

# Putting Plans to Real Use

Intelligent Systems for Planning, Execution and Collaboration



**Austin Tate**  
**IAI, University of Edinburgh**

## Planning

- Key task
- List of important and varied applications
- HTN framework as an integrator
- Wide variety of planning techniques

## Execution - USE of plans

- Examples

## Collaboration

- Plans to aid communications and collab.

## Pointer to the Future

- Web + Social Networking + Agents  
+ Plans + Virtual Worlds

# AI Planning

- Practical AI Planners
- Edinburgh Planners
  - Nonlin
  - O-Plan
  - Optimum-AIV
  - I-X/I-Plan
- Planning++

# Edinburgh AI Planners in Productive Use



<http://www.aiai.ed.ac.uk/project/plan/>

# Nonlin (1974-1977)

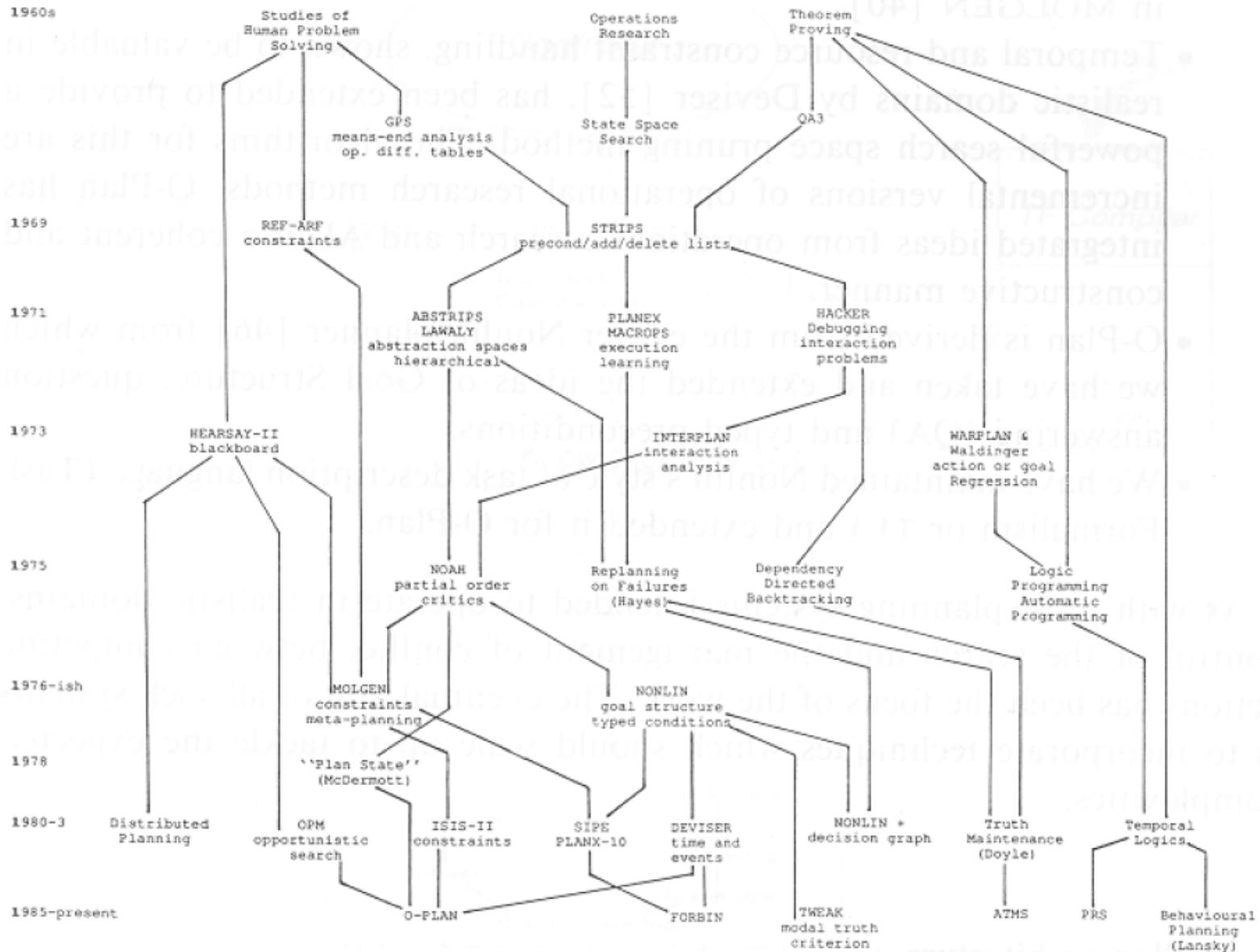
- Hierarchical Task Network Planner
- Partial Order Planner
- Plan Space Planner (vs. Application State Space)
- Goal structure-based plan development - considers alternative “approaches” based on plan rationale
- QA/“Modal Truth Criterion” Condition Achievement
- Condition “Types” to limit search
- “Compute Conditions” for links to external data and systems (attached procedures)
- Time and Resource Constraint checks
  
- Nonlin core is basis for text book descriptions of HTN Planning

# O-Plan (1983-1999) Features

- Domain knowledge elicitation and modelling tools
- Rich plan representation and use
- Hierarchical Task Network Planning
- Detailed constraint management
- Goal structure-based plan monitoring
- Dynamic issue handling
- Plan repair in low and high tempo situations
- Interfaces for users with different roles
- Management of planning and execution workflow

**Features Typical of a number of Practical AI Planning Planners**

# O-Plan (1983-1999) Lineage



# O-Plan Unix Sys Admin Aid

**Volume groups example**

This example has O-Plan produce a shell script for removing a volume group.

To remove a volume group with the `vgremove` command, it is first necessary to remove all logical volumes from the group and all but one physical volume. To remove a logical volume, it is necessary to unmount any file system on it.

The volume group in the example is named `vg0`. The logical and physical volumes in the group have names `lv1`, `lv2`, ... and `pv1`, `pv2`, ... respectively. File systems have names `fs1`, `fs2`, ..., and we assume that they are mounted on the corresponding logical volumes (`fs1` on `lv1`, `fs2` on `lv2`, and so on).

---

The volume group contains:

2 logical volumes.  
3 physical volumes.

Produce a plan to remove the volume group.  
 Undo all changes to the form.

[Jeff Dalton](#)

**VG results**

---

O-Plan version 3.3+  
Release date: 01-Aug-00  
Build date: 16-Aug-00

---

Planning statistics:

:am-cycles	= 37
:n-alts-chosen	= 2
:n-alts-remaining	= 3
:n-poisons	= 2

Script:

```
#!/bin/sh
/usr/umount fs1
/usr/sbin/lvremove -f lv1
/usr/umount fs2
/usr/sbin/lvremove -f lv2
/usr/sbin/vgreduce vg0 pv1
/usr/sbin/vgreduce vg0 pv2
# physical volume pv3 will be removed automatically
/usr/sbin/vgremove vg0
rm -r vg0
```

[The TF file](#)  
[Mail a comment](#)

# O-Plan Emergency Response Task Description, Planning and Workflow Aids

O-Plan Task Assigner - COA-2 Definition - Microsoft Internet ...

