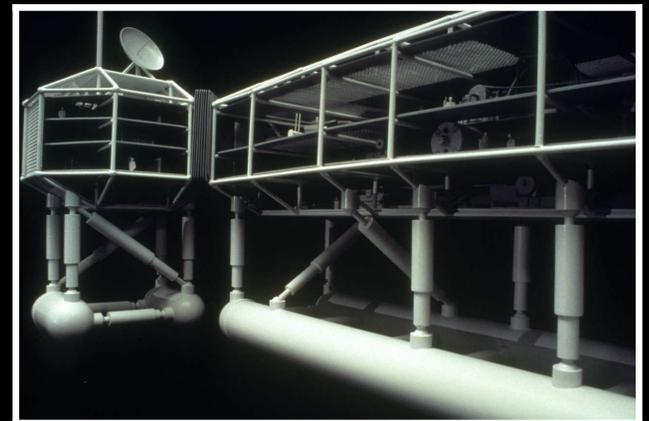
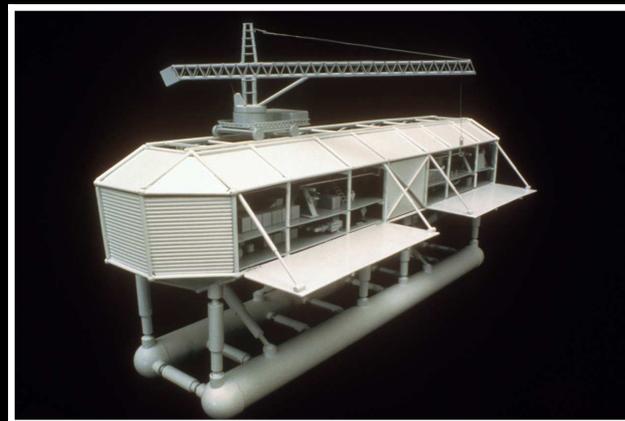
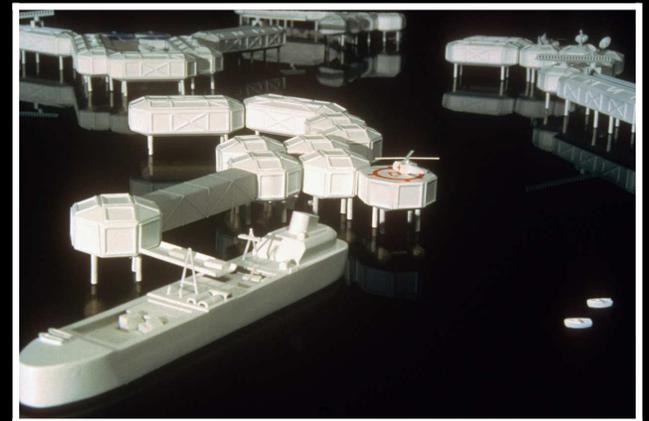
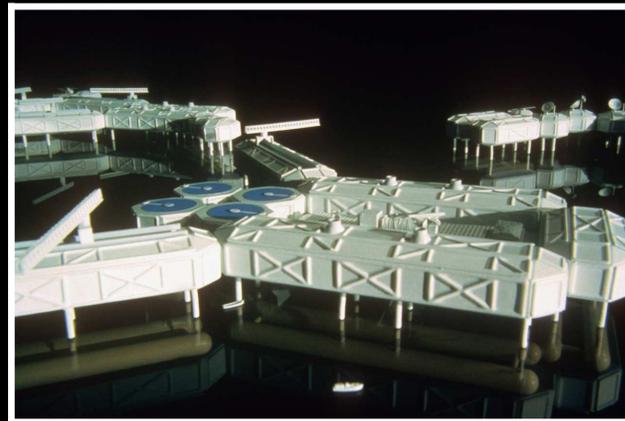
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Fall 1986

Institutional / Industrial Ocean-deployed Resource Extension Systems

Aquatecture Mobile Offshore Industry

- *Grand Prize*
3rd International
Osaka Design
Competition
- *Selected Concept*
ID International
Design Review



- Multiple project
integration

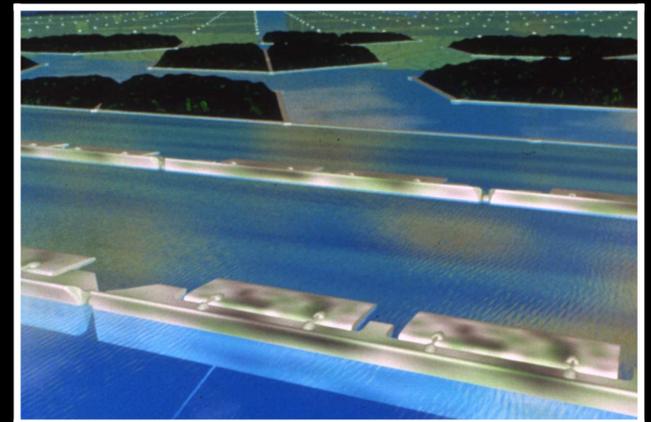
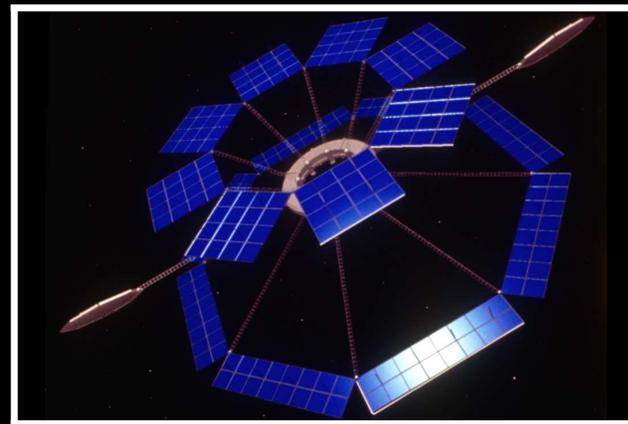
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Fall 1986

Governmental / Industrial Climate Change Mitigation Systems

Project Phoenix

- *Grand Winner*
Environmental Technology
"1991 Year's Greatest
Achievements in Science
and Technology"
Popular Science
- *Selected Concept*
**ID International
Design Review**



• Computer-graphic
conceptual prototypes

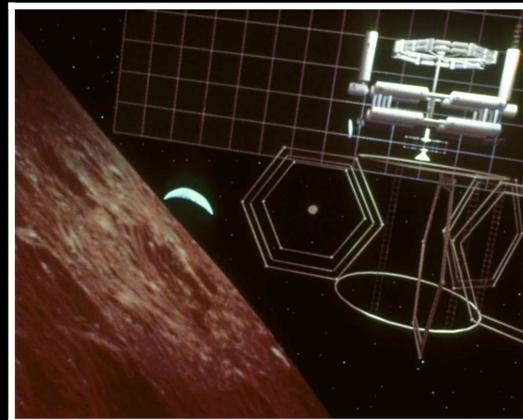
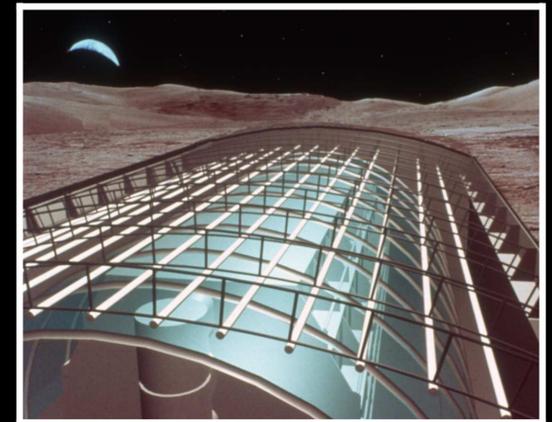
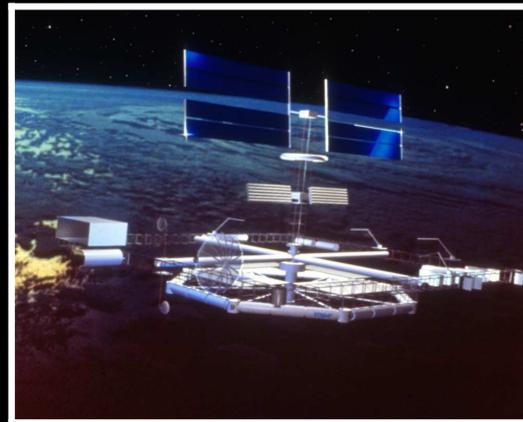
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Fall 1988

Governmental / Industrial Climate Change Mitigation Systems

Project Phoenix Fire Replaced

- *Grand Winner*
Environmental
Technology
"1991 Year's Greatest
Achievements in Science and
Technology" **Popular Science**
- *Selected Concept*
**ID International
Design Review**

