

Supporting Collaborative Operations within a Coalition Personnel Recovery Center

Gerhard Wickler¹, Austin Tate¹ and
Jeffrey Hansberger²

¹ AIAI, University of Edinburgh, UK

{g.wickler, a.tate}@ed.ac.uk

² USJFCOM/J9, Norfolk, VA, USA

Jeff.Hansberger@je.jfcom.mil



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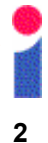
Overview



- **The I-X Framework:**
 - The <I-N-C-A> Ontology and I-X Process Panels.
 - Intelligence through Hierarchical Task Refinement.
 - Other I-X Tools.
- **The Co-OPR Application:**
 - Personnel Recovery: Organization and Roles.
 - Personnel Recovery Centers: Layout and Tools.
 - Customizing I-X for Personnel Recovery
 - Experiments and Evaluation
- **Conclusions and Future Research**



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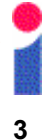
“To-Do” Lists and I-X Process Panels



- **organizing work: to-do lists**
 - universally acknowledged to be useful
 - help people remembering what needs to be done
 - » ensure everything gets done
 - » provide overview of unaccomplished tasks
- **the I-X framework**
 - for creating applications in which multiple agents
 - » adopt a task-centric view of a situation
 - » must coordinate to perform their activities
- **I-X Process Panels**
 - principal interface to an I-X application
 - provide functionality of to-do list (amongst others)



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I-X Process Panels and the <I-N-C-A> Ontology



- **Process Panels reflect underlying ontology: <I-N-C-A>**
- **<I-N-C-A>: generic model for synthesis tasks**
 - **nodes: components of the artifact to be designed**
 - **constraints: required relations between nodes and environment**
 - **issues: points to be addressed before design is complete**
 - **annotations: additional information, e.g. rationale**
- **<I-N-C-A> for synthesizing plans (courses of action)**
 - **nodes: activities that are to be performed as part of the plan**
 - **constraints: temporal constraints, world state constraints, resource constraints, etc.**
 - **issues: flaws in the plan, opportunities**
 - **annotations: anything, e.g. rationale for activities**



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I-X Process Panel: Example



- **issues: questions**
- **activities: items on the to-do list**
 - described as verb plus parameters
 - can be annotated
 - have priority
 - actions suggested by I-X
 - » tick off
 - » refine task
 - » pass to others
 - » use custom handler
- **state: world state information**
- **annotations: none shown here**

Description	Annotations	Priority	Action
setup-jprc		Nor...	Expand using setup-jprc-by-check...
rescue shaky45		High	Expand using deal-with-incident
rescue figgy41		High	Expand using deal-with-incident
note reporting-agency		High	Done
assign-incident-id figgy41 [5:?incident-id=I-002]		High	Expand using update-incident-board
acquire-incident-location [5:?incident-id=I-002]		High	Expand using update-incident-loca...
validate-incident [5:?incident-id=I-002]		High	Done
request isoprep [5:?incident-id=I-002]		High	Done
determine-threats [5:?incident-id=I-002]		High	No Action
ensure-conditions [5:?incident-id=I-002]		High	No Action
plan-and-execute-mission [5:?incident-id=I-002]		High	No Action
receive task-authority I-001		High	Done
receive launch-approval I-001	done - succe...	High	Escalate to JTFC

Pattern	Value
latitude figgy41	31.76
longitude figgy41	14.21

Key	Value
-----	-------



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Hierarchical Task Refinement in I-X Process Panels



- **I-X Process Panel matches task pattern against activities to identify applicable refinements**
 - manual expansion through action menu
 - automated planning attempts to find possible completions of the current partial plan
 - option management allows exploration of “what if” scenarios
 - option evaluation matrix supports option comparison
- **users may add activities at any level manually to adapt plan**
- **helps users by:**
 - keeping track of (known) applicable methods
 - checking consistency of constraints associated with a plan
 - supporting option exploration and evaluation



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Co-OPR2



Priority	Action
Normal	No Action

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



Central Authorities

<input type="radio"/> Activity	<input type="radio"/> High Priority	Report Type = information
<input type="radio"/> Constraint	<input checked="" type="radio"/> Normal Priority	Recipient = me
<input checked="" type="radio"/> Report	<input type="radio"/> Low Priority	Send
<input type="radio"/> Message	<input type="radio"/> Lowest Priority	