Address: <http://oplan.aiai.ed.ac.uk:40017/gpdt3/t/coa-def/2>

[Simple process editor](#) | [<1-N-OVA> process editor screen](#)

### Objectives

1	evacuate injured	Abyss
2	evacuate injured	Barnacle
3	evacuate injured	Calypso
4	repair gas leak	Barnacle
5		

### Situation

Weather	Time Limit	Road Delta Abyss	Road Abyss Barnacle	Road Barnacle Calypso	Road Calypso Delta
clear	24	open	open	open	open

Define COA 2    Undo changes to form    [Back to matrix without change](#)

### COA objectives

COA	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5
1	Evacuate injured Abyss	Evacuate injured Barnacle	Evacuate injured Calypso	Repair gas leak Barnacle	

O-Plan Task Assigner - COA Evaluation Matrix - Microsoft Inte...

Address: <http://oplan.aiai.ed.ac.uk:40017/gpdt3/t/matrix>

[Restart](#) | [Help](#) | [Map](#) | [Scenario](#) | [TF file](#) | [Server status](#) | [Select evaluations](#) | [Exit](#)

Define task:	COA-1	<a href="#">Add COA</a>
Split COA:	<a href="#">Split</a>	
Add to task:	<a href="#">Add</a>	
Set authority:	Auth	
Generate plan:	Plan	
actions in plan:	132	
levels in plan:	3	
longest path length:	113	
minimum duration:	17 hrs	
effectiveness:	77%	
Address issues:	3	
View plan:	<a href="#">View</a>	

### COA objectives

COA	Objective 1	Objective 2	Objective 3	Objective 4
1	Evacuate injured Abyss	Evacuate injured Barnacle	Evacuate injured Calypso	Repair gas leak Barnacle

### COA initial situations

COA	Weather	Time Limit	Road Delta Abyss	Road Abyss Barnacle	Road Barnacle Calypso
<a href="#">Default</a>	clear	24	open	open	open
1	clear	24	open	open	open

The default is used as

O-Plan Planner - COA Evaluation Matrix - Microsoft Internet ...

Address: <http://oplan.aiai.ed.ac.uk:40017/gpdt3/p/matrix>

[Help](#) | [Map](#) | [Scenario](#) | [TF file](#) | [Server status](#) | [Select evaluations](#) | [Logout](#) | [Reload](#)

	COA-2.1	COA-2.2	COA-2.3	COA-2.4
Advise planner:	<a href="#">Advice</a>	<a href="#">Advice</a>	<a href="#">Advice</a>	<a href="#">Advice</a>
Add constraints:	<a href="#">Add</a>	<a href="#">Add</a>	<a href="#">Add</a>	<a href="#">Add</a>
Set authority:	<a href="#">Auth</a>	<a href="#">Auth</a>	<a href="#">Auth</a>	<a href="#">Auth</a>
Generate plan:	<a href="#">Replan</a>	<a href="#">Replan</a>	<a href="#">Replan</a>	<a href="#">Replan</a>
actions in plan:	88	88	88	88
levels in plan:	3	3	3	3
longest path length:	69	57	57	41
minimum duration:	10 hrs	9 hrs	9 hrs	7 hrs
object types:	6	7	7	8
object values:	8	9	9	10
effectiveness:	89%	91%	91%	94%
Address issues:	1	1	1	1
View plan:	<a href="#">View</a>	<a href="#">View</a>	<a href="#">View</a>	<a href="#">View</a>
Select for return:	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">Yes</a>

[Return plans](#)

### COA objectives

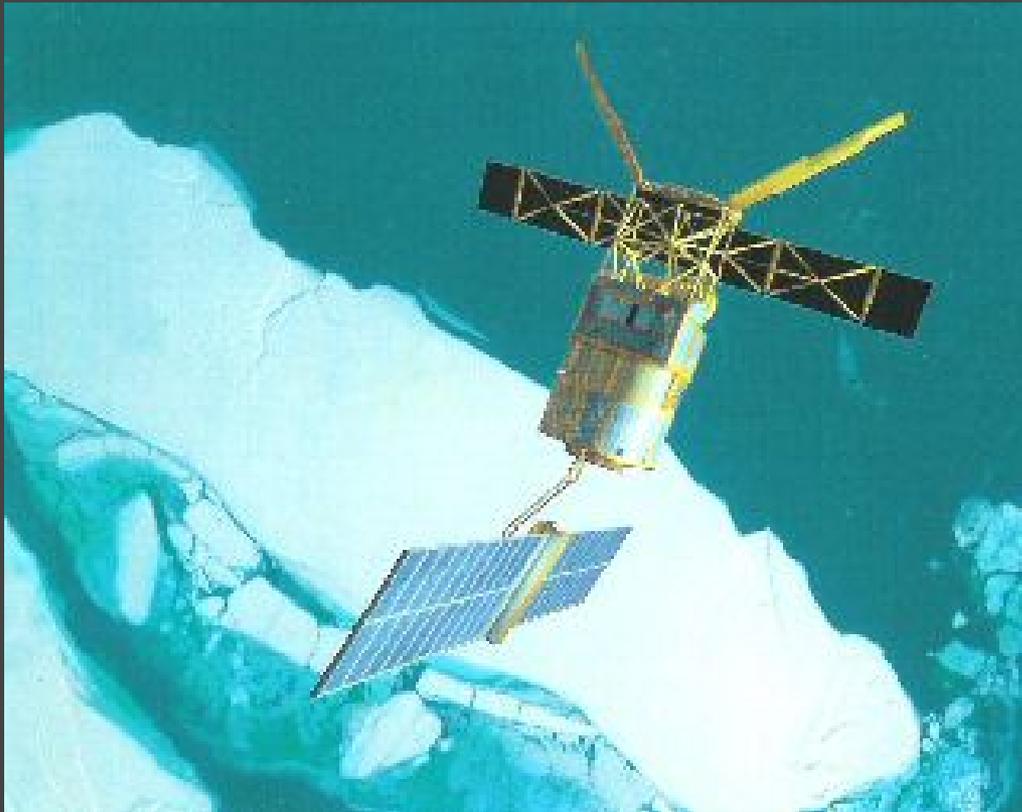
COA	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5
2.1	Send medical supplies Abyss	Evacuate injured Barnacle	Send medical supplies Calypso	Repair gas leak Barnacle	
2.2	Send medical supplies Abyss	Evacuate injured Barnacle	Send medical supplies Calypso	Repair gas leak Barnacle	
2.3	Send medical supplies Abyss	Evacuate injured Barnacle	Send medical supplies Calypso	Repair gas leak Barnacle	
2.4	Send medical supplies Abyss	Evacuate injured Barnacle	Send medical supplies Calypso	Repair gas leak Barnacle	

# Practical Applications of AI Planning – O-Plan Applications

O-Plan has been used in a variety of realistic applications:

- Noncombatant Evacuation Operations (Tate, et al., 2000b)
- Search & Rescue Coordination (Kingston et al., 1996)
- US Army Hostage Rescue (Tate et al., 2000a)
- Spacecraft Mission Planning (Drabble et al., 1997)
- Construction Planning (Currie and Tate, 1991 and others)
- Engineering Tasks (Tate, 1997)
- Biological Pathway Discovery (Khan et al., 2003)
- Unmanned Autonomous Vehicle Command and Control
  
- O-Plan's design was also used as the basis for Optimum-AIV (Arup et al., 1994), a deployed system used for assembly, integration and verification in preparation of the payload bay for flights of the European Space Agency Ariane launcher.

