



U.S. Army Research, Development and Engineering Command



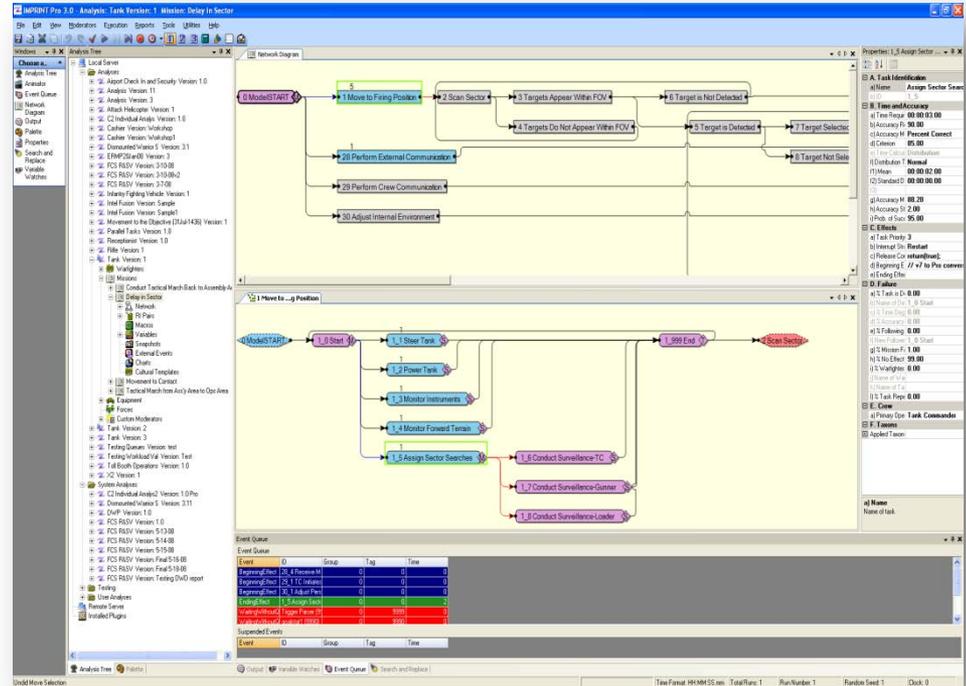
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Expanding IMPRINT Capabilities with Plug-in Technology

MANPRINT Practitioner's Workshop
18 March 2010



Improved Performance Research Integration Tool



300+ users supporting Army, Navy, Air Force, Marines, NASA, DHS, DoT and other organizations across the country

<http://www.arl.army.mil/IMPRINT>



- Set realistic system requirements
- Identify future manpower & personnel constraints
- Evaluate operator & crew workload
- Test alternate system-crew function allocations
- Assess required maintenance man-hours
- Assess performance during extreme conditions
- Examine performance as a function of personnel characteristics and training frequency
- Identify areas to focus test and evaluation resources
- Quantify human system integration risks in mission performance terms to support milestone review
- Represent humans in federated simulations

IMPRINT is a trade-off analysis tool



- *Software component that adds features or capability to another application*
www.it-station.co.uk/jargon.html
- *A computer program that works with a software application to provide a specific function*
www.webdesignseo.com/bloggng-terms/blog-glossary.php
- *A computer program that interacts with a host application (a web browser or an email client, for example) to provide a certain, usually very specific, function "on demand"*
<http://en.wikipedia.org/wiki/Plugins>

Why Plug-ins for IMPRINT?

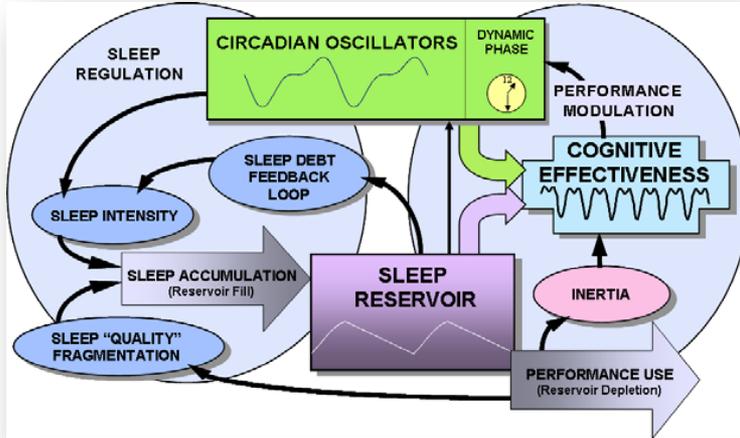
- Require specific functionality targeted to a subset of users
- Enhancement does not fit well into existing IMPRINT user interfaces or modeling schemes