Received

Command Centre

Joint Personnel Recovery Center

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

Annotations

Key

"plan.name"

JPRC

I-X Process Panel
 Based on I-X Technology

Plan Replan Check Plan

Collaboration and Communication

Emergency Responders

Intel/Observers/Sensors

File New Options Tools Help

COA-1

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

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

State

Pattern	Value
latitude CA_Coastguard_Cutter	36.82488
longitude CA_Coastguard_Cutter	-123.82172
maxSpeed CA_Coastguard_Cutter	35knh
type CA_Coastguard_Cutter	cutter
latitude Fort_Bragg	0

Annotations

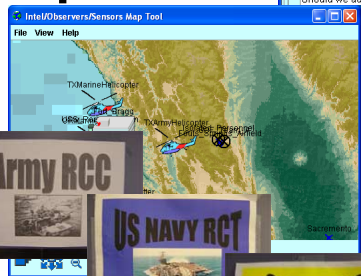
Key

"plan.name"

Value

"COA-1.1"

I-X Process Panel
 Based on I-X Technology



UNESCO Archeological Team (IP) Messenger

Archeological Team (IP)

Options Tools Help

COA-1

Compose Message

Issue

Activity

Constraint

Message

Report Type = information

Recipient = me

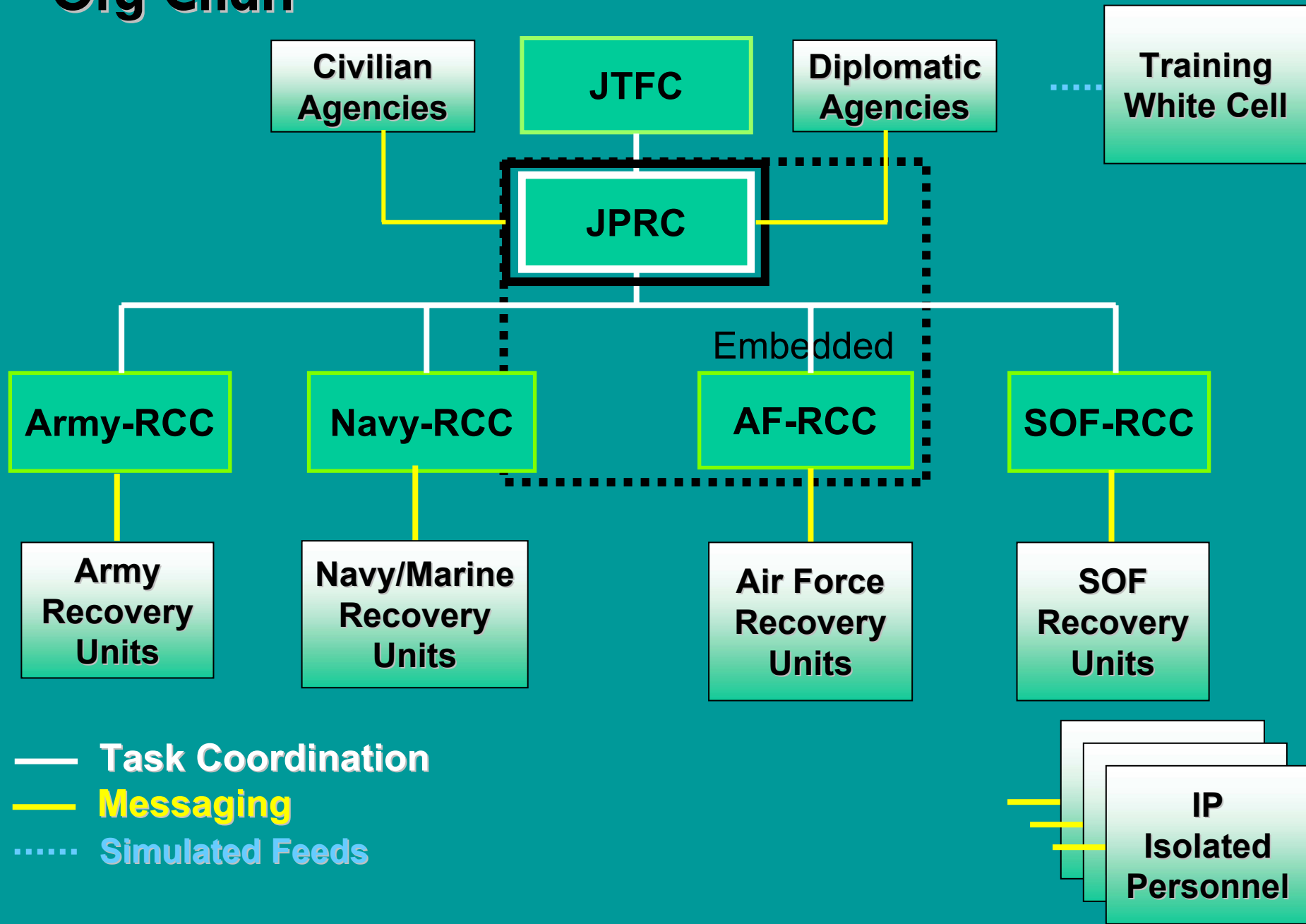


Isolated Personnel

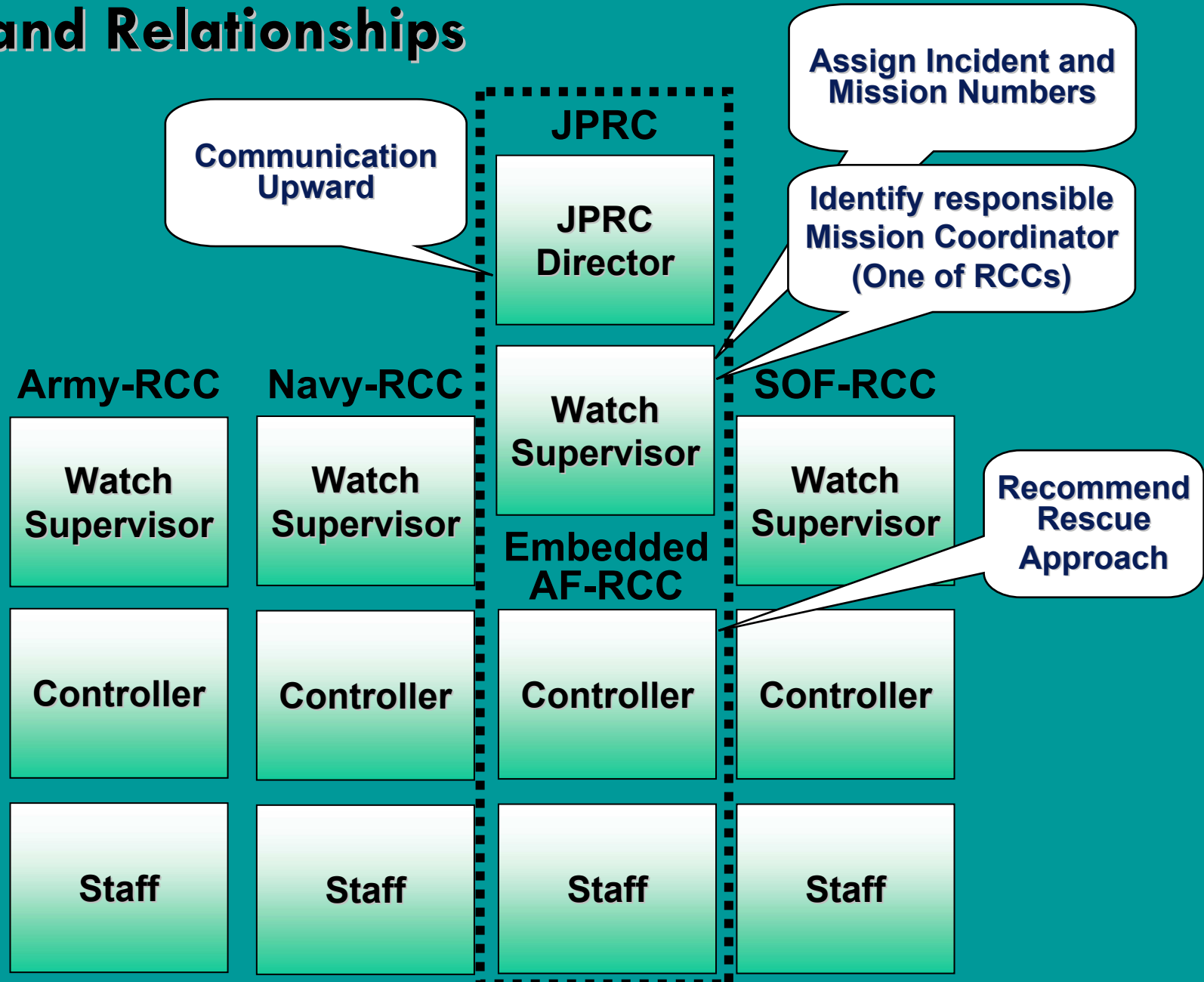
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Org Chart