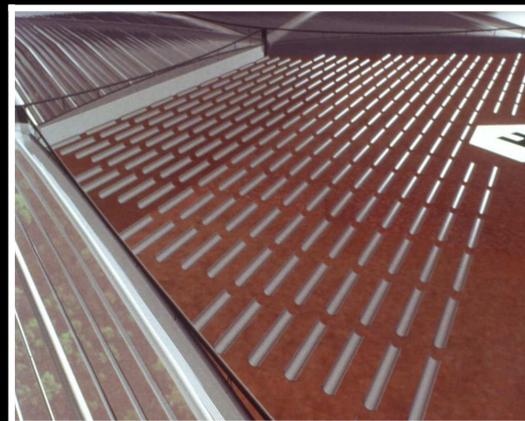


-
- Computer-graphic
conceptual prototypes

Governmental / Industrial Climate Change Mitigation Systems

Project Phoenix Fire Reversed *Desert Regreening*

- *Grand Winner*
Environmental
Technology
"1991 Year's Greatest
Achievements in Science and
Technology" **Popular Science**
- *Selected Concept*
**ID International
Design Review**

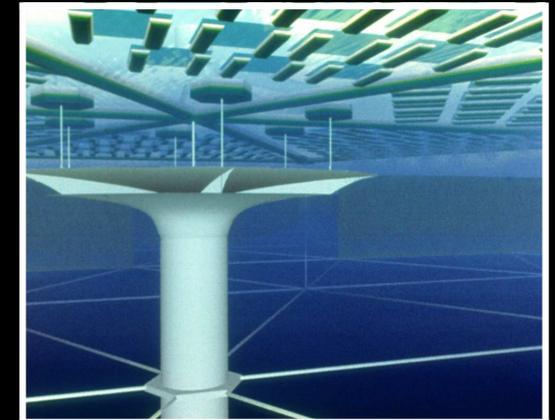
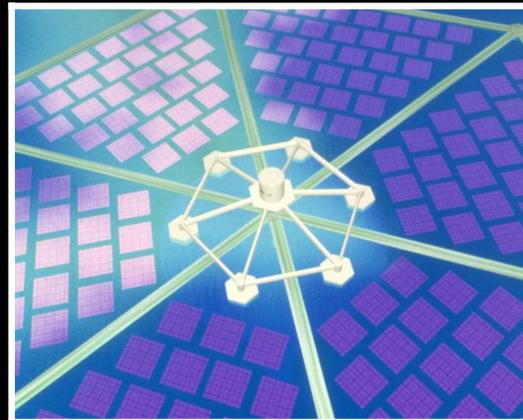
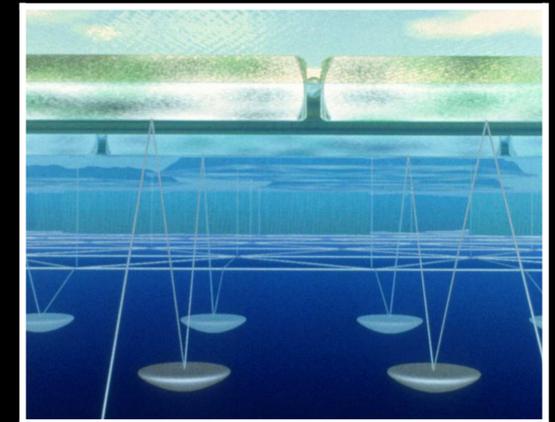
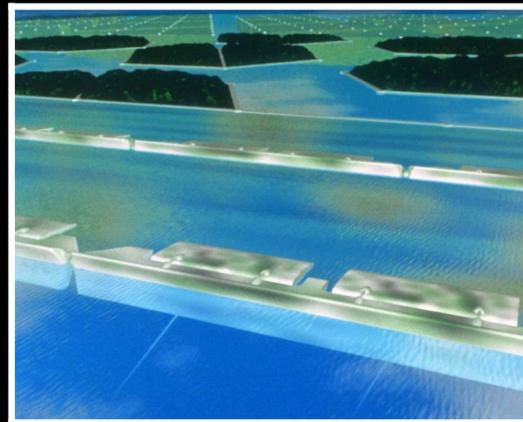


-
- Computer-graphic
conceptual prototypes

Governmental / Industrial Climate Change Mitigation Systems

Project Phoenix Fire Reversed *Floating Wetlands*

- *Grand Winner*
Environmental
Technology
"1991 Year's Greatest
Achievements in Science and
Technology" **Popular Science**
- *Selected Concept*
**ID International
Design Review**



-
- Computer-graphic
conceptual prototypes

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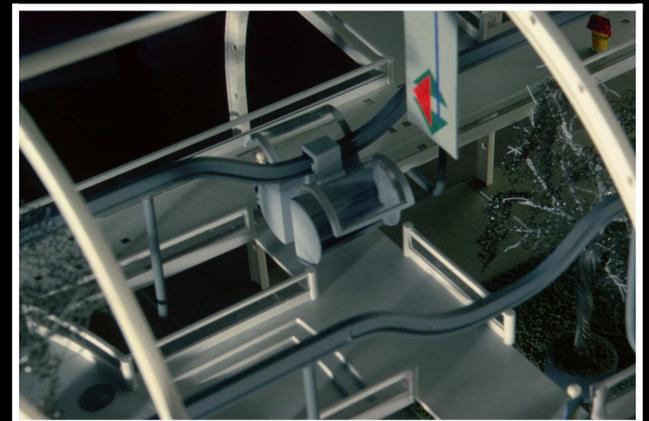
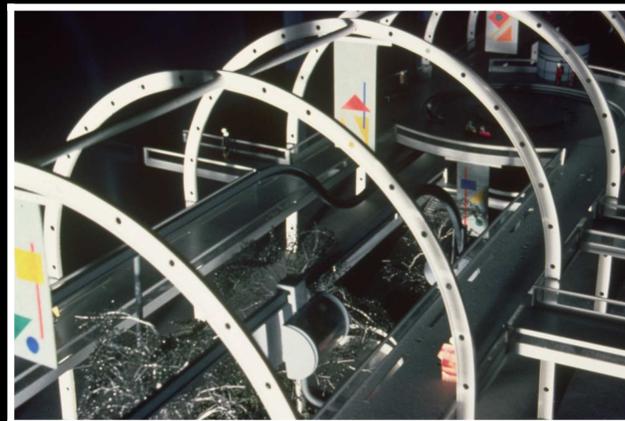
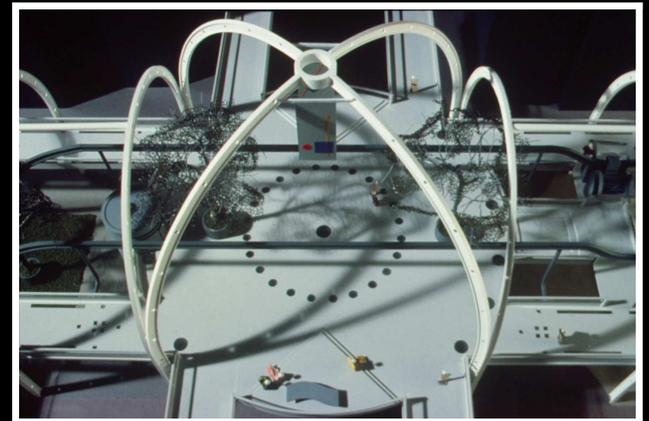
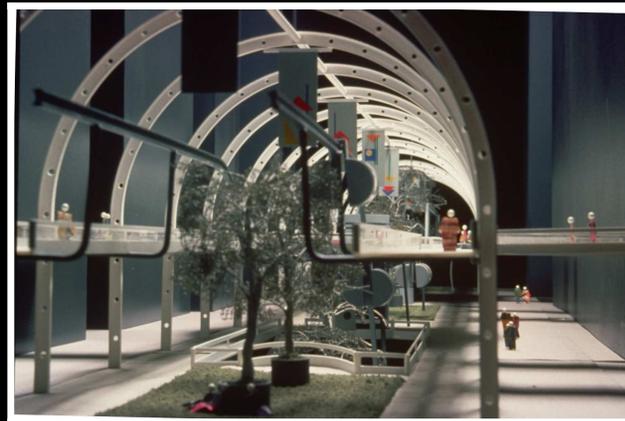
Fall 1988