Current Plug-ins

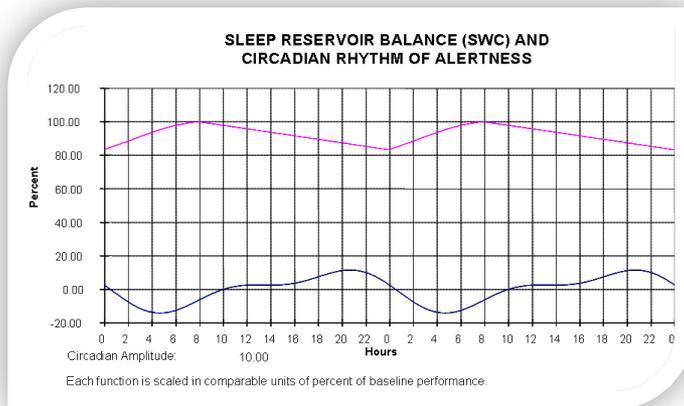
- Sleep, Activity, Fatigue and Task Effectiveness (SAFTE)
- Sea State
- Air Force Human System Integration (AF HSI)
- Combat Damage (proof of concept only)
- Training (in development)
- Multimodal Information Design System (MIDS)



- Examine impact of fatigue on performance



Hursh's SAFTE Model



Fatigue

Sleep/Activity History

- 1 hour of sleep per day for the past 4 days
- 2 hours of sleep per day for the past 4 days
- 4 hours of sleep per day for the past 4 days
- 6 hours of sleep per day for the past 4 days
- 8 hours of sleep per day for the past 4 days

Enable Advanced Options

Advanced Options

Reset to Defaults

Start Day: 8/10/2009

Start Time: 23:00

Starting State

Asleep Awake

Sleep/Wake Pattern

Hours Asleep: Add

Hours Awake: Add

Sleep Hours	Wake Hours
6	18
6	18
6	18
6	18

Delete Clear

Funded by ARL



IMPRINT Operations Model Report Mission Performance									
Analysis Name: Rifle									
Analysis Version: 1									
RNS: 1									
Mission: Destroy Enemy Targets									
MissionID: 49									
Date: 12-Mar-2010									
8 hours of sleep per day									
00:07:55.95									
% Met									
Times Performed	Standard	Minimum	Maximum	Mean	Std. Dev.	Time	Accuracy	Both Time And Accuracy	Result
100	00:11:06.00	00:04:30.95	00:11:08.20	00:07:55.95	00:01:28.30	99.00	100.00	99.00	This DOES meet the performance criterion of 80%

IMPRINT Operations Model Report Mission Performance									
Analysis Name: Rifle									
Analysis Version: 1									
RNS: 1									
Mission: Destroy Enemy Targets									
MissionID: 49									
Date: 12-Mar-2010									
4 hours of sleep per day									
00:09:42.92									
% Met									
Times Performed	Standard	Minimum	Maximum	Mean	Std. Dev.	Time	Accuracy	Both Time And Accuracy	Result
100	00:11:06.00	00:05:30.59	00:13:45.07	00:09:42.92	00:01:49.96	79.00	100.00	79.00	This does NOT meet the performance criterion of 80%

IMPRINT Operations Model Report Mission Performance									
Analysis Name: Rifle									
Analysis Version: 1									
RNS: 1									
Mission: Destroy Enemy Targets									
MissionID: 49									
Date: 12-Mar-2010									
1 hour of sleep per day									
00:28:16.75									
% Met									
Times Performed	Standard	Minimum	Maximum	Mean	Std. Dev.	Time	Accuracy	Both Time And Accuracy	Result
100	00:11:06.00	00:16:00.32	00:40:02.18	00:28:16.75	00:05:21.05	0.00	100.00	0.00	This does NOT meet the performance criterion of 80%

