DIP
University of Genoa

PLACRA & SIMILO

Agostino G. Bruzzone

Simone Simeoni

Simone Viazzo

Federico Figini

In Cooperation with

LAMCE
Universidade Federal do Rio de Janeiro

CIELI

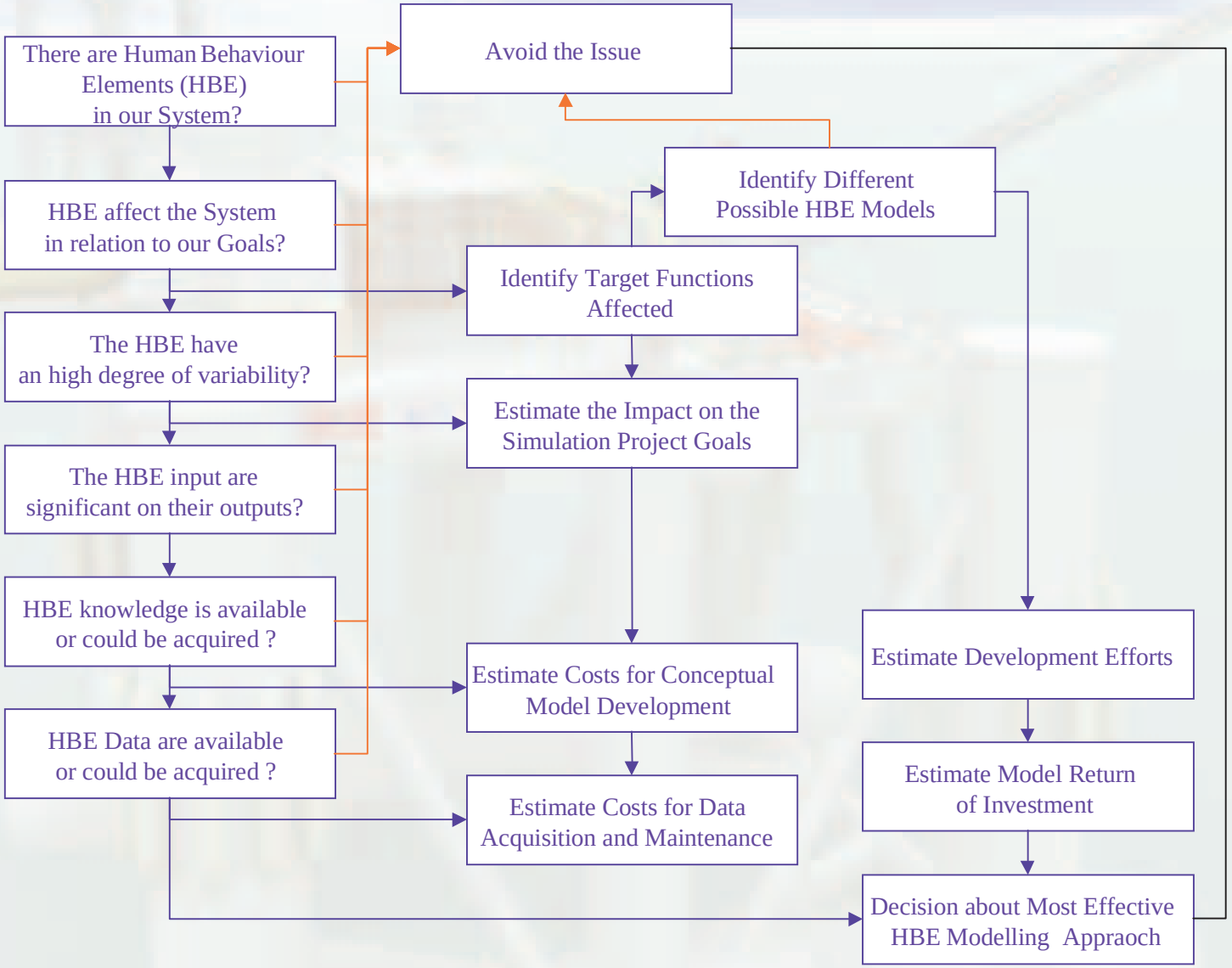
CETENA

MIMOS

Goals

- Estimation of Effectiveness in using Modeling & Simulation, Computer Graphic & Virtual Reality in Platform Organization and Operative Procedures
- Development of a Case Study Combining the different techniques (M&S, CG, VR)
- Validation & Verification over the developed Models
- To Estimate the impact of these integrated Systems as support for SBDVP (Simulation Based Design & Virtual Prototype)

Modelling Humans



Vessel Micrologistics

New Technologies and Procedures allows today to reorganize Processes and Logical Operations

- **Automation and/or Process Changes**
- **People/Cargo Movements**
- **Space Reallocations**

Only SBDVP supports effectively on-board implementation of these new approaches by estimating peculiarities:

- **Limited/Multifunctional Space**
- **People Polyfunctional Roles**
- **Different Operative Conditions**
- **Sea Operations 365/24**

These additional modelling efforts are balanced by improvements in:

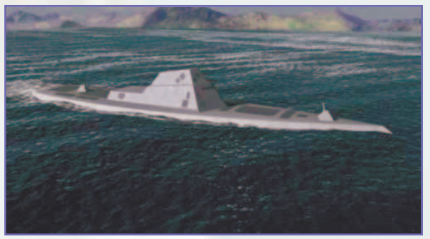
Cost Reduction
Higher Operative Effectiveness
On-Board Quality of Life

Examples of Experiences

VR for ergonomic design of control room on Oil Platforms - Petrobras

M&S for Operative reorganization of Logistics and Handling Procedures on LPD17 - US Navy

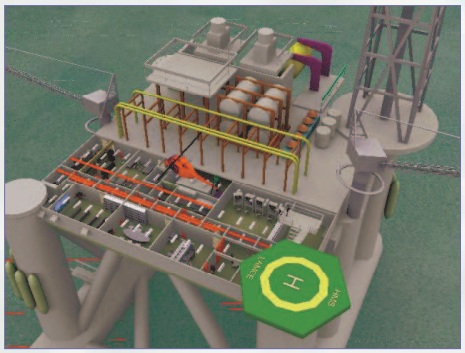
M&S for polyfunctional automation in crew role assignment on DD21 - US Navy



Example: Quality of Life in Oil Platforms

In Vessels and Oil Platform it is possible by modelling re-engineering the space allocation;