Project

Governmental / Commercial Urban Environmental Integration System

Galleria Chicago

- *Demonstration Project*
State Street Mall
Chicago



Fall 1988

Commercial K-12 Educational Support System

Kore Computer

- *Demonstration project*
Apple Computer
- *Book Chapter*
Design for Integrity



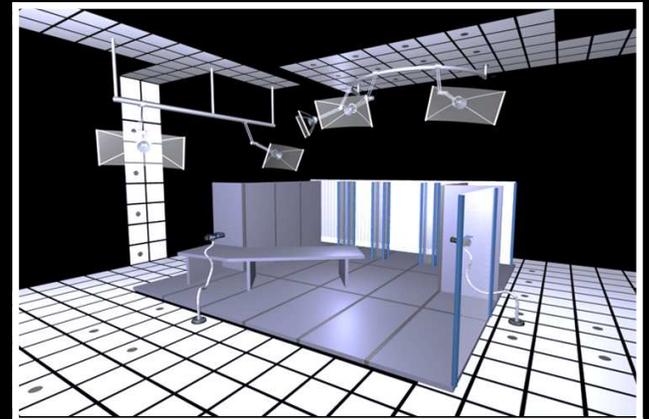
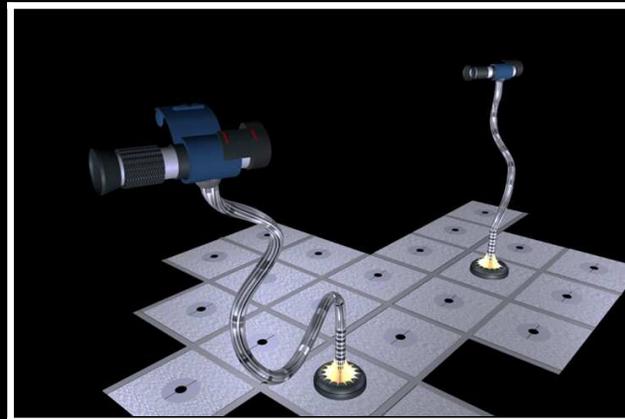
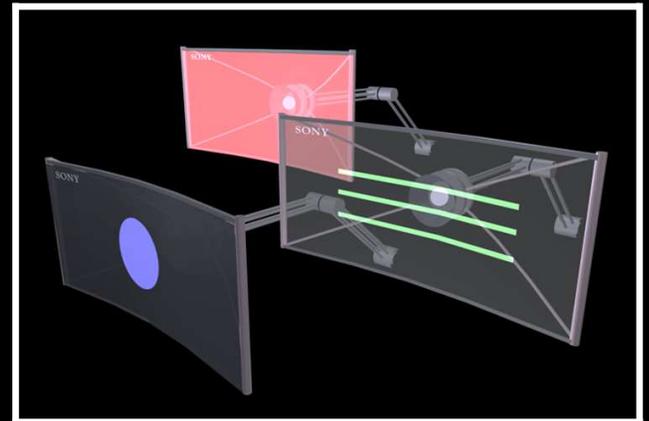
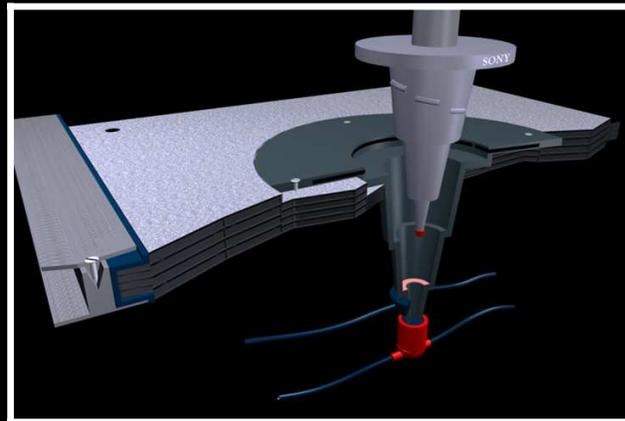
-
- Means/Ends Analysis
 - Ends/Means Synthesis

Fall 1990

Industrial / Commercial Telecommunication Production System

TV Command

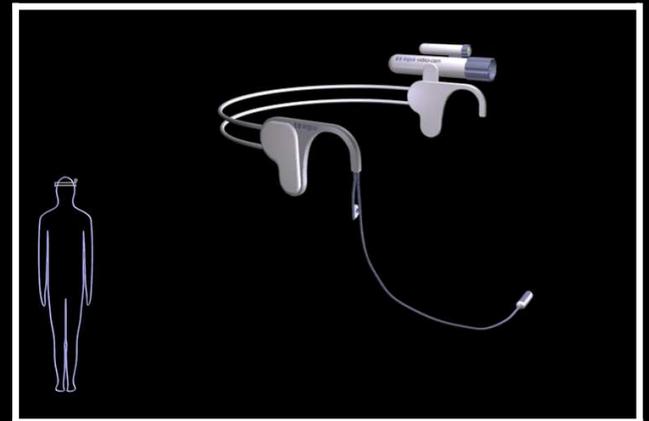
- *Demonstration project*
Sony
- *Book Chapter*
Design for Integrity



Industrial / Institutional Distributed Health Care System

Argus

- *Demonstration project*
Hewlett Packard
- *Book Chapter*
Design for Integrity



Design Education – IIT Institute of Design

Curricular Revisions

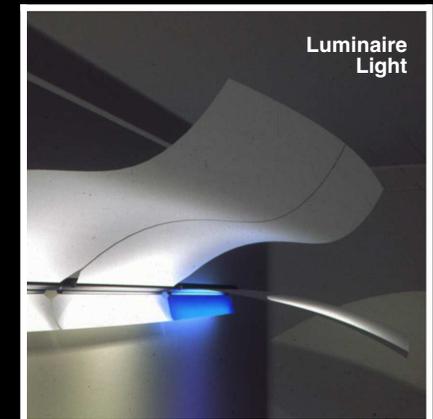
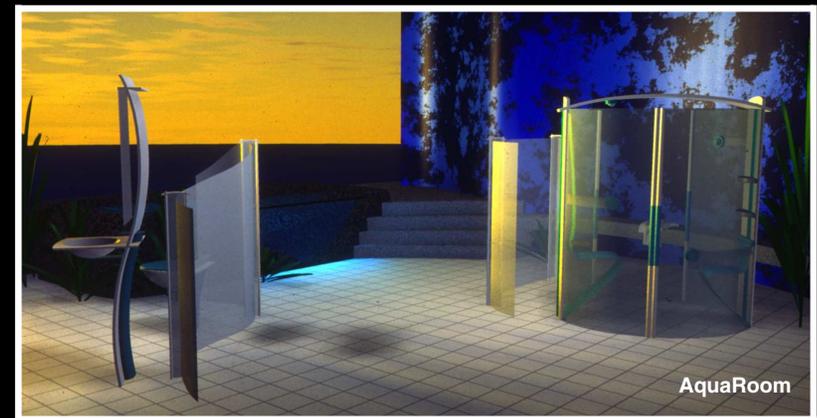
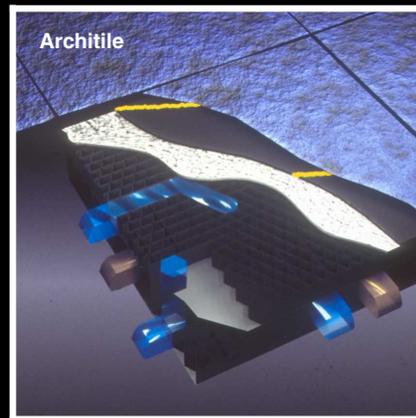
Commitment to Research

- *Research and Teaching PhD Degree*
First U.S. PhD in design
- *Terminal Professional MDes Degree*
Two year program terminating in a demonstration project
- *Theory Courses and Workshops*
Eight-week, 1½-credit theory courses;
Sixteen-week, 2 or 4-credit workshop courses