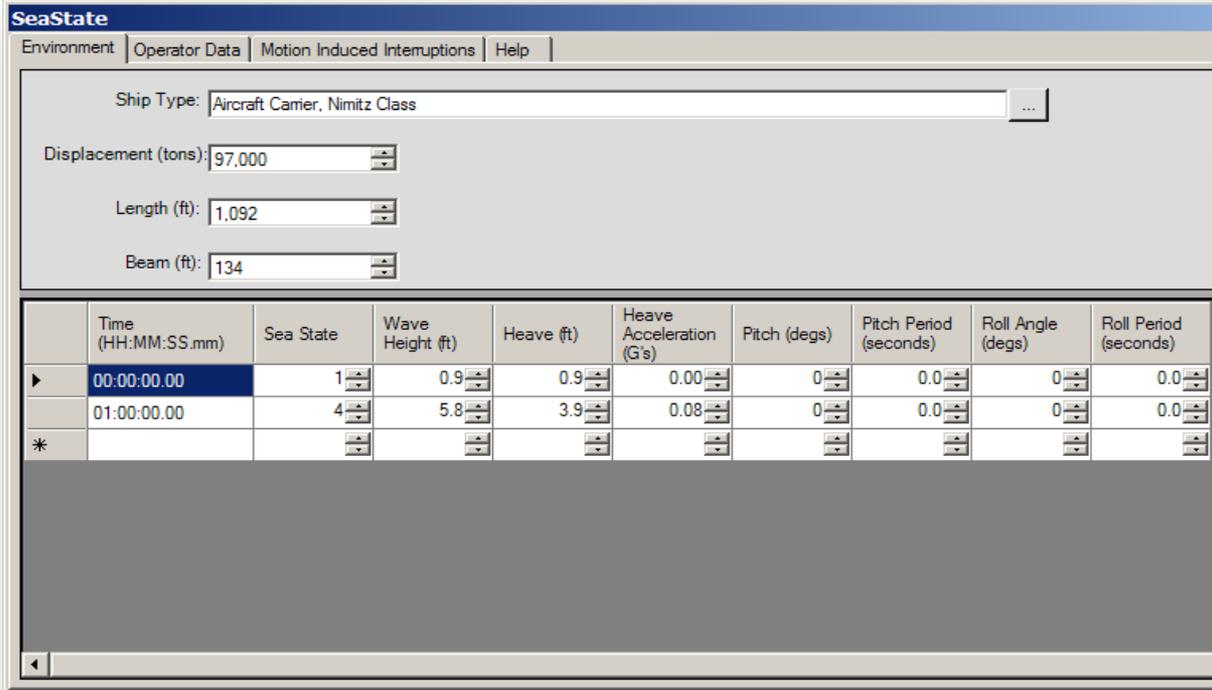
Example Results

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



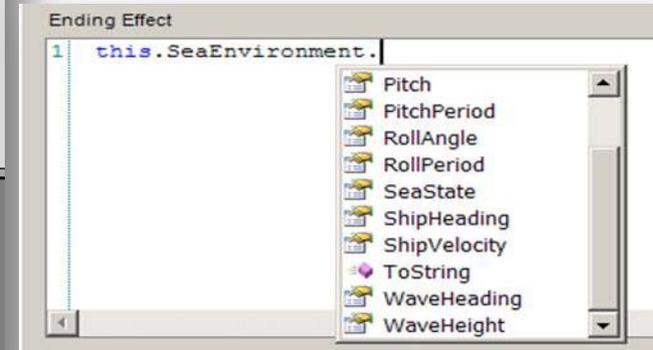
- Current effort
 - Integrate with IMPRINT Forces module
- Future enhancements
 - Apply SAFTE only to selected tasks in a model
 - Different sleep schedules for different operators
 - Apply SAFTE effectiveness predictions to task accuracy

- Conduct testing of sea state human performance theories



The SeaState GUI includes tabs for Environment, Operator Data, Motion Induced Interruptions, and Help. Configuration fields include Ship Type (Aircraft Carrier, Nimitz Class), Displacement (97,000 tons), Length (1,092 ft), and Beam (134 ft). A table below shows mission parameters over time.