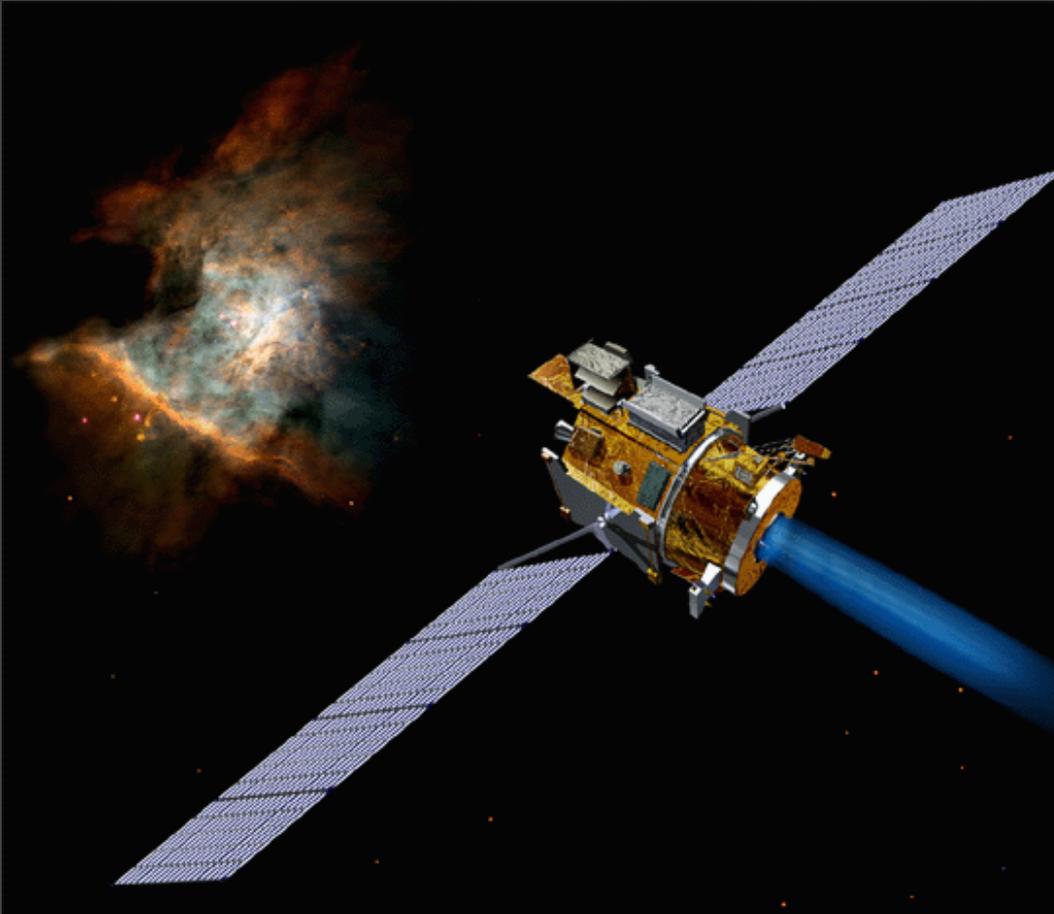
# Optimum-AIV



# Optimum-AIV (1992-4) Features

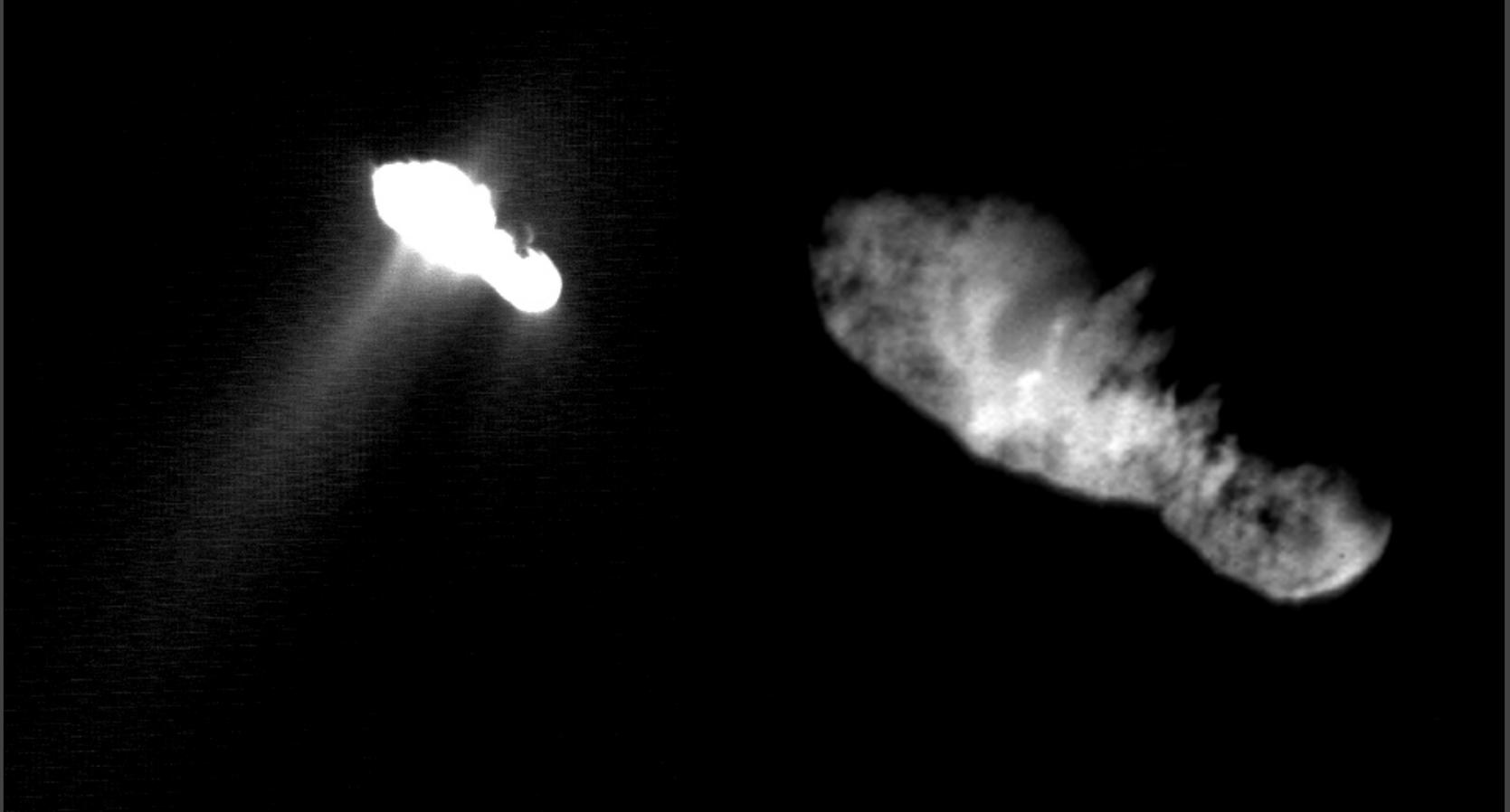
- Rich plan representation and use
- Hierarchical Task Network Planning
- Detailed constraint management
- Planner and user rationale recorded
- Dynamic issue handling
- Plan repair using test failure recovery plans
- Integration with ESA's Artemis Project Management System
- 
- Next: NASA use of AI planning and execution...  
To boldly go....