Commercial Future of Plastics in Home Systems

Nanoplastics

- *Finalist*
3rd International
Forma Finlandia
Competition



- Future projections for society based on science projections

• www.id.iit.edu/618/

Fall 1992

Commercial Lighter-than-Air Transport System

Aerotecture

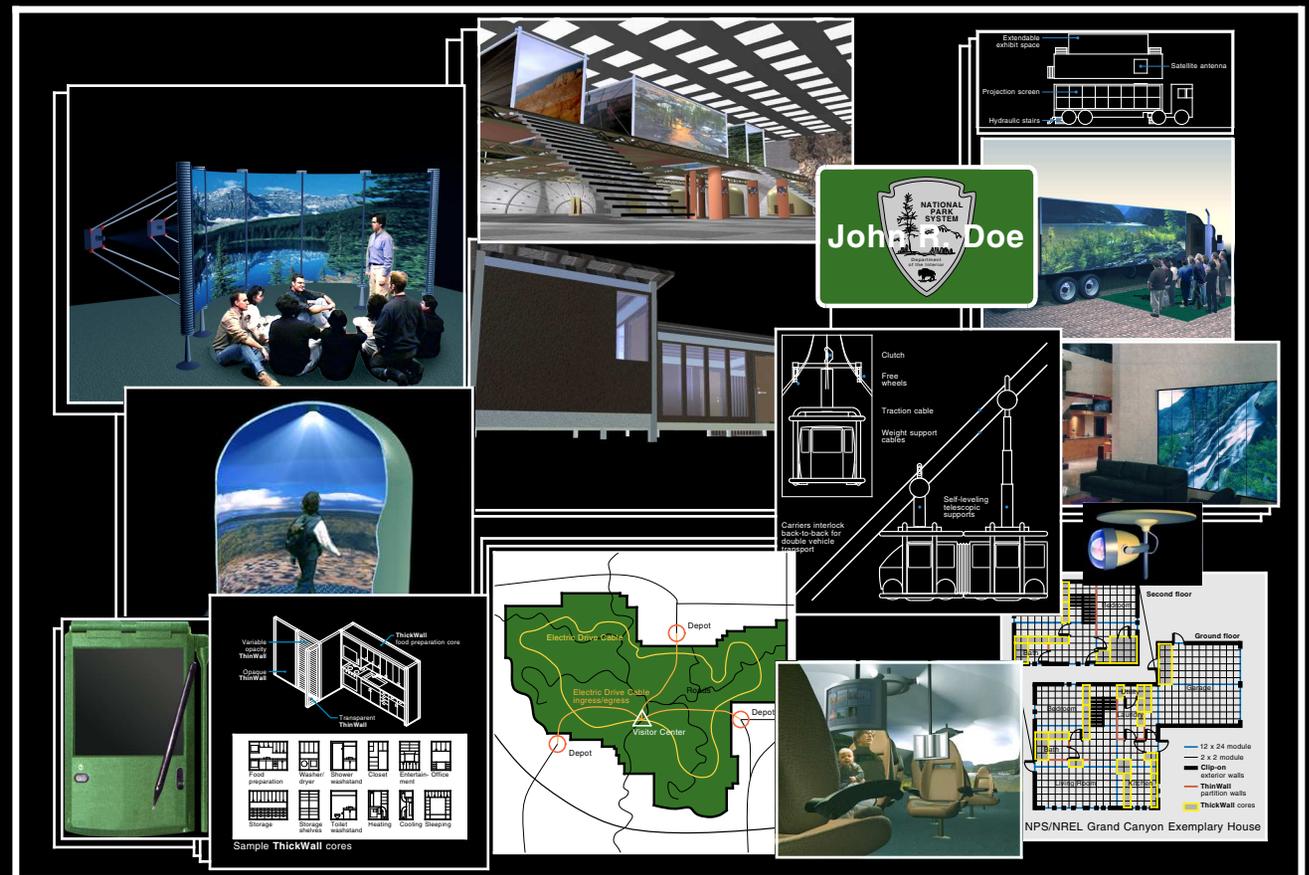
- *Bronze Prize*
6th International
Osaka Design
Competition



Governmental National Parks Conservation System

National Parks System

- *Commissioned Project*
National Parks Foundation



Institutional Inter/Intra Institutional Service Systems

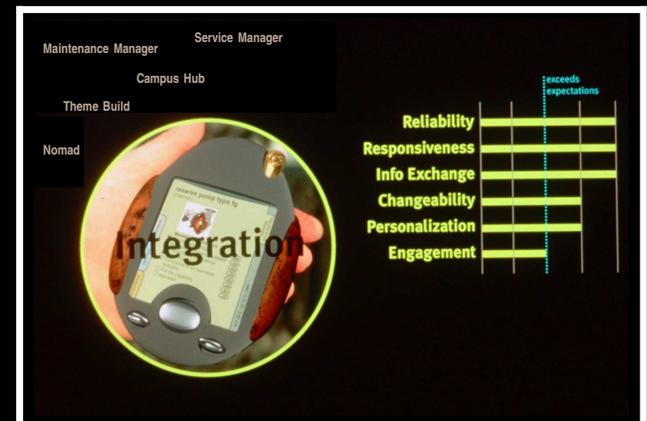
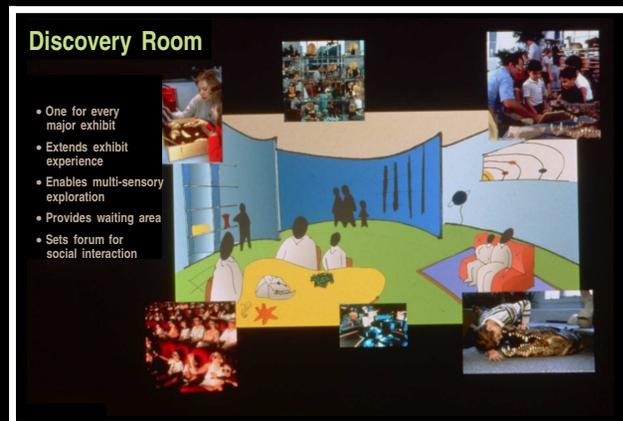
Chicago Museum Campus

- *Demonstration Project*
Field Museum
Shedd Aquarium
Adler Planetarium

- Formatted System Elements

- Solution Element and System Element Properties and Features

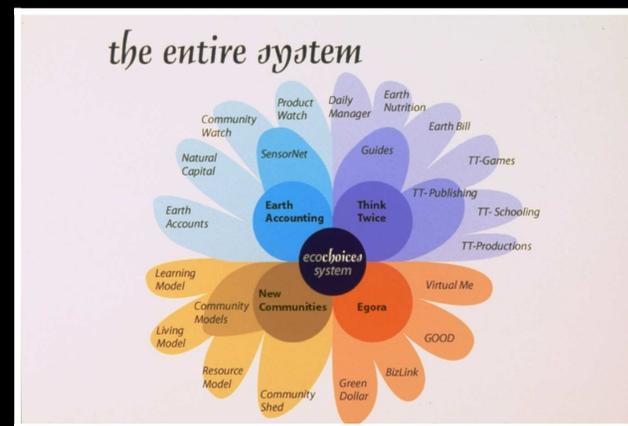
- System Element interaction



Project Governmental Environmental Awareness and Action System

Eco-Choices

- *Demonstration Project*
Environmental Stewardship Organizations



Earth Accounting: Sensonet
ProductWatch
Embedded sensor microchips

Properties

- Miniaturized usage and emission sensors
- Wireless network connections
- Integration with household management systems

Features

- Transmits product environmental impact information throughout lifecycle
- Allows consumers to precisely measure their usage
- Allows manufacturers to eco-optimize design

ecochoices

Think Twice: Guides
Earth Nutrition Label
An environmental lifecycle impact labeling system

Properties

- Standardized labeling system
- Total environmental impact data
- Resource use, energy use, pollution, and waste data

Features

- Provides impact data
- Alerts users to the product's environmental cost
- Compares product impacts against total usage guidelines

Earth Facts
Serving Size: 1/2 cup (128g)
Servings Per Container: about 11

	Cereal with 1/2 cup (128g)	
	Cereal	Dark Milk
Natural Capital	100	140
Global Warming	0	0
% Daily Value**		
Landfill Waste	0%	0%
Non-Biodegradable	0%	0%
Energy Use	0%	0%
Hazardous Waste	4%	7%
Air Emissions	8%	10%
CO ₂	16%	16%
H ₂ O		
SO ₂		
Individual Daily World Share	2,000	2,500
Natural Capital	Less than 65g	80g
Global Warming	Less than 25g	35g
Air Pollution	Less than 300mg	300mg
Energy Use	Less than 2,000mg	2,000mg
Water Usage	300g	275g
Toxic Waste	25g	30g

ecochoices

eGora
BizLink
An In-store consumer-business communication system

Properties

- Interactive screen retail displays
- Smart product readers
- Point of Purchase live customer service connection
- Consumer opinion bulletin boards

Features

- Eliminates need for packaging as information carrier
- Enables consumers and manufacturers to share information
- Enables products to connect directly with their manufacturers and send information to consumers

ecochoices

Spring 2000

Governmental Disaster Preparation/Response/Recovery Systems

Safe Earth

- *Demonstration Project*
Disaster Management Agencies

Strategy
Product performance

Ordinary Conditions Disaster Extraordinary Conditions

DSR Lab
Research and testing facilities for disaster related products + technologies
Product development lab
...
Develops products + technologies that make disaster preparedness simple and affordable
Facilitates collaboration between victims + designers

Warning

Active Smart Messaging System
Multi-media warning system
Defined, clear, actionable warnings
...
Provides warning of impending disasters to individuals on wireless devices
Provides warnings according to personal preferences such as language
Allows confirmation of threat
Provides best actions to take

Evacuation

SafeStop
Disaster-proof structure
City-icon
Ascending + descending observation deck
...
Provides easily accessible, clear destination for communities during evacuation
Serves as a tourist attraction during non-disaster situations