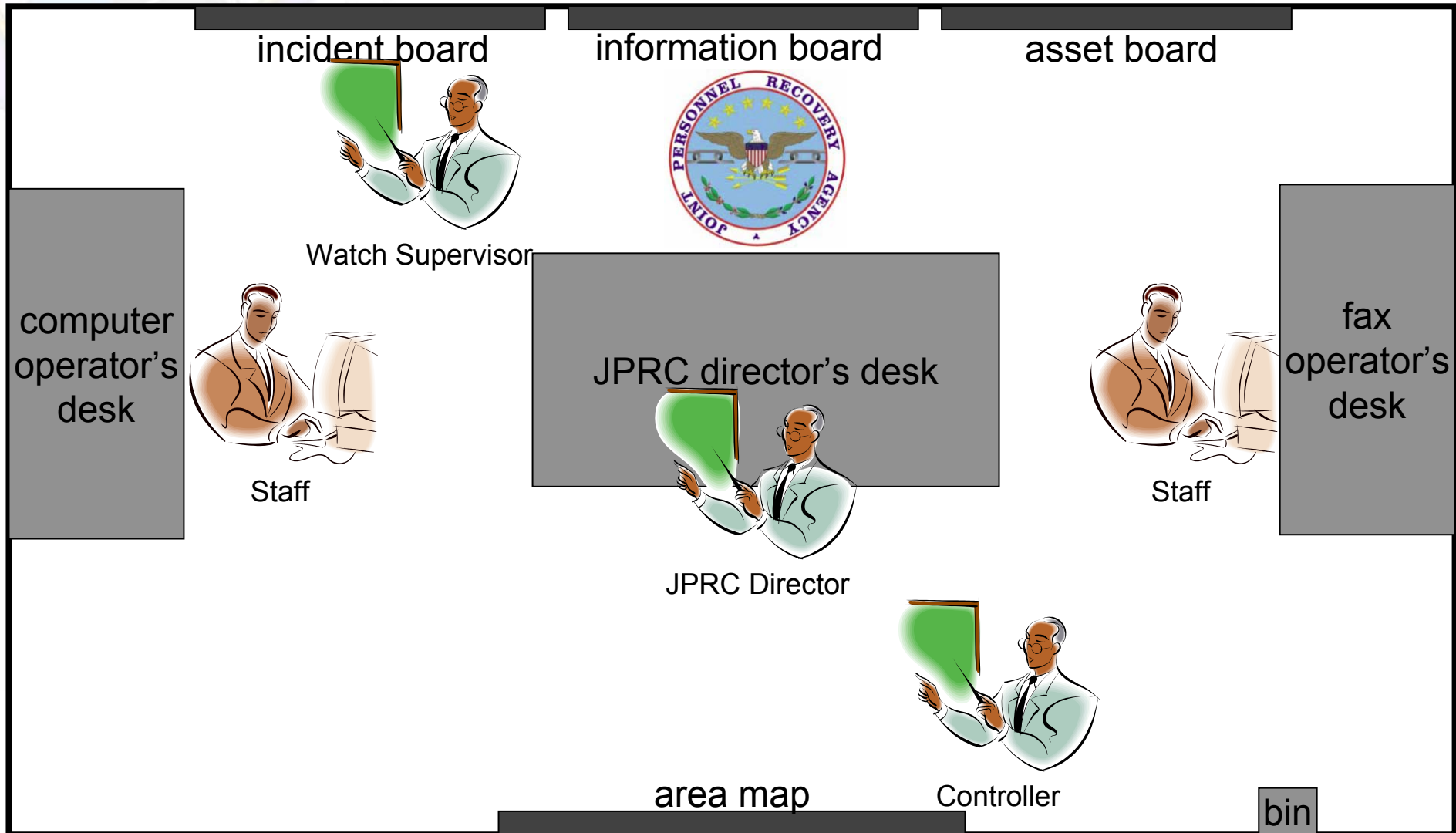


Roles and Relationships



See JPRA/PRETC Field Training References Staff Roles and Responsibilities Pages M-1 to M-3

Typical Rescue Coordination Centre



Typical Rescue Coordination Centre



INCIDENT/MISSION											
INC # / DTG	MSN # / DTG	TYPE OF INCIDENT	NAME OR CALL SIGN	TYPE OF ACFT	UNIT	# OF PERSONNEL	FRAG MSN #	LKP / DTG	THREAT LKP / DTG	TIME OF LAST CONTACT	STATUS / REMARKS
I-001	M-001	BEACON OFF	Flyer 01	F117	9 FS	1					Captured (Puzzle)
I-002	M-002		Flyer 04	F116	9 FS	1					RECOVERED
I-003	M-003		William 05	F18	VF-113	1					RECOVERED
I-005	M-005		Scale 08	F15C	9A FS	1					RECOVERED
I-006			EMERGENCY 13	S13	96S	4					MAJ DAY - GIBBTING
I-007			Serpent 34								SOCACC
I-008		BEACON	Mushell 16	S3B							MAJ DAY

WEATHER DATA AS OF: Jun 09 June

400 = 0315

LOD: M