# Deep Space 1 – 1998-2001



<http://nmp.jpl.nasa.gov/ds1/>

# DS 1 – Comet Borrelly



<http://nmp.jpl.nasa.gov/ds1/>

# DS1 Remote Agent Approach

- **Constraint-based planning and scheduling**
  - supports goal achievement, resource constraints, deadlines, concurrency
- **Robust multi-threaded execution**
  - supports reliability, concurrency, deadlines
- **Model-based fault diagnosis and reconfiguration**
  - supports limited observability, reliability, concurrency
- **Real-time control and monitoring**

# Common Themes in Practical Applications of AI Planning

- Outer “human-relatable” approach (e.g. HTN)
- Underlying rich time and resource constraint handling
- Integration with plan execution
- Model-based simulation and monitoring
- Rich knowledge modelling languages and interfaces



# Planning Research Areas & Techniques

- |                              |                          |                          |                |
|------------------------------|--------------------------|--------------------------|----------------|
| – Domain Modelling           | HTN, SIPE                | – Plan Repair            | O-Plan         |
| – Domain Description         | PDDL, NIST PSL           | – Re-planning            | O-Plan         |
| – Domain Analysis            | TIMS                     | – Plan Monitoring        | O-Plan, IPEM   |
| – Search Methods             | Heuristics, A*           | – Plan Generation        | Macrops, EBL   |
| – Graph Planning Alghms      | GraphPlan                | – Case-based Planning    | CHEF, PRODIGY  |
| – Partial-Order Planning     | Nonlin, UCPOP            | – Plan Learning          | SOAR, PRODIGY  |
| – Hierarchical Planning      | NOAH, Nonlin, O-Plan     | – User Interfaces        | SIPE, O-Plan   |
| – Refinement Planning        | Kambhampati              | – Plan Advice            | SRI/Myers      |
| – Opportunistic Search       | OPM                      | – Mixed-Initiative Plans | TRIPS/TRAINS   |
| – Constraint Satisfaction    | CSP, CP, MMS             | – Planning Web Services  | O-Plan, SHOP2  |
| – Optimisation Methods       | Meta-CA, Ant Colony Opt. | – Plan Sharing & Comms   | I-X, <I-N-C-A> |
| – Issue/Flaw Handling        | O-Plan                   | – NL Generation          | ...            |
| – Plan Analysis              | NOAH, Critics            | – Dialogue Management    | ...            |
| – Plan Simulation            | CinetiQ                  |                          |                |
| – Plan Qualitative Modelling | Excalibur                |                          |                |

**Problem is to make sense of all these techniques**

**Deals with whole life cycle of plans**

# A More Collaborative Planning Framework

- **Human relatable and presentable objectives, issues, sense-making, advice, multiple options, argumentation, discussions and outline plans for higher levels**
- **Detailed planners, search engines, constraint solvers, analyzers and simulators act in this framework in an understandable way to provide feasibility checks, detailed constraints and guidance**
- **Sharing of processes and information about process products between humans and systems**
- **Current status, context and environment sensitivity**
- **Links between informal/unstructured planning, more structured planning and methods for optimisation**

# I-X/I-Plan (2000- )

- **Shared, intelligible, easily communicated and extendible conceptual model for objectives, processes, standard operating procedures and plans:**
  - I            **Issues**
  - N            **Nodes/Activities**
  - C            **Constraints**
  - A            **Annotations**
- **Communication of dynamic status and presence for agents, and reports about their collaborative processes and process products**
- **Context sensitive presentation of options for action**
- **Intelligent activity planning, execution, monitoring, re-planning and plan repair via I-Plan and I-P<sup>2</sup> (I-X Process Panels)**

# <I-N-C-A> Framework

- **Common conceptual basis for sharing information on processes and process products**
- **Shared, intelligible to humans and machines, easily communicated, formal or informal and extendible**
- **Set of restrictions on things of interest:**
  - **I**            **Issues**            e.g. what to do? How to do it?
  - **N**            **Nodes**            e.g. include activities or product parts
  - **C**            **Constraints**       e.g. state, time, spatial, resource, ...
  - **A**            **Annotations**      e.g. rationale, provenance, reports, ...
- **Shared collaborative processes to manipulate these:**
  - **Issue-based sense-making (e.g. gIBIS, 7 issue types)**
  - **Activity Planning and Execution (e.g. mixed-initiative planning)**
  - **Constraint Satisfaction (e.g. AI and OR methods, simulation)**
  - **Note making, rationale capture, logging, reporting, etc.**
- **Maintain state of current status, models and knowledge**
- **I-X Process Panels (I-P<sup>2</sup>) use representation and reasoning together with state to present current, context sensitive, options for action**

**Mixed-initiative collaboration model of “mutually constraining things”**

# I-P<sup>2</sup> aim is a Planning, Workflow and Task Messaging “Catch All”

- Can take ANY requirement to:
  - Handle an issue
  - Perform an activity
  - Respect a constraint
  - Note an annotation
- Deals with these via:
  - Manual activity
  - Internal capabilities
  - External capabilities
  - Reroute or delegate to other panels or agents
  - Plan and execute a composite of these capabilities (I-Plan)
- Receives reports and interprets them to:
  - Understand current status of issues, activities and constraints
  - Understand current world state, especially status of process products
  - Help user control the situation
- Copes with partial knowledge of processes and organisations

# I-X Process Panel and Tools

## Process Panel

### Domain Editor

The Domain Editor window displays a task flow diagram for the process 'rescue-1-team-sof-support-sof-recovery'. The diagram consists of several nodes connected by arrows, representing a sequence of tasks. The nodes are:

- 1: report ?ip
- 2: locate ?ip
- 3: allocate-one-sof-oda ?sof (support and recover ?ip)
- 4: move-from-base ?sof ?ip
- 5: support ?sof ?ip
- 6: recover ?sof ?ip
- 7: return ?ip

The left sidebar shows a list of available activities, including 'provide-communication', 'provide-food', 'provide-medical-advice', 'provide-medical-team', 'provide-medical-supplies', 'provide-sof-support', 'recover-by-civilian-fixed-wing', 'recover-by-civilian-heli', 'recover-by-civilian-means', 'recover-by-civilian-trucks', 'recover-by-covert-means', 'recover-by-grey-force', 'recover-by-negotiation', 'recover-by-sof', 'recover-by-sof-heli', 'recover-covertly-with-civ-trucks', and 'rescue-1-team-sof-support-sof-recovery'.