Rescue

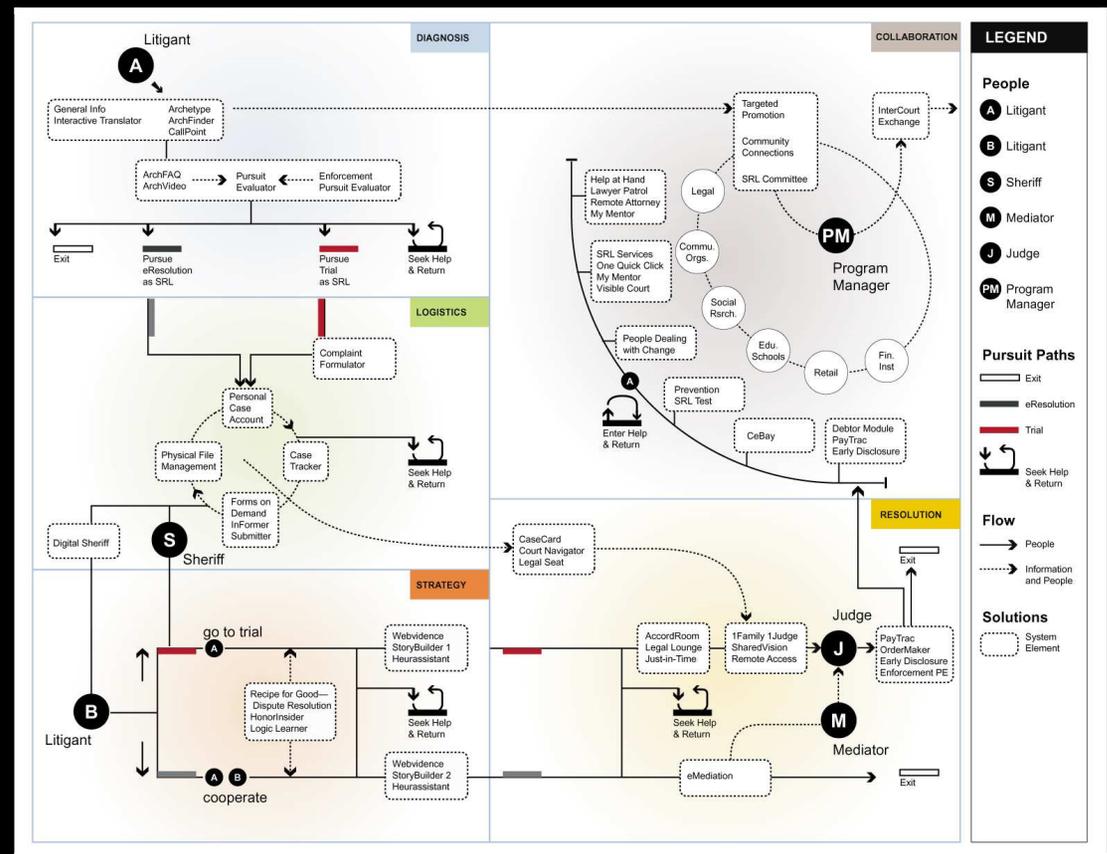
ExRo
Video camera with live feed to rescuers
Two-way voice transmission
Wings
Spider legs
Crash-resistant body
...
Flies or walks into debris impossible for human or animal access
Records situation under debris
Transmits visual information to rescuers
Transmits voice to instruct + calm victims

Governmental State Courts Information Services System

Access to Justice

- *Commissioned Project*
National Center for State Courts
- *Book*
Access to Justice. Meeting the Needs of Self-Represented Litigants

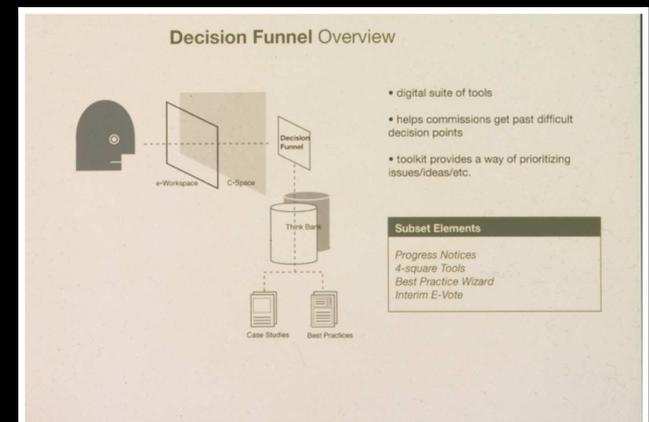
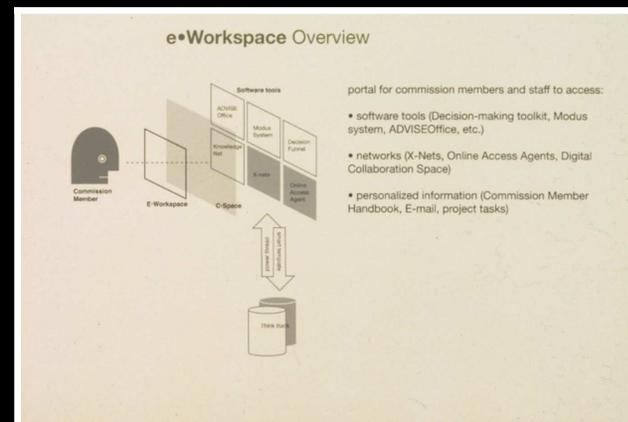
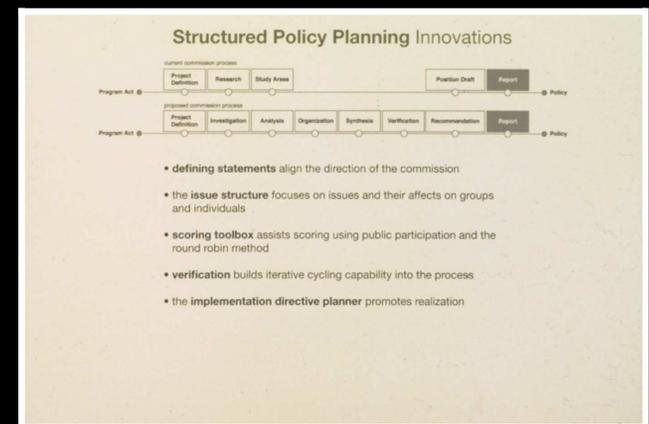
- Shared authority for direction
- Integration of disciplines



Project Governmental Advisory Recommendation Planning System

Planning for Innovation

- *Demonstration Project Governmental Commissions*



- Planning the design of a planning system

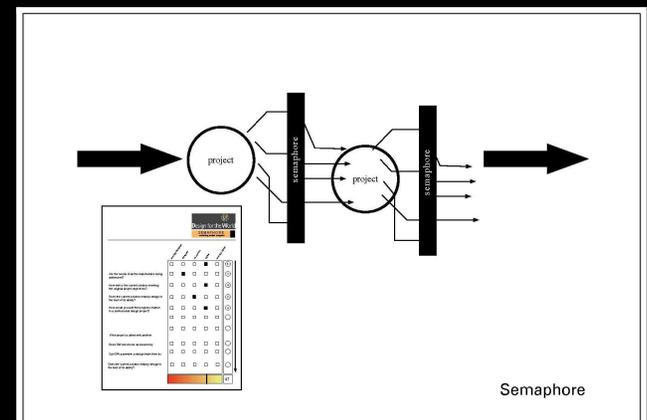
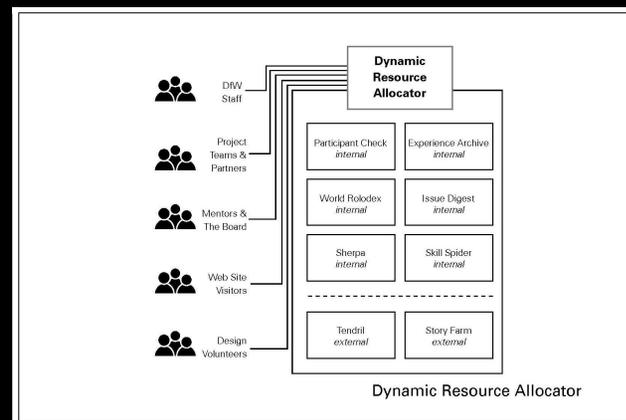
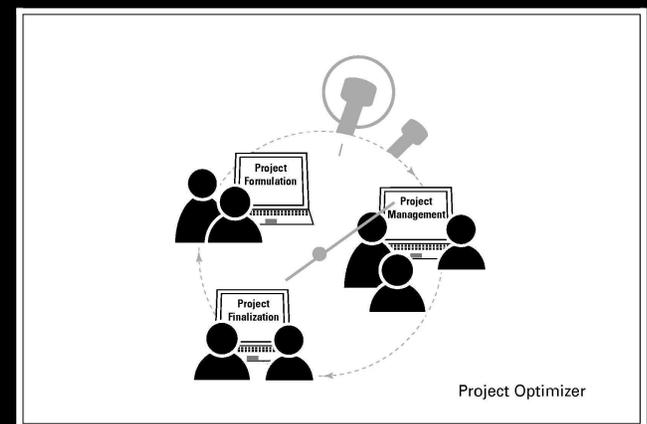
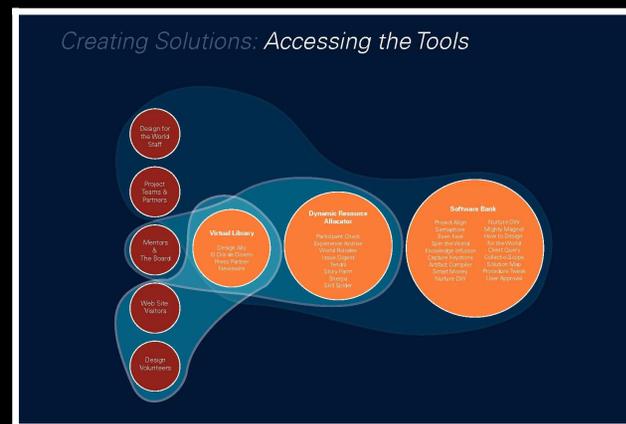
Spring 2002