WOD: Woody

NOD: 84

SARNEG

0123456789

NIGHTROADS

DUFFESS WORD: Puzzle

3MNT: 0434Z
SR: 0500Z
SS: 1959Z
EENT: 2030Z

WIND (DIR SPD GUSTS): Surf 30 @ 22 kt

MOONRISE/SET: 1924Z / 0608Z

TULUM:

SYNOPSIS:

UNIT # & TYPE	LOCATION (ICAD)	UNIT POC / NUMBERS	ASSETS	ALERT	STATUS	REMARKS / TASKED WORK #
24 ABZ12 LJH-LJH	Dyerba	Dyerba	Ship 500K			
24 ABZ14 24 DR 60	MADANTIN TF Eagle			0+30	Mission Ready	
24 ABZ14 24 DR 60	TALIS			0+30	Mission Ready	
24 ABZ14 24 DR 60	160 ANN DPTJ	160 ANN DPTJ	0001-0000 30 min		10-12	
Johnson 91-94 4 MH47E 1091	160 ANN DPTJ	160 ANN DPTJ	0001-0000 30 min		10-12	
SBAT 32/33 2x MH60G	55M SOB DPTJ	55M SOB DPTJ	0001-0000 30 min		10-12	
TDN 9544 1x AS 135 2065	160 ANN DPTJ	160 ANN DPTJ	0001-0000 30 min		10-12	

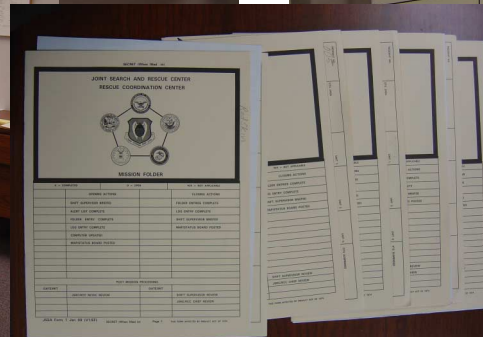
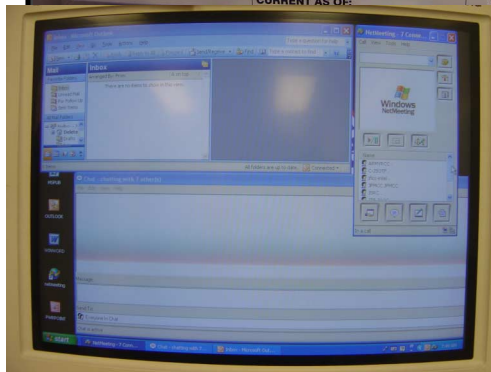
NOD: 84