### Map Tool

The Map Tool window displays a topographic map of a region, likely in the Fouts Springs area. The map shows terrain contours, roads, and various locations. Key locations marked on the map include 'LZ-N-Brutan-Ranch', 'Brutan-Ranch', 'Incident Command Post', and 'Conspirators-Team-1'. The map tool includes a toolbar with various navigation and analysis tools, and a status bar at the bottom showing coordinates (1,62,500 Lat Lon Point [lat=39,43336,lon=-122,5804]).

Annotations	Priority
Mission Analysis:	▼ Normal
	▼ Normal
	▼ Normal
	▼ Normal

Annotations	Priority
	▼ Normal
	▼ Low
	▼ Normal
	▼ High
	▼ Normal
	▼ Normal
	▼ Normal
	▼ Highest
	▼ Normal
	▼ No Action
	▼ No Action
	▼ No Action

- Expand using locate-using-satellite-intelligence
- Expand using locate-using-human-intelligence
- Send to Compendium as a node

The Joint Personnel Recovery Center Messenger window displays a transcript of a message. The message content is:

Assisting Military Planner with operational approach to use a single SOF ODA to land at Fouts Spring.  
 JPRC at 22-Nov-04 12:03:52:  
 Assisting Military Planner with operational approach to use a single SOF ODA to land at Fouts Spring.

The window also includes a 'Compose Message' section with radio buttons for 'Issue', 'Activity', 'Constraint', 'Report', and 'Message', and priority options: 'Highest Priority', 'High Priority', 'Normal Priority', 'Low Priority', and 'Lowest Priority'. There are also fields for 'Report Back - Ref', 'Report Type', and 'Recipient'.

### Messenger

### I-Plan

The JPRC I-X I-Plan Tool window displays planning statistics for the mission 'SOF-Entry-Via-Fouts-Springs-2.2.2'. The statistics are:

- Steps taken = 25
- Alternatives posted = 24
- Alternatives picked = 5
- Alternatives remaining = 25
- Number of nodes = 7
- Longest node-end path length = 11

The window includes buttons for 'Plan', 'Replan', and 'Check Plan'.

# I-X for Emergency Response

**Joint Personnel Recovery Center**

File New Options Tools Help Test

COA-1

**Issues**

Description	Annotations	Priority	Action
Can we use local tran...		Normal	No Action

**Activities**

Description	Annotations	Priority	Action
report UNESCO-Team		High	No Action
locate UNESCO-Team		High	No Action
support UNESCO-Team		High	No Action
transport [1:?of-team] [2:?origin] [3:?desti...	Allow use ...	High	No Action
perform-support-ops [1:?of-team]		High	No Action

**State**

Pattern: maxSpeed ORMarineHelicop  
 Type: ORMarineHelicop  
 Location: SOF-Team-A

**Annotations**

Key: "plan-name"

**Joint Personnel Recovery Center I-Plan Tool**

File

COA-1

Planning statistics:  
 Steps taken = 100  
 Alternatives posted = 36  
 Alternatives picked = 22  
 Alternatives remaining = 14  
 Number of nodes = 21  
 Longest node-end path length = 31

Plan Replan Check Plan



Central Authorities

Activity High Priority  
 Constraint Normal Priority  
 Report Low Priority  
 Message Lowest Priority

Report Type: Information  
 Recipient: me

Send

UNITED NATIONS SECRETARY-GENERAL The Office

Collaboration and Communication

Command Centre

Archeological Team (IP) Messenger

Archeological Team (IP)

File Options Tools Help Test

COA-1

**Issues**

Description	Annotations	Priority	Action
use local tran...		Normal	No Action

**Activities**

Description	Annotations	Priority	Action
report UNESCO-Tea...		High	No Action
locate UNESCO-Tea...		High	No Action
support UNESCO-Tea...		High	No Action

**State**

Pattern	Value
latitude_CA_Coastguard_Cutter	38.82488
longitude_CA_Coastguard_Cutter	-123.82172
maxspeed_CA_Coastguard_Cutter	25knots
type_CA_Coastguard_Cutter	cutter
latitude_Fort_Bragg	0

**Annotations**

Key	Value
"plan-name"	"COA-1.1"

IP Process Panel  
 Based on I-X Technology



Emergency Response

IntelObservers/Sensors

File New Options Tools Help Test

COA-1

**Issues**

Description	Annotations	Priority	Action
Should we add a diversion?		Low	No Action

**Activities**

Description	Annotations	Priority	Action
CO-Tea...		High	No Action
SCO-Tea...		High	No Action
SCO-Tea...		High	No Action
ESCO...		High	No Action

**State**

Pattern	Value
isbello_EI	not-available
isbello_EI	available

**Map Tool**

Map showing locations: TMarineHelicopter, USMC, CA\_Coastguard\_Cutter, etc.

Intel  
 I-X Process Panel  
 Based on I-X Technology

Isolated Personnel



# Requirements for Effective Distributed Task-centric Collaboration

- **Mix of physical operations centres and remote access**
- **Bring in experts for improved analysis and option generation**
- **Share community knowledge and experience**
- **Share Standard Operating Procedures and Lessons Learned**

**Communication, Collaboration and Task & Process Centric Activities**

# I-Room: a Virtual Space for Intelligent Interaction

Operations Centres, Brainstorming Spaces, Team Meeting Rooms, Training and Review Areas



# I-Room Introduction

- I-Room provides a 3D virtual space with multiple work zones, designed for collaborative and brain storming style meetings
- I-Rooms are used in the I-X research on intelligent collaborative and task support environments
- The main feature of the I-Room is the link up with external web services, collaboration systems and intelligent systems aids

# I-Room Applications

- **Virtual collaboration centre**
- **Business teleconferencing**
- **Team Meetings for project and product reviews**
- **Product Help Desks**
- **Design to Product - product lifecycle support**
- **Environment, building and plant monitoring**
- **Health and safety at work, disability awareness**
- **Intelligent tutors, guides and greeters**
- **Active demonstration pavilions**