NGO Institutional Process Evaluation Systems

Design for the World

- *Commissioned Project Design for the World*
- *Special Commendation ICSID Design for the World, Barcelona*

- System evaluation techniques



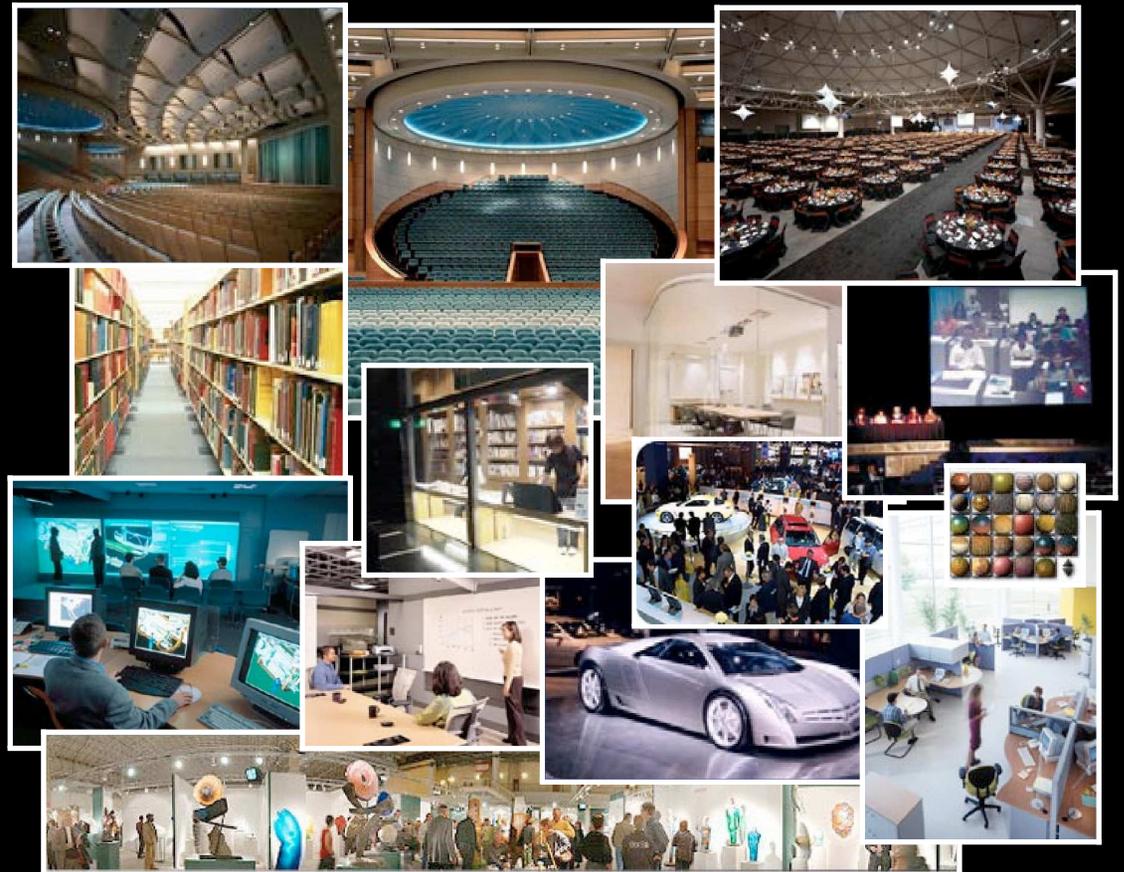
Project

Institutional

International Design Institute for Chicago

IDI/C

- *Demonstration Project*
 - IIT
 - Chicago
 - The international design community

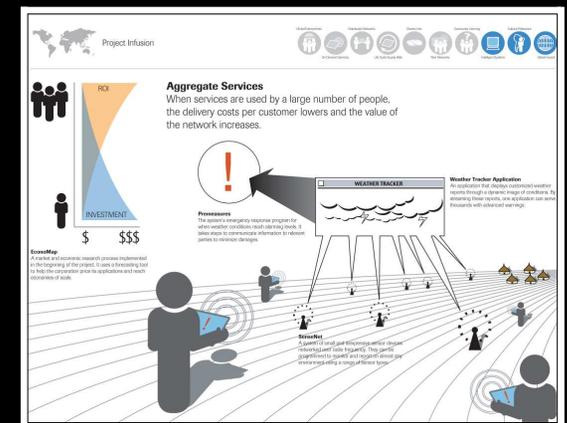
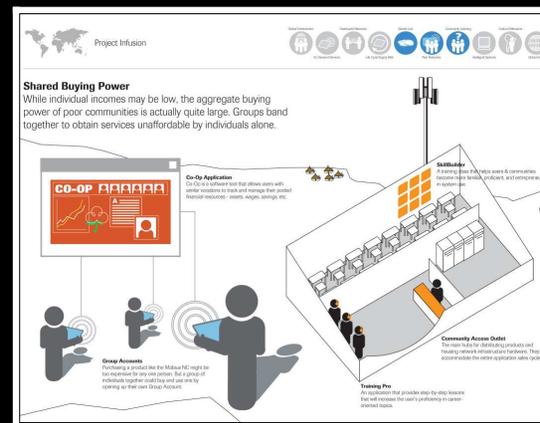
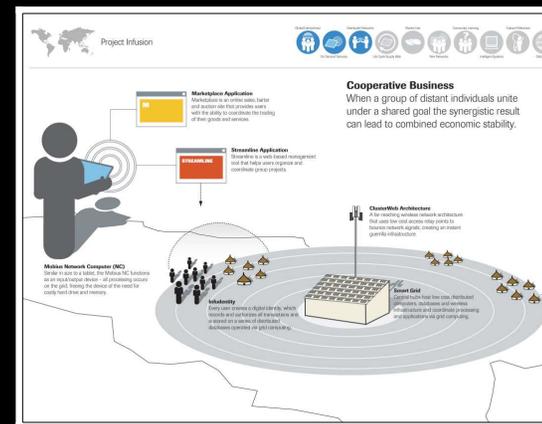


Fall 1990 / Spring 2003

Commercial Cloud Network Computing System

Project Infusion

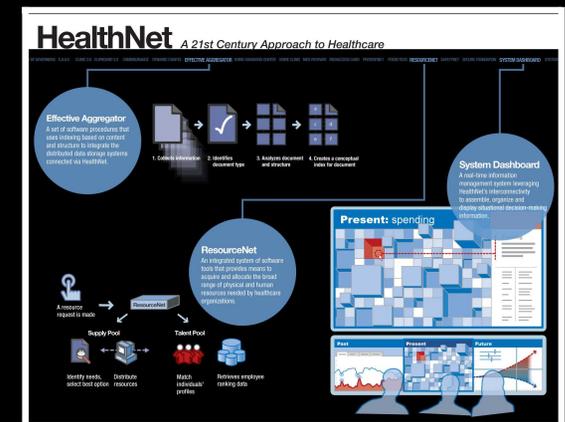
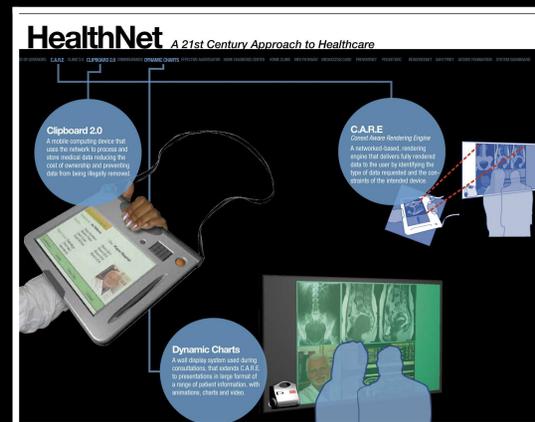
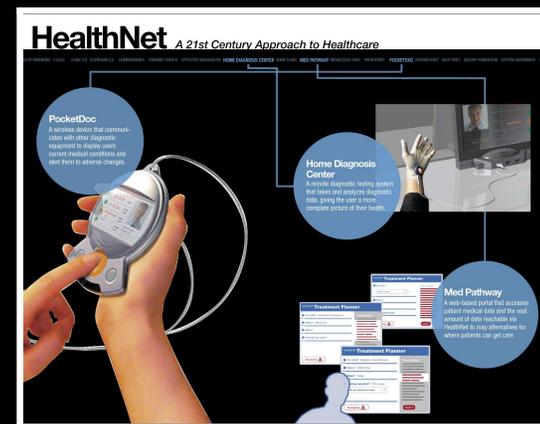
- *Finalist:* Work category
1st International
INDEX Awards
Copenhagen



