


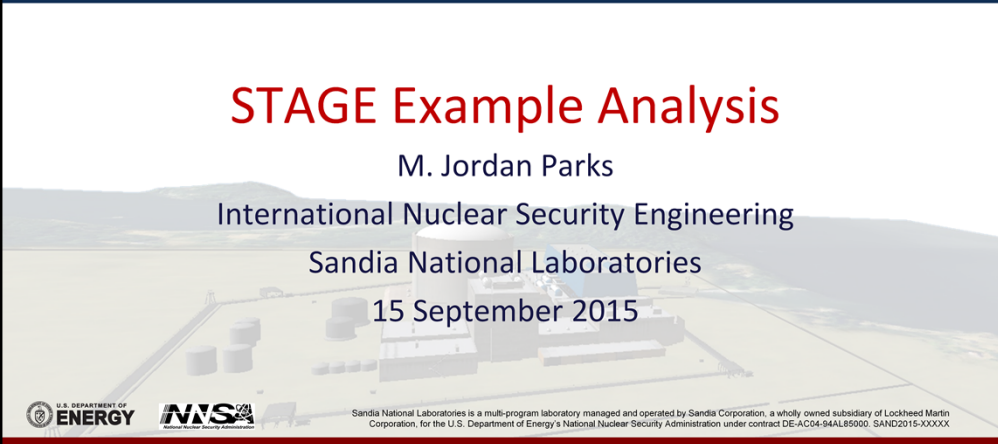
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Exceptional service in the national interest



STAGE Example Analysis

M. Jordan Parks
International Nuclear Security Engineering
Sandia National Laboratories
15 September 2015



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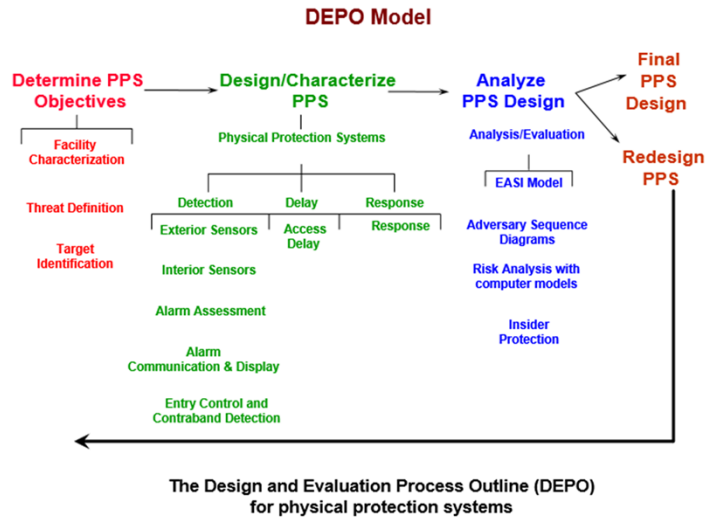
IEEE ICST Conference Presentation

SAND NO. 2012-6364.

Overview

- VA Process Refresher
- Presagis Tools
 - Workflow
- Terrain
- 3D Modeling
- Scenario Modeling
 - Data Requirements
 - Behavior Model

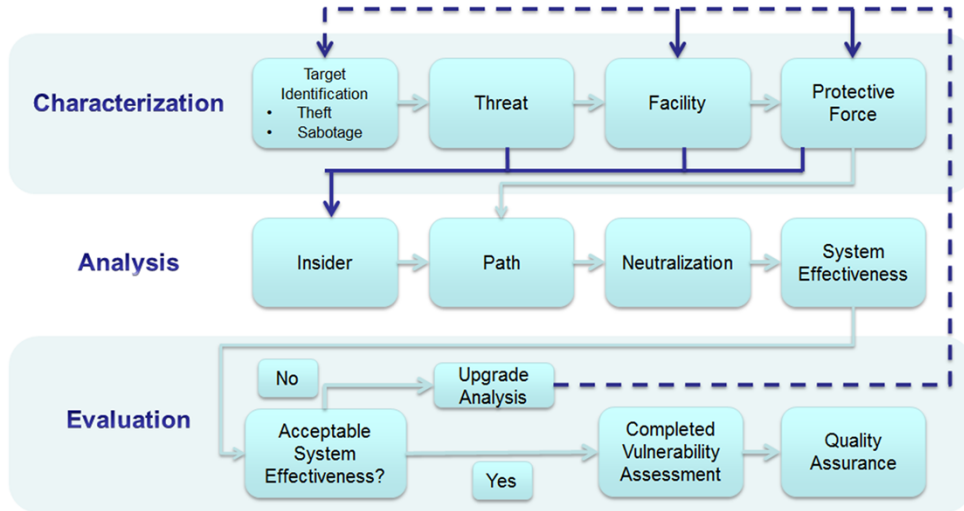
Design Evaluation Process Outline (DEPO)