SARNEG

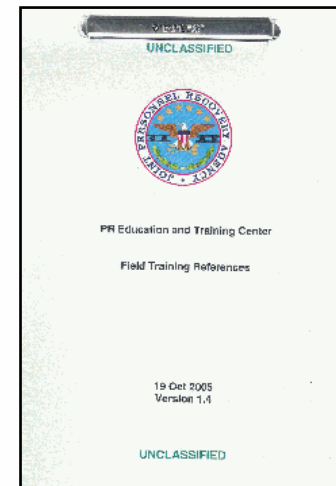
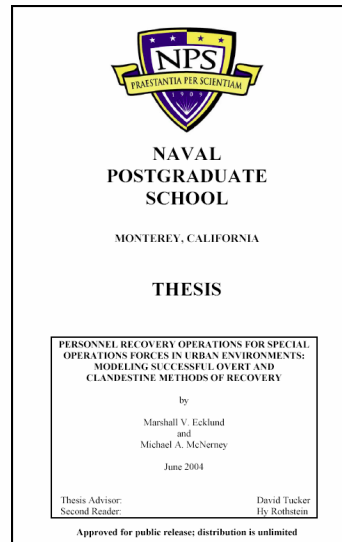
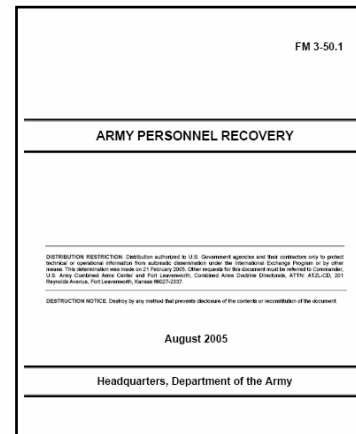
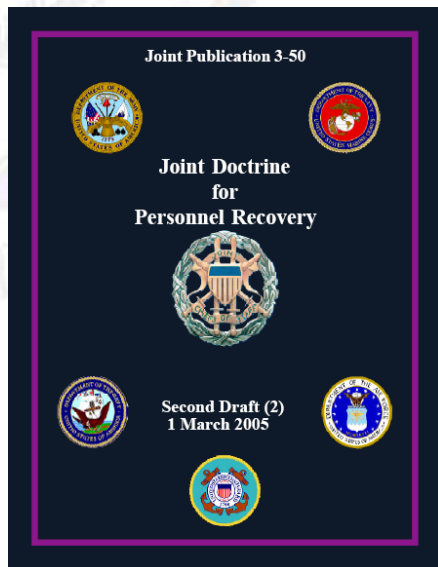
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NIGHTROADS

DUFFESS WORD: PUZZLE



Knowledge Engineering



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JPRC Using I-X



The screenshot displays the JPRC (Joint Personnel Recovery Center) software interface. It includes several key components:

- Issues Panel:** A table with columns for Description, Annotations, Priority, and Action. It lists tasks like 'locate UNESCO-Team' and 'support UNESCO-Team'.
- Activities Panel:** A table with columns for Description, Annotations, Priority, and Action. It lists tasks like 'transport [1]?sof-team' and 'perform-support-ops'.
- State Panel:** A table with columns for Pattern and Value. It lists items like 'maxSpeed ORMarineHelicopter' and 'location SOF-Team-A'.
- Annotations Panel:** A table with columns for Key and Value. It lists items like 'plan.name' and 'COA-1'.
- JPRC I-X Process Panel:** A panel based on I-X Technology.
- JPRC I-X Map Tool:** A map showing terrain and various markers.
- Joint Search and Rescue Center Mission Folder:** A document titled 'JOINT SEARCH AND RESCUE CENTER RESCUE COORDINATION CENTER MISSION FOLDER' with a grid for tracking mission progress.
- Personnel Recovery Center Panel Incidents View:** A table with columns for mission.no, inc.type, callign, a/c.type, unit, pas, and fra. It lists incidents like 'M-004' and 'Fuzzy41'.
- Joint Personnel Recovery Center Panel HTML Viewer:** A web browser displaying a 'Phone Book' with columns for Entity, POC, and Ext. No. It lists contacts like 'JTFC', 'JFLCC', 'JFACC', 'JFMCC', and 'JFSOCC'.
- Compose Message Panel:** A form for sending messages with options for Issue, Activity, Report, or Message, and priority levels (Highest, High, Normal, Low, Lowest).