Institutional National Health Care System

HealthNet

- *Finalist*: Body category
1st International
INDEX Awards
Copenhagen



Institutional International Sport Scoring System

InterPlay

- *Finalist*: Play category
1st International
INDEX Awards
Copenhagen

InterPlay
an interactive evaluation system



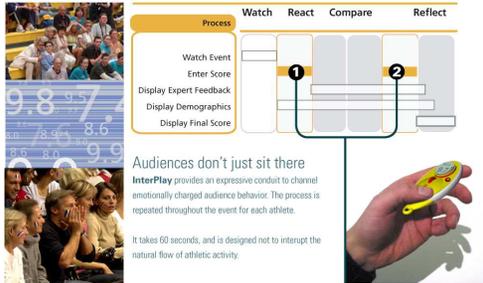
Enabling spectator participation where judging is a critical factor

In the time between viewing an event and official scoring, spectators transmit an initial score, view a composite spectator voting result, review expert commentary on freeze-frame images of the action, submit a final score, and compare the final spectator opinion with the official decision.

InterPlay
an interactive evaluation system

time (seconds) 10 20 30 40 50 60

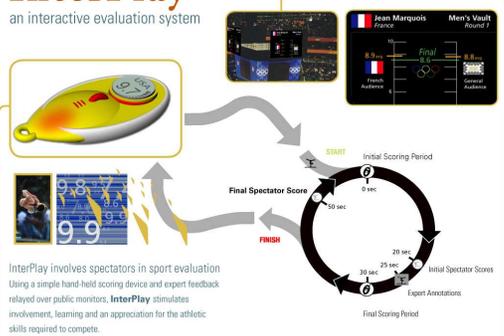
Process Watch React Compare Reflect



Audiences don't just sit there
InterPlay provides an expressive conduit to channel emotionally charged audience behavior. The process is repeated throughout the event for each athlete.

It takes 60 seconds, and is designed not to interrupt the natural flow of athletic activity.

InterPlay
an interactive evaluation system



InterPlay involves spectators in sport evaluation. Using a simple hand-held scoring device and expert feedback relayed over public monitors, **InterPlay** stimulates involvement, learning and an appreciation for the athletic skills required to compete.

Project

Commercial International Sustainable Housing System

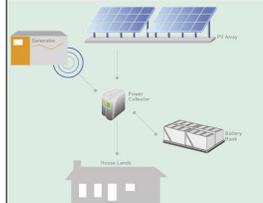
Evolutionary Housing

- *Finalist:* Home category
1st International INDEX Awards Copenhagen

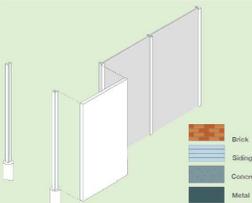
An Evolutionary Housing System
Structure and Utilities



ASM Framing
ASM Frames are individual prefabricated frame components that, when assembled, form the structure of the house. These components assemble side-by-side for single and multi-level structures.

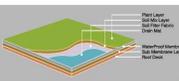


Stand-alone Photovoltaic (PV) Electricity System
This system, which uses lead-free PV modules, provides power to the house and allows excess energy to be stored for later use, used by others in the community or sold back to the power company.



CEX Exterior Surfaces
CEX is an exterior wall-panel component system that allows the user to select a individualized exterior surface for their home. Simplex Connects technology allows for easy and secure attachment.

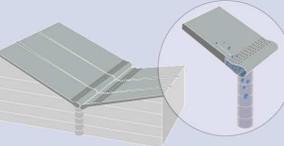
An Evolutionary Housing System
Water Systems



Green Grid Roofing System
A part of the Grid System, The Green Grid Roofing System offers a lightweight, modular design that arrives at the home planned and ready for installation. The modules, composed of recycled plastics, can be placed directly on the existing roofing membrane or any other surface, provided the structural capacity is present.

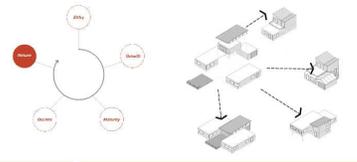


Safe Water Filter
The Safe Water Filter is part of the Pooled Cans. The filter provides a family with an ozone treated water source. It effectively kills waterborne diseases such as cryptosporidium and bacterium such as e. coli.



Fill Roofing
FillRoofing is a water collection and integrated filtration system. Filtration lines can be introduced to create various size roofs. Panels can be used for flat, gabled or lean-to styles.

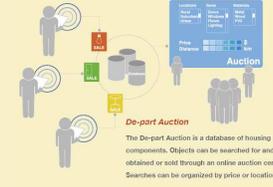
An Evolutionary Housing System
Return Phase



Return
The return phase is the point at which a house is sold or returned to market. Cores and components are reintroduced into the system to serve the needs of other home owners.



Central Control Database
The centralized database incorporates elements from national and international sources. It aggregates construction information and specific data for entities that are related to the architectural process.

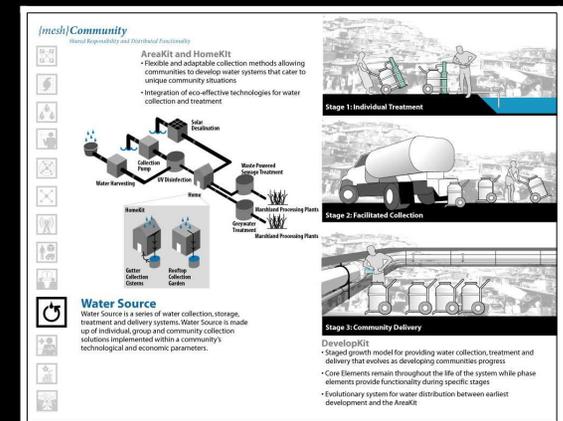
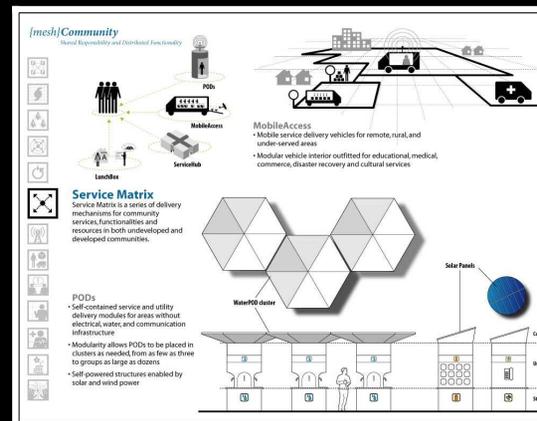
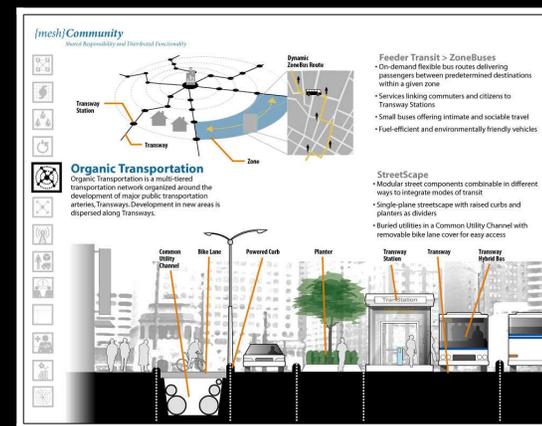


De-part Auction
The De-part Auction is a database of housing components. Objects can be searched for and obtained or sold through an online auction center. Searches can be organized by price or location.