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Vulnerability Analysis - Process



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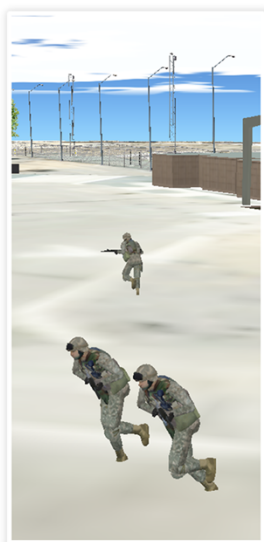
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Pros and Cons

- Pros
 - High flexibility
 - High traceability
 - Open code if desired
 - Very little coding required
 - Standard Model Formats
 - Customizable Data Reporting
- Cons
 - High level of VA Training
 - Out-of-the-box customization to run with high fidelity
 - Requires multiple tools to go from source data to simulation

SAND Number for STAGE Intro Pres – India SAND2012-9303

Presagis Tools



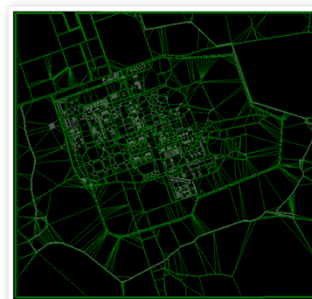
STAGE



Creator Pro

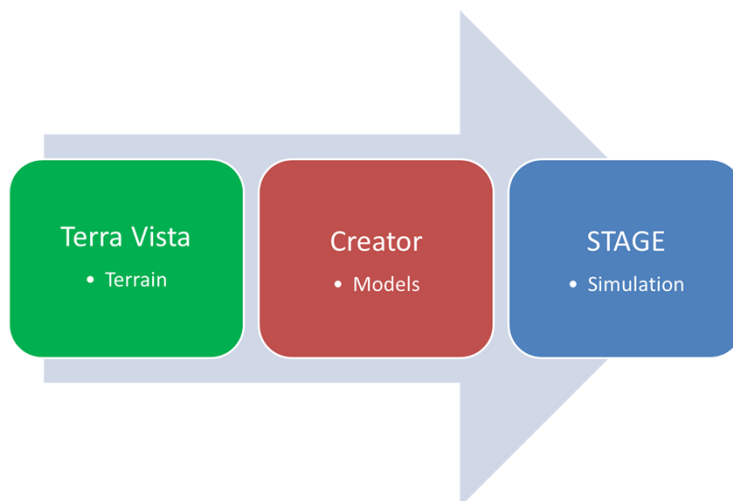


Terra Vista



SAND Number for STAGE Intro Pres – India SAND2012-9303

Tools Workflow

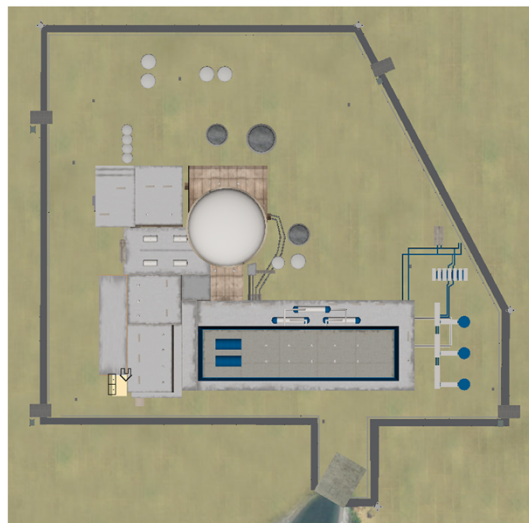


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Terrain Creation – Terra Vista

- Terra Vista
 - GIS
 - Data Aggregation
 - Terra Vista Output
- Common Terrain formats
 - Can be used with multiple tools
 - Compilers for many different formats



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Building Modeling - Creator

- Creator
 - 3D Modeling
 - A.I. Runtime Integration
 - Complex interiors



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Scenario Modeling - STAGE

- STAGE
 - Data aggregation
 - Weapons
 - Sensors
 - VA concepts
 - Detection, Delay, Response
 - Scenario Planning
 - Logic Modeling
 - Mission Planning
 - Scenario Execution
 - Data Collection
 - Analysis