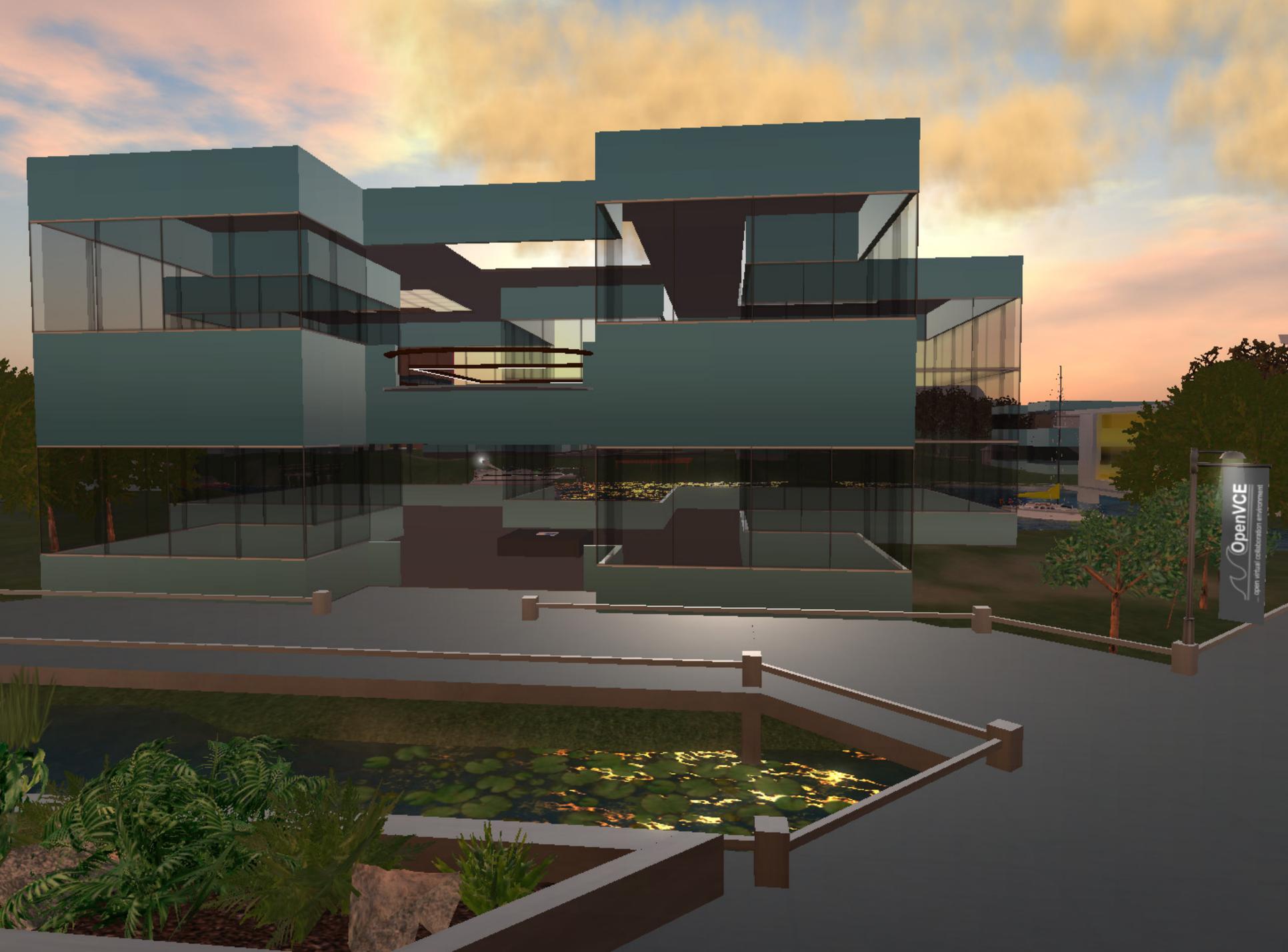
# I-Room Integration

- The I-Room 3D virtual space is linked to a social networking and community knowledge management web portal in OpenVCE.net
- Recent experimental use of the I-Room and OpenVCE for the "Whole of Society Crises Response" (WoSCR) community in the conduct of emergency response and crisis management
- This is intended as a contribution to the wider notions of "The Helpful Environment"

# I-Room: Mixed-initiative Collaboration

Truly distributed mixed initiative collaboration and task support is the focus of the I-Room, allowing for the following tasks:

- situation monitoring
- sense-making
- analysis and simulation
- planning
- option analysis
- briefing
- decision making
- responsive enactment



Planning, Evaluation  
Option Argumentation

Briefing and  
Decision Making

Central  
Meeting  
Area

Sensing and  
Situation Analysis

Acting, Reacting  
and Communication

# Project to provide a Virtual Collaboration Environment for the WoSCR Community

- Whole of Society Crisis Response Community
- Cognitive Work Analysis of Requirements and Technologies
- Virtual Collaboration Environment:
  - Web-based portal
  - Virtual interaction space
  - Community tools including I-Room
  - Collaboration protocol
- USJFCOM, US ARL HRED, CMU, U.Virginia, U.Edinburgh, Perigean Technologies

# Open Virtual Collaboration Environment

- **Web-based Collaboration Portal**

- Drupal CMS
- Also explored Facebook, Google Groups, Yahoo Groups, Ning Groups, Grou.ps, Joomla CMS, Moodle VLE
- Linkups to external web services and gadgets

- **Virtual World 3D Space**

- Second Life
- Opensim (potentially behind a firewall)

- **Virtual Collaboration Protocol**

- Standard Operating Procedures
- FAQ and Tips
- Protocol (Rob Cross, University of Virginia)