	Time (HH:MM:SS.mm)	Sea State	Wave Height (ft)	Heave (ft)	Heave Acceleration (Gs)	Pitch (degs)	Pitch Period (seconds)	Roll Angle (degs)	Roll Period (seconds)
▶	00:00:00.00	1	0.9	0.9	0.00	0	0.0	0	0.0
	01:00:00.00	4	5.8	3.9	0.08	0	0.0	0	0.0
*									



The Ending Effect script editor shows a dropdown menu with the following options: Pitch, PitchPeriod, RollAngle, RollPeriod, SeaState, ShipHeading, ShipVelocity, ToString, WaveHeading, and WaveHeight.

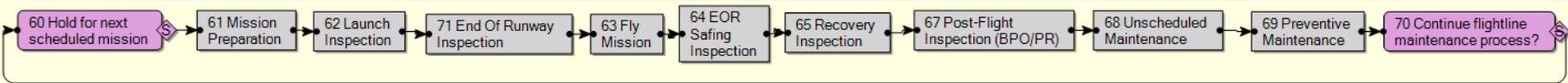
Intelligent code allows user to change parameters and access calls during a mission run

GUI allows user to set parameters for start of mission and to “script” sea state levels

Funded by Navy HSI



- Investigate relationship between human performance and Air Force (AF) operational metrics



C-17 Globemaster III

Mission Name: C-17 Globemaster III

Description:

HSI Mission Data:

Force	Mission	Maintenance/Supply	Output Options	Mission Criteria
Weapon System				
Number Of Systems		10		
Manpower				
Crew Chiefs		10		
Maintenance Techs		20		
Weapon Techs		20		
Equipment				
Fueling Trucks		3		

Simulate AF mission generation and flightline maintenance for the following weapons systems

- C-17 Globemaster III
- CV-22 Osprey
- F-15C Eagle
- F-15E Strike Eagle
- MQ-1 Predator
- MQ-9 Reaper

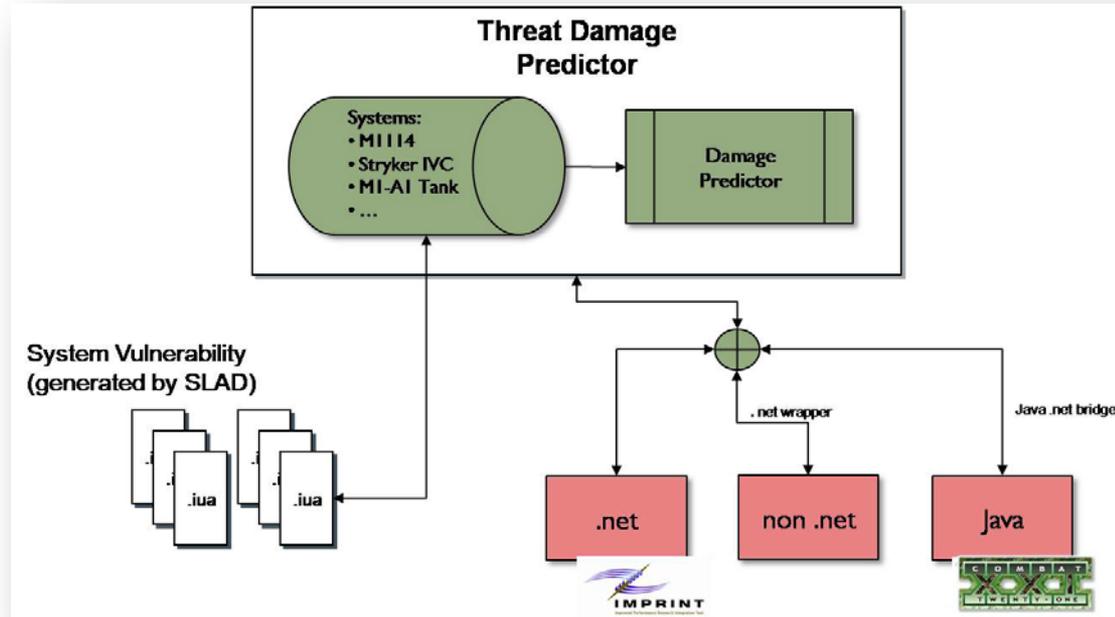
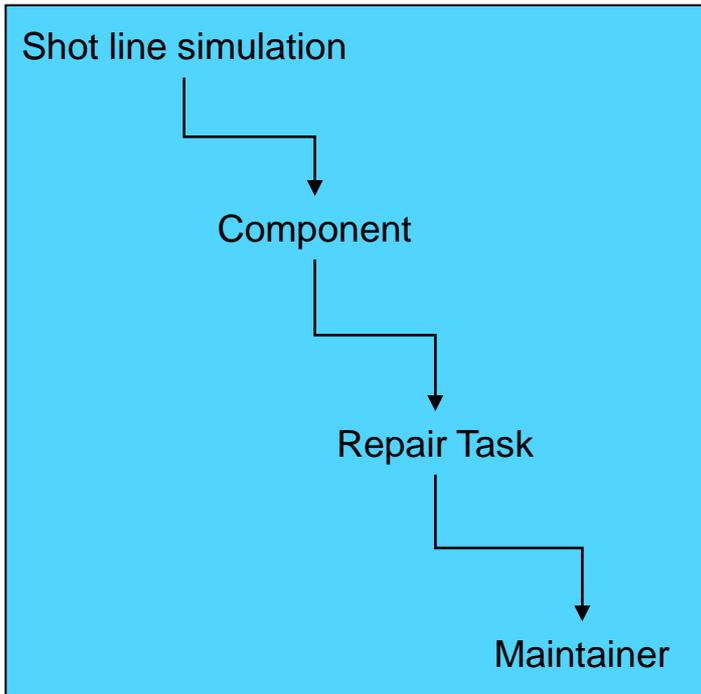
Funded by AFRL, Brooks