Type	Logical Op	Trigger	Open	Value	Action
AI	AND	ISSET	is	TRACK_MUST	
AI	AND	Reason	is		
AI	AND	Track Health	is	State	Deployment Assign #1
AI	AND	Is Vehicle Building	is	State	STAFF Engage_S10
AI	AND	Is Fuelled	is	State	
AI	AND	Track To Area - ECP	is	State	
AI	OR	Track To Area - FIB	is	State	
AI	OR	Track To Area - FIB	is	State	
ESDP	AND	Track Health	is	State	Deployment Assign #1
AI	AND	Is Vehicle Building	is	State	STAFF Engage_S10
AI	AND	Is Fuelled	is	State	
AI	OR	EXTREMELY DAMAGED	is	Value_#1	RAF - Process avail
AI	AND	Reason	is		
AI	AND	Reason	is		
AI	OR	EXTREMELY DAMAGED	is	Value_#1	RAF - Process avail
AI	AND	Reason	is		
AI	AND	Reason	is		
AI	AND	ACTIVATED	is	State	
AI	AND	Ending State	is	COMPLETED	
AI	AND	Reason	is	Process avail/State	

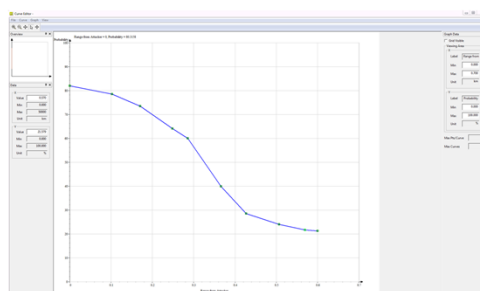


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Data Input and Aggregation

- Customizable databases
- Generic data provided
 - User generated databases recommended
- Data requirements
 - Sensor Performance
 - P_H/P_K or equivalent
 - Delay Times
 - Response Force Times (RFTs)



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Behavior Modeling

- Conditional logic based behavior model
- Library of simple actions, conditions, decision states
 - Local Variables
 - A.I. Integration
- When combined creates complex behavior
 - No coding experience necessary
- Mission Based
- Generic Submissions
 - Generalizable
 - Reduces development time
 - Simplifies logic modeling process

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Mission – Adversary Commander

Mission Context						
Database: UUR_INNM_N_Scenario: UUR_INNM_NPP_C Platform: []						
Task Group	Type	Logical Oper.	Left Term	Oper.	Right Term	Action
Init	INIT					String breachProgress = fence String taskADV = ADV_01 String taskSupport = ADV_02 Bool secondPidAsBreached = False Bool isReadyToSelect = false
Climb Breach Complete	AT		EXTERN EVENT	=	Climb Breach Finished	Send Fence Climbed TO TEAM
		AND	Reason	=		breachProgress = combat
		AND	From	=	ADV_01	
Breach First PIDAS fence	IF		Group Count - RF_Patrol_01	=	0	breachProgress = PIDAS1 Send RF_Patrol_01 Defeated TO TEAM
Breach Second PIDAS fence	AT		EXTERN EVENT	=	Mech Breach Finished	
		AND	Reason	=		
		AND	From	=		
	IF		secondPidAsBreached	=	false	breachProgress = PIDAS2 Send Breach Second PIDAS fence TO TEAM secondPidAsBreach = True
	ELSE					breachProgress = ExpBreach Send PIDAS has been breached TO TEAM
Explosive Breach Finished	AT		EXTERN EVENT	=	Explosive Breach Finished	breachProgress = complete
		AND	Reason	=		Send Explosive Breach Complete TO TEAM
		AND	From	=		START SelectTaskSupport
Task ADV KIA Check	IF		Group Count - taskADV	=	0	START SelectNewTaskADV ENABLE Task ADV KIA Check
End	END					