Project Governmental / Industrial International Sustainable Community System

{Mesh}Community

- *Entry: Community category*
1st International INDEX Awards Copenhagen



Governmental

Local/State/National Policy Making Systems

Design Thinking

- *Demonstration project*
Local, State and National Governments
- *Four Projects*
**Education
Research
Campaign
Demonstration**

- Integration of design planning with policy planning



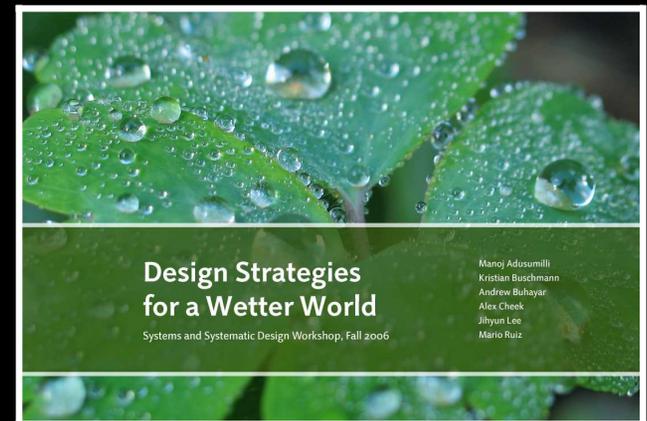
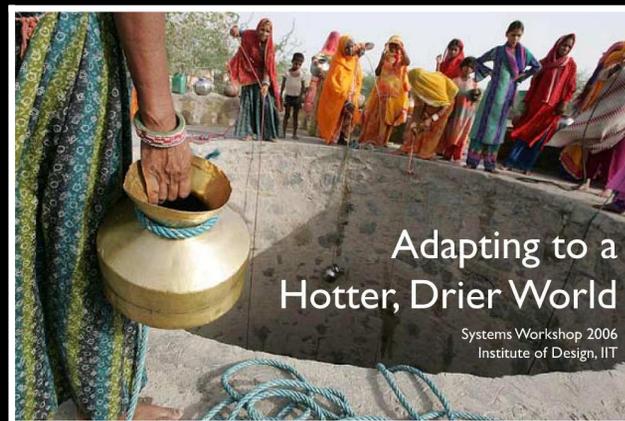
- www.id.iit.edu/552/

Fall 2005

Governmental Climate Change Adaptive Response Systems

Massive Change

- *Demonstration project*
**Chicago Planning Commission,
Department of Environment**

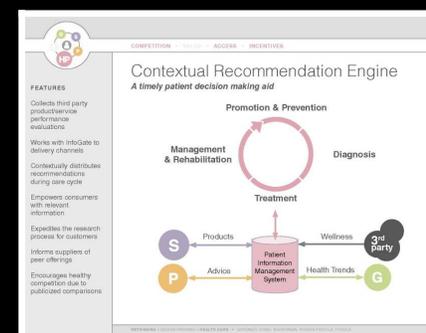
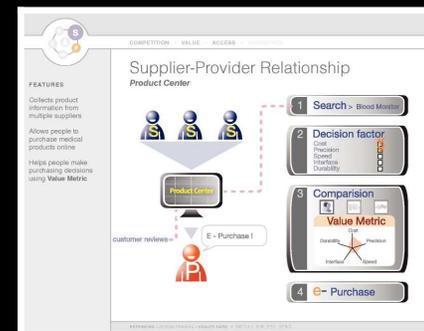
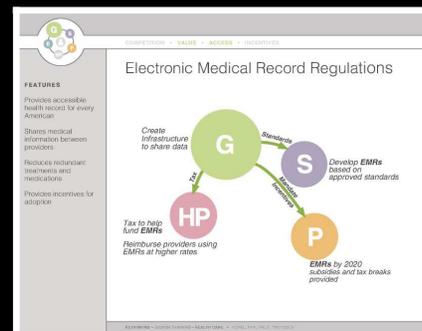


Project Governmental/Institutional/Industrial National Health Care System

Rethinking- Designthinking -Health Care

- Commissioned
Project
Robert C. Pew II

- Recommendation
2008
Presidential
Candidates



- www.id.iit.edu/824/

Fall 2007

Governmental Environmental and Infrastructural Systems

Chicago: Vision for the Future

- *Next 100 Years
Burnham Plan
Centennial*

Utility Main
Unified network of underground tunnels

CHICAGO: VISION FOR THE FUTURE
Hyperconnected Infrastructure

- Coordinates utilities into one unified path
- Enables repair with minimal disruption
- Provides alternative modular surfaces for greenways, streets or canals

Modular Surfaces
Sub-Main
Shielding Compartments

Utility Main network
Street
Canal
Greenway
Alternative modular surfaces

Intelligent Infrastructure • E Pluribus Unum • Community Development • Emergency Network 4

Hyperconnected Infrastructure

New Connected Infrastructure
Vertically Layered Thruways

CHICAGO: VISION FOR THE FUTURE
Responsive Transport

- Vertically Layered Thruways serve as major arterial corridors
- Thruway layout based on current elevated train & highway layouts
- At least 1 layer is dedicated to public and/or shared transportation
- Greenways incorporated to improve travel experience and buffer system output

Vertically Layered Thruways

New Connected Infrastructure • Evolutionary Maintenance • Optimization • Travel Experience 37

Responsive Transport

RiverWalk :: Mobi-Mods
Adaptable floating architecture for river amenities

CHICAGO: VISION FOR THE FUTURE
Featured Environment

- Mobile and modular architecture offers flexible space for cafes, restaurants, light retail, and entertainment
- Barges transport Mobi-Mods to different river locations
- Maximizes usable river space by while preserving valuable land

RiverWalk • Canals • Islands • RiverHaven 11

Featured Environment

Urban Agriculture
Vertical Farms

CHICAGO: VISION FOR THE FUTURE
Infused Nature

Greenways • ParkLife • CEAS • nature.edu • Urban Agriculture • Outside In 39

Infused Nature

Commercial Self-Sufficient Housing System

Future Living

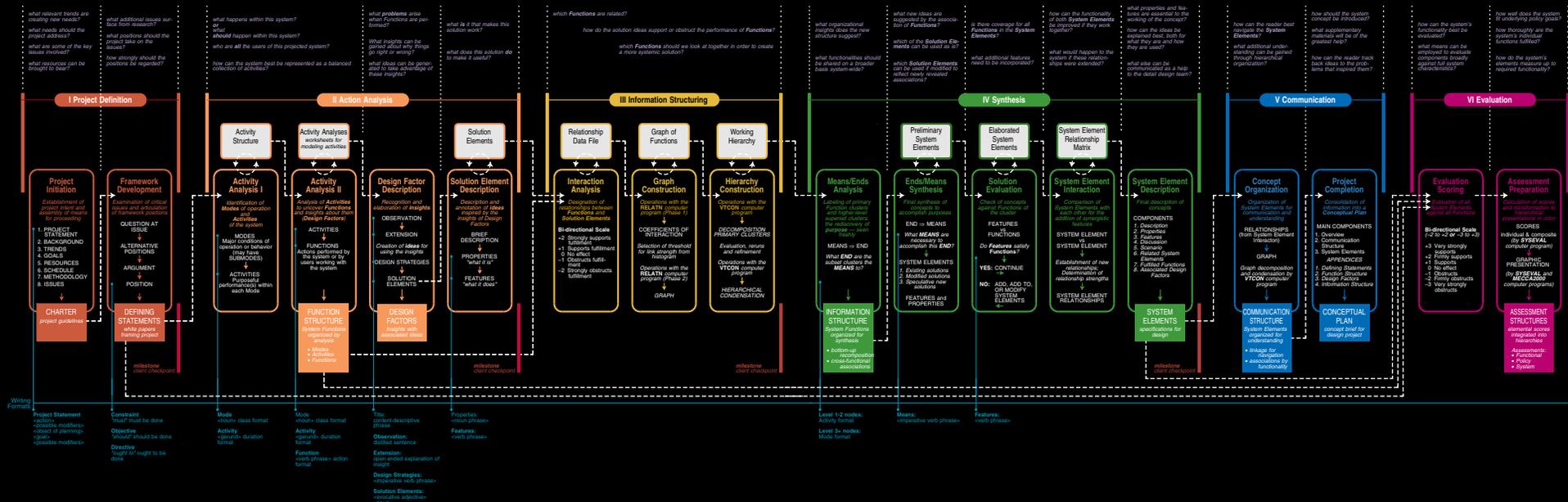
- *2010 International traveling show d3 Natural Systems "Housing Tomorrow"*
- *2010 Bronze Award International Design Excellence Awards IDSA*



Structured Planning Tools for Planning

The Structured Planning Process 2010

- tool kit
- information handling process



- **book:** Structured Planning. Advanced Planning for Business, Institutions and Government

Systems & Systematic Design

Tracing the Evolution of Design Methodology at the Institute of Design 1965 - 2010

Charles L. Owen

**Distinguished Professor
Emeritus**

www.id.iit.edu

The projects viewed here in summary are from 109 conducted in the years between 1965 and 2010. Many have full reports, and all since 2003 (including some digitized earlier reports) are in .pdf form at the Institute of Design web site.

All will become part of the IIT Archive.