- Current effort
 - Plug-in upkeep
- Future enhancements
 - **Maintenance** – Incorporate major preventive maintenance inspections (e.g. hourly post flight, preventive, home station checks)
 - **Personnel** – Allow selection of available manpower by AFSC and match to malfunctioned component and repair time
 - **Environment, Safety, and Occupational Health** – Predict chances of an incident occurring based on past accident rates
 - **Work Shifts** - Develop interface for prescribing exact manpower details by hour

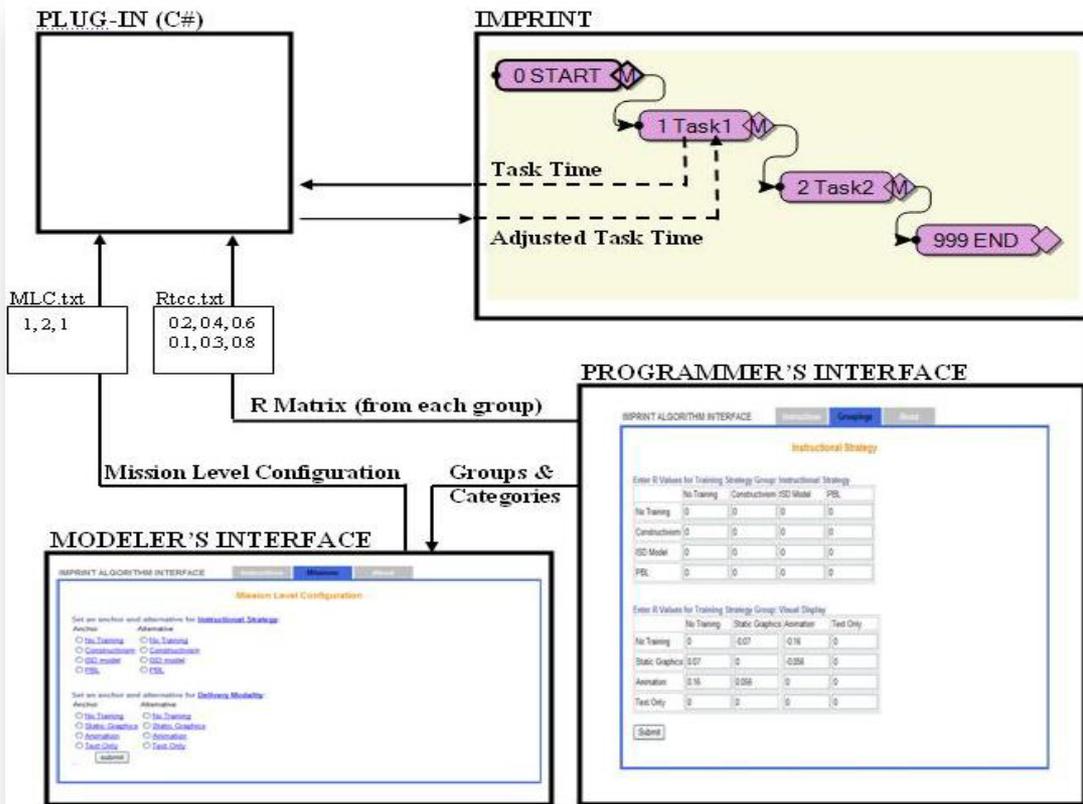


- Examine effect of combat damage on maintenance manpower



Funded by Army, LOG FACT

- Examine effect of training type on performance



IMPRINT ALGORITHM INTERFACE | Instructions | Categories

Categories List

Select one of the following categories to test in your model:

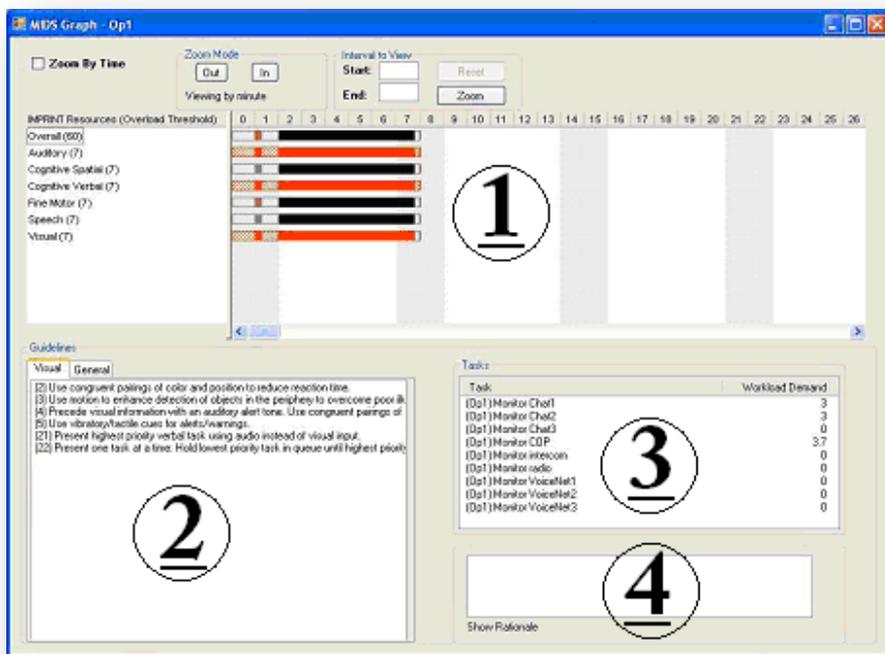
Cognitive Tasks

- [Heuristics - expand](#)
- [Animation](#)
- [Feedback - expand](#)
- [Simulation - expand](#)
- [Experiential learning - expand](#)
- [Procedural information - expand](#)
- [Worked Examples - expand](#)
- [Fading - expand](#)
- [Timing of Instructional Support - expand](#)
- [Computer based - expand](#)
- [Learning strategies\(dscn mngn\) - expand](#)
- [Experience level - expand](#)
- [Whole vs part task - expand](#)
- [Cooperative learning - expand](#)

Anchor:	Alternative:
<input checked="" type="radio"/> No illustration	<input type="radio"/> No illustration
<input type="radio"/> Static graphics	<input type="radio"/> Static graphics
<input type="radio"/> Static graphics+ motion cues	<input type="radio"/> Static graphics+ motion cues
<input type="radio"/> Animation	<input checked="" type="radio"/> Animation