SAND2015-2825 R – Lone Pine Attack PLans

Sub-Mission – Explosive Breach

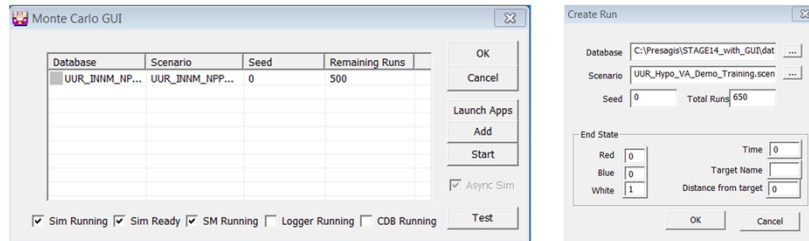


Mission Context						
Database: UUR_INNM_N Scenario: UUR_INNM_NPP_D Platform: [Platform]						
Task Group	Type	Logical Oper.	Left Term	Oper.	Right Term	Action
Init	INIT					Goto Breach Location Set Position State - Stand Set Visibility Factor - 1.0
Arrive at Location	AT		ACTION ENDED	=	Goto Target	Wait - 5s - Explosive Breach
		AND	Ending State	=	COMPLETED	Send Explosive Breach Begins TO Reporter, ADV_Commander
		AND	Reason	=	Arrive at Location	
Set Charge	AT		ACTION ENDED	=	Wait	Send Charge Set TO Reporter
		AND	Ending State	=	COMPLETED	Go to Retreat Location
		AND	Reason	=	Explosive Breach	
Safety Wait	AT		ACTION ENDED	=	Goto Target	Wait - 5s - Safety Wait
		AND	Ending State	=	COMPLETED	
		AND	Reason	=	Go to Retreat Location	
Detonates Return	AT		ACTION ENDED	=	Wait	Send Charge Detonates TO Reporter
		AND	Ending State	=	COMPLETED	Goto back to Breach Location
		AND	Reason	=	Safety Wait	
Clear Debris	AT		ACTION ENDED	=	Goto Target	Wait - 5s - Clear Debris
		AND	Ending State	=	COMPLETED	Send Clear Debris TO Reporter
		AND	Reason	=	Arrive Back at Location	
Breach Finished	AT		ACTION ENDED	=	Wait	Send Explosive Breach Finished TO Reporter, ADV_Commander
		AND	Ending State	=	COMPLETED	STOP Sub-Mission
		AND	Reason	=	Clear Debris	
End	END					

SAND2015-2825 R – Lone Pine Attack PLans

Scenario Execution

- Large Batch Execution
 - Can run through the Scenario Manager (runs can be viewed)
 - Can run as process (runs cannot be viewed real time)
- Logger Function
 - Playback of any run
- Snapshot and Restore
 - Playback from any point with possible novel outcomes



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Data Analysis

- Scenario Information stored in *.CSVs (Excel readable)
- Data is easily parsed
- Sensitivity Analysis

Name	KIA Red	KIA Blue	Time On Task	Time Off Task	Blue Wins	Red Wins	Pn
Averages	6.36	5.98	00:00:00.00	00:03:13.38	121	79	0.605
20140212_085059	7	6	0:00	00:03:11.33	1	0	1
20140212_085434	6	7	0:00	00:03:17.93	0	1	0
20140212_085816	6	7	0:00	00:03:11.33	1	0	1
20140212_090158	7	7	0:00	00:03:11.33	1	0	1
20140212_090533	5	9	0:00	00:03:17.93	0	1	0
20140212_090914	5	8	0:00	00:03:18.00	0	1	0
20140212_091256	7	5	0:00	00:03:11.33	1	0	1
20140212_091629	6	7	0:00	00:03:17.93	0	1	0
20140212_092010	7	4	0:00	00:03:08.46	1	0	1
20140212_092342	6	6	0:00	00:03:17.93	1	0	1
20140212_092723	7	4	0:00	00:03:08.46	1	0	1
20140212_093055	6	9	0:00	00:03:17.93	0	1	0
20140212_093437	7	4	0:00	00:03:08.43	1	0	1
20140212_093809	5	7	0:00	00:03:18.03	0	1	0
20140212_094151	7	6	0:00	00:03:12.32	1	0	1

Sim Time	Reporter	Report	Instances
00:00:10.989	Reporter	Outer Fence Breached	1
00:00:19.965	Reporter	Vibration Fence Breached	1
00:00:32.934	Reporter	PIDAS Breached - Task team enters LA	1
00:00:33.891	Reporter	PIDAS Breached Assault moving to ambush position	1
00:01:03.963	Reporter	754 - KIA	1
00:01:27.744	Reporter	Times Pedestrian Blast Breached	1
00:01:27.744	Reporter	Bunker Outer Pedestrian Blast Door Breached	1
00:01:45.699	Reporter	Bunker Inner Pedestrian Blast Breached	1
00:01:53.26	Reporter	Bunker 5th Floor	1
00:02:00.458	KIA_AdminB	RF22 - KIA	1
00:02:01.407	KIA_AdminR	A07 - KIA	1
00:02:03.651	Reporter	Cutting Target Tie Downs	1
00:02:05.334	KIA_AdminB	RFP21 - KIA	1
00:02:20.118	KIA_AdminB	A03 - KIA	1
00:02:22.098	KIA_AdminB	RF07 - KIA	1
00:02:23.022	KIA_AdminR	A04 - KIA	1

These will be replaced with like pictures from the actual scenario

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Thanks!

QUESTIONS?

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