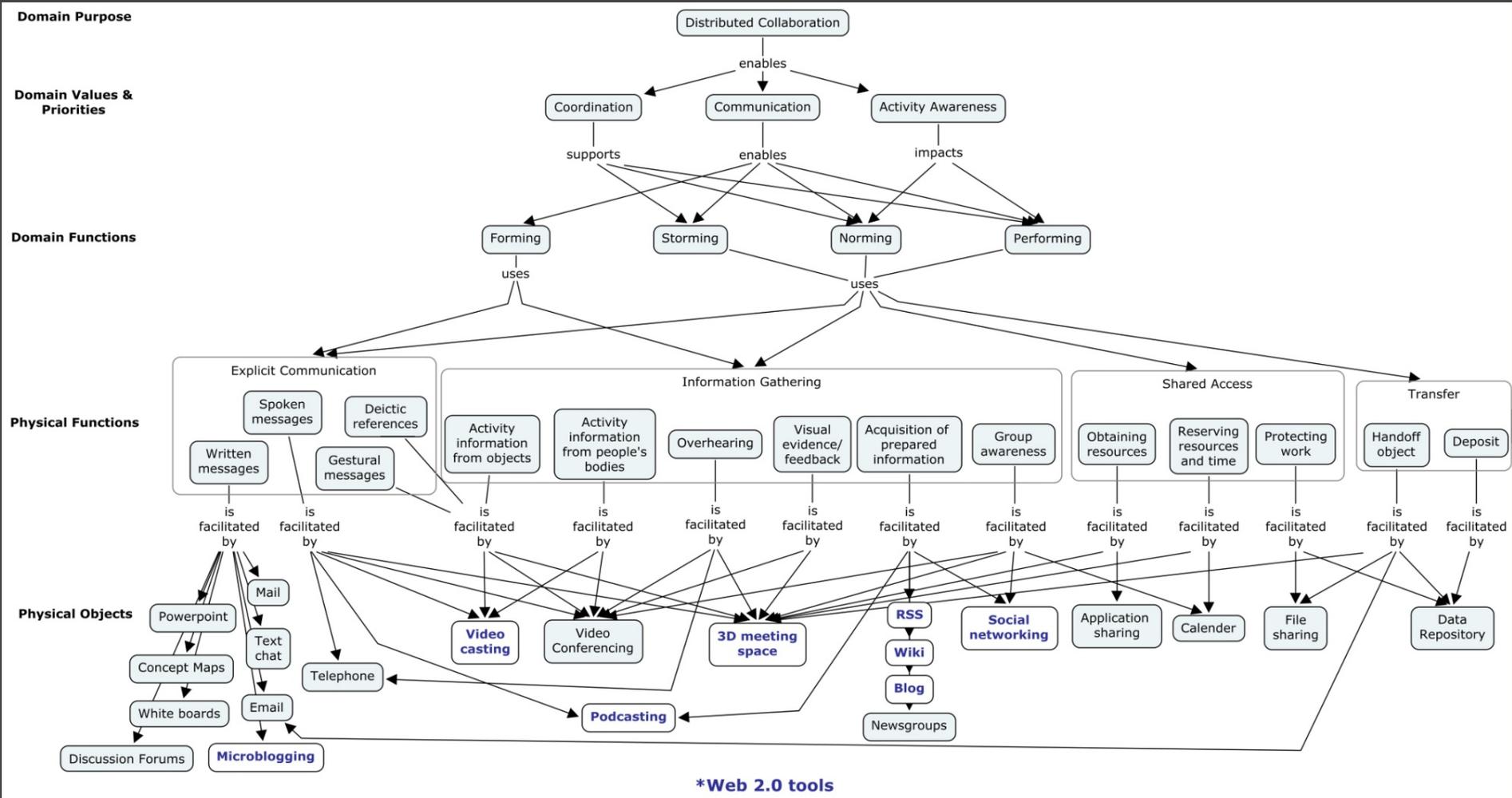
- **Community Tools**

- AIAI I-Room – a Room for Intelligent Interaction
- CMU Catalyst Community Knowledge base
- Concept Maps, and Experimental 3D Model Visualizations

# WoSCR

- Whole of Society Crisis Response Community
- The Whole of Society Crises Response (WoSCR) community takes a "whole of society" approach to complex problems seeking to input PMESII factors into the analysis and decision support when a crisis occurs. It seeks a global comprehensive approach to crises response
- PMESII stands for the "Political, Military, Economic, Social, Infrastructure, and Information" considerations involved in crisis and emergency response

# Cognitive Work Analysis



## Austin Tate

- Home
- Messages
- ▷ Blogs
- Forums
- Wiki
- ▷ Events
- ▷ Files
- Images
- Videos
- ▷ More content
- ▷ Create content
- FAQ
- Links
- My profile
- Log out

## 3D space

**teleport now**

Access: Chat, Wave, HW, QT  
[Setup/Help, Register avatar]  
[Terminals, Presenter, Blogger]

## Event calendar

April						
S	M	T	W	T	F	S
					1	2
					3	
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	



Welcome to the OpenVCE community portal. All content is community-created, so become a registered user and start contributing!

## Forthcoming events

Federal Consortium for Virtual Worlds Conference 2010	2 weeks 5 days from now	contact: Austin Tate
WoSCR Community - Possible Virtual Iterative Workshop Series - VIWS-4	5 weeks 2 days from now	contact: Austin Tate

## Current discussions



OpenVCE envisioned site structure started by Jeff Hansberger, last reply by Austin Tate 28 weeks ago



The weakest link started by ac, last reply by erapisardi 4 weeks ago



Expt Case 0 H1N1 Forum started by Austin Tate, last reply by Jeff Hansberger 18 weeks ago

[more](#)

## What are you doing?

Austin Tate Meeting Ken Anderson of Project EPIC - see <http://sn.im/tweakt> max 140 characters



Austin Tate Meeting Ken Anderson of Project EPIC - see <http://sn.im/tweakt> 1 day ago [Edit](#) [Delete](#)



Austin Tate Writing paper on OpenVCE support to WoSCR for KSCO-2010 <http://ksco.info/ksco-2010.html> 2 days ago [Edit](#) [Delete](#)



lfuentes Preparing a presentation to the Virginia Local Government IT Executives (VALGITE) for Apr 26 on VOICCE 3 days ago

Search this site:

Search the Wiki:

**I-Room**  
Concept Maps Second Life  
QOC Shared Media I-  
Zone QOCTale Lounge

## Who's online

There are currently 1 user and 6 guests online.



Austin Tate

## Latest wiki updates

PMESII-Tools 3 weeks 6 days ago

PMESII-Tools 3 weeks 6 days ago

PMESII-Tools 4 weeks 1 day ago

VOICCE 6 weeks 2 days ago

Main Page 6 weeks 3 days ago

[more](#)

## What's happening



lfuentes has updated group VOICCE Group 14 hours ago



lfuentes has updated VOICCE Resources and VOICCE 14 hours ago



Austin Tate has updated I-Zone and I-Room - A Virtual Space for





# Helpful Environment

The Future of AI

## The "Helpful Environment": Geographically Dispersed Intelligent Agents That Collaborate

Austin Tate, Artificial Intelligence Applications Institute, University of Edinburgh

**A**I's first 50 years have given us powerful techniques and tools, some which have found significant and valuable application. AI technology helps many people on a regular basis, both directly and indirectly, through the goods they use, through the services they receive, and in the course of their work. The promise of ubiquitous computing,

*A future network of sophisticated sensors, protection, and repair systems could be integral to clothing, communications devices, transportation systems, buildings, and the environment.*

*These would form the basis for a distributed, adaptable, and resilient "helpful environment."*

sensor grids, home robots, and Web services is an exciting new driver for AI that should see its reach extend still further into our everyday lives. AI's role in underpinning much of the emerging Semantic Web is one example already showing widely we'll use the methods in the future.

Imagine an environment where sophisticated sensors and microsystems or sensor networks diagnose, protect, and repair systems are integral to clothing, communications devices, vehicles, transportation systems, buildings, and the environment. These would form the basis for a distributed, adaptable, and resilient "safety net" for every individual and organization at personal, family, business, regional, national, and international levels. In natural-disaster-prone areas, government legislation, building codes, and insurance requirements would ensure that all future PDAs, communication devices, vehicles, and buildings include appropriate sensor and actuator systems to assist both their users and others nearby. Systems would adapt and respond to emergencies whether or not communication were possible. Where feasible, local help would be used, with appropriate call on shared services facilities, when this is both possible and necessary. Through this framework, requests for assistance could be validated and then made available and appropriate services in a highly distributed market fashion. Services would be provided to individuals or communities through this network to add value and give all users of assistance beyond the emergency response aspects. In

emergency situations, the local infrastructure would be exponentially the facilities of the responder teams at any level from local police, ambulance, and fire response. Also the way to an automated response. An emergency zone's own infrastructure could be augmented on demand by bringing down temporary sensor grids and placing specialized devices and robotic responders into the disaster area.

### Emergency response challenges

The United Nations Office for the Coordination of Humanitarian Affairs (<http://ochaonline.org>) is one of the international bodies that are charged with assisting in international crises. OCHA's primary functions are to:

- develop common strategies for response,
- assess situations and needs,
- convene coordination forums,
- mobilize resources,
- address common problems, and
- administer coordination mechanisms.