Funded by AFRL, Mesa

- Develop potential mitigation strategies from multimodal design guidelines matched to areas of high workload as identified in IMPRINT



Task	Workload Demand
(Op1) Monitor Chat1	3.7
(Op1) Monitor Chat2	0
(Op1) Monitor Chat3	0
(Op1) Monitor COP	5
(Op1) Monitor intercom	0
(Op1) Monitor radio	0
(Op1) Monitor VoiceNet1	0
(Op1) Monitor VoiceNet2	0
(Op1) Monitor VoiceNet3	0

Guideline15

Auditory icons and earcons are useful when visual channel overloaded.

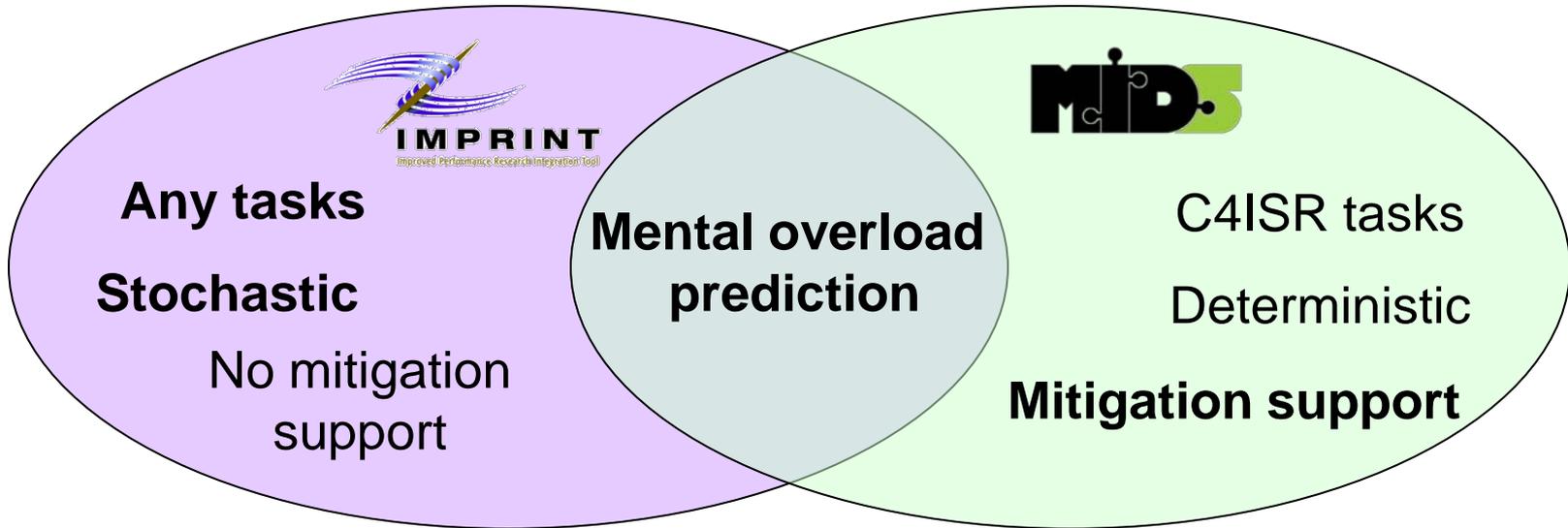
Example	Rationale
	Auditory icons are vocal sounds that semantically relate environmental sounds to a given object (e.g., use the sound of a door opening to open a file). A listener's interpretation of the physical sound is considered a "sound symbol." Auditory icons are useful in complex environments where users are visually overloaded; they are generally easy to learn and thus should be used for systems that require minimal training (ETSI, 2002; Gaver, 1997).

[Show Rationale](#)

Funded by ARL



Use the strengths of each tool to compensate
for their limitations



IMPRINT with MIDS plug-in

- Current effort
 - Multiple operators
 - Coordinated MIDS/IMPRINT Reports
 - Prioritization of guidelines
 - Predictive assessment of guidelines
- Future enhancements
 - Dependent on feedback from application by users



Join the IMPRINT Plug-in Club!