- Communications
- Simple Chat
- Structured chat
- Information sharing
- Task Support
- Checklists
- To do list
- Progress reporting
- Plan option aids
- Whiteboards
- Incident
- Weather/Codes/Info
- Assets
- Mapboards
- Web Resources
- Fact Book
- Phone List
- Codes
- Mission Folders (to be active?)

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Experiments



The screenshot displays a Windows XP desktop environment with several overlapping windows. The primary window is the 'Joint Personnel Recovery Center Panel', which contains several sub-panels:

- Issues View:** A table listing incidents with columns for incident-no, mission-no, inc-type, callsign, ac-type, unit, frag-rsn, latitude, longitude, threat, and last-contact. One entry is visible: incident-no I-001, mission-no shaky45, inc-type shaky45, latitude 36.45, longitude 10.14, threat none.
- Activities View:** A list of tasks such as 'setup-jprc', 'rescue shaky45', 'note reporting-agency', 'assign-incident-id shaky45', 'acquire-incident-location', 'validate-incident', 'request isoprep', 'determine-threats', 'ensure-conditions', and 'plan-and-execute-mission'. Each activity has a priority level (e.g., High, Normal) and an action button.
- I-Plan (I-Plan Option Tool):** A table showing mission options for different COA (Course of Action) scenarios. The table has columns for Option Title, Base, COA-1, COA-1.1, and COA-1.2. Rows include 'issues in plan', 'activities in plan', 'longest path length', 'objects used in plan', and 'simulated execution'.
- Map View:** A satellite map showing a geographical area, likely the location of the incident.
- Communication Tools:** A 'JTFC' (Joint Task Force Control) window with a 'Send' button and a 'Style' dropdown menu.

The desktop also shows a Skype window, a Microsoft Word document, and a taskbar with various system icons and the start button.



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Evaluation and Results



- **aim: show value of I-X technology**
- **evaluation methodology**
 - role-play CPX (JPRC director, watch supervisor, controller)
 - analyze and categorize cognitive tasks: timing
- **experimental results**
 - use of SOPs encouraged a methodical approach
 - interruptions: quick resumption of activity

Phase	OODA	SHORe	“JPRC Experiment C” Analysis
1	<i>observe</i>	<i>stimulus</i>	<i>information-gathering</i>
2	<i>orient</i>	<i>hypothesis</i>	<i>sense-making</i>
3	<i>decide</i>	<i>option</i>	<i>decision-making</i>
4	<i>act</i>	<i>response</i>	

37	0:51:15	JD	decision-making	request launch authority
38	0:53:00	JD	decision-making	mission establish
39	0:55:00	JD	decision-making	send plan to whitecell
40	0:55:45			[wait for confirmation from whitecell]
41	0:57:02	JD	housekeeping	updates state assuming mission complete
42	1:00:00	GW	housekeeping	rescue figgy, note reporting agency, establ
43	1:01:00	GW	information-gathering	request info - incident location
44	1:02:13	GW	information-gathering	receive location
45	1:02:36	GW	information-gathering	validate incident (WoD)
46	1:03:30	GW	information-gathering	awaiting message
47	1:04:00	GW	housekeeping	broadcast WoD update to all subordinates
48	1:04:46	GW	information-gathering	SOPREP - VOC
49	1:06:58	GW	sense-making	identify threats - I-X msgs
50	1:09:47	GW	sense-making	ensure conditions, ensure OSC
51	1:11:10			[interrupt] duress word
52	1:13:00	GW	sense-making	reviews plan (threats) so far



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Conclusions



- **I-X Process Panels: view as intelligent and collaborative to-do lists**
 - intelligence: seamless integration through hierarchical task refinements modelled in I-DE
- **Co-OPR application: lessons learned**
 - evaluation now almost complete
 - early experiments show how I-X addresses some of the problems observed during a CPX
 - I-X naturally supports handover between shifts
 - some issues with the generic user interface need work



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