These challenges face any group or organization that intends to help in a crisis.

Local or regional governments are often responsible for the event handling, planning, coordination, and issue reporting throughout emergency response. They must harness local response capabilities to augment their own by calling on other resources. Figure 1 shows the Tokyo Metropolitan Government's emer-

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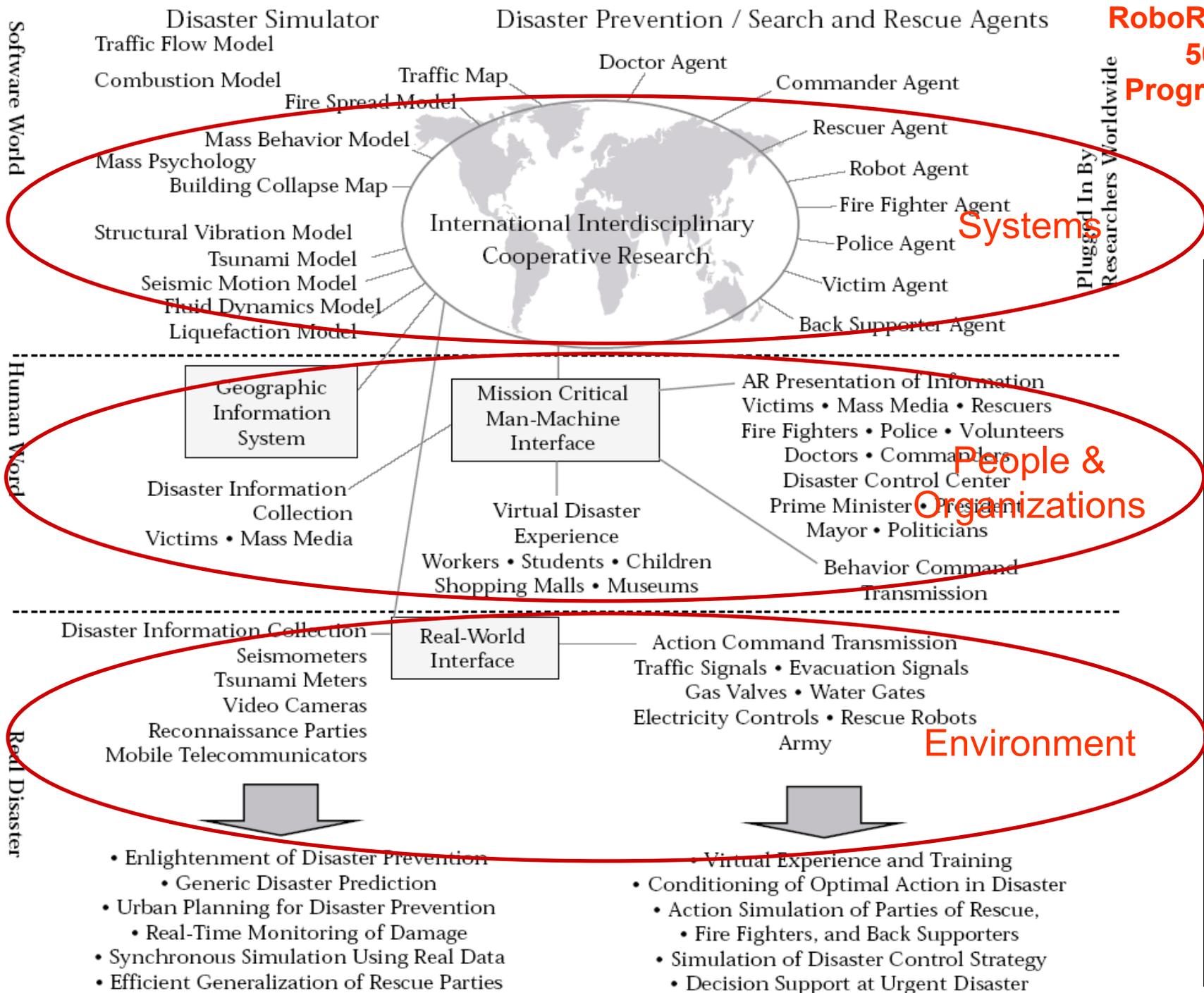
57

The creation and use of task-centric virtual organizations involving people, government and non-governmental organizations, automated systems, grid and web services working alongside intelligent robotic, vehicle, building and environmental systems to respond to very dynamic events on scales from local to global.

- Multi-level emergency response and aid systems
- Personal, vehicle, home, organization, district, regional, national, international
- Backbone for progressively more comprehensive aid and emergency response
- Also used for aid-orientated commercial services
- Robust, secure, resilient, distributed system of systems
- Advanced knowledge and collaboration technologies
- Low cost, pervasive sensor grids, computing and communications
- Changes in codes, regulations, training and practices

Tate, A. (2006) The Helpful Environment: Geographically Dispersed Intelligent Agents That Collaborate, Special Issue On "The Future of AI", IEEE Intelligent Systems, May-June 2006, Vol. 27, No. 3, pp 57-61. IEEE Computer Society.

# RoboRescue 50 Year Programme



Adapted from H. Kitano and S. Tadokoro, RoboCup Rescue A Grand Challenge for Multiagent and Intelligent Systems, AI Magazine, Spring, 2001.

# Helpful Environment Related Projects

- CoAKTinG (Collaborative Advanced Knowledge Technologies in the Grid) – also I-Rescue (Kobe Earthquake), AKT e-Response (Oil Spill & Plane Crash) and EU OpenKnowledge e-Response
  - Linking issue handling, argumentation, process support, instance messaging and agent presence notification
  - Range of natural, industrial and other emergency scenarios
- CoSAR-TS (Coalition Search and Rescue – Task Support)
  - Use of OWL ontologies and OWL-S described services to describe components
- Co-OPR (Collaborative Operations for Personnel Recovery)
  - Use of OWL ontologies and OWL-S described services to describe components. Policy driven agent communication
- FireGrid
  - to establish a cross-disciplinary collaborative community to pursue fundamental research for developing faster than real time emergency response systems using the “Grid”
- e-Response
  - Creation and use of task-centric virtual organizations to respond to highly dynamic events on scales from local to global
  - Flood, metropolitan emergency and industrial accident scenarios
- OpenVCE.net
  - Open Virtual Collaboration Environment mixes web 2.0, social network, structured wiki and 3D virtual world meeting spaces
  - Support for Helpful Organizations such as WoSCR, KSCO, MPAT



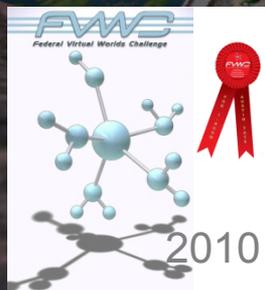
# I-X – Intelligent Systems Technology

## OpenVCE – Virtual Collaboration Environment

### I-Room – a Virtual Space for Intelligent Interaction

#### The Helpful Environment

**Social Web + Agents + Plans + Virtual Worlds**



<http://i-x.info>

<http://openvce.net>

<http://openvce.net/i-room>

<http://openvce.net/helpful-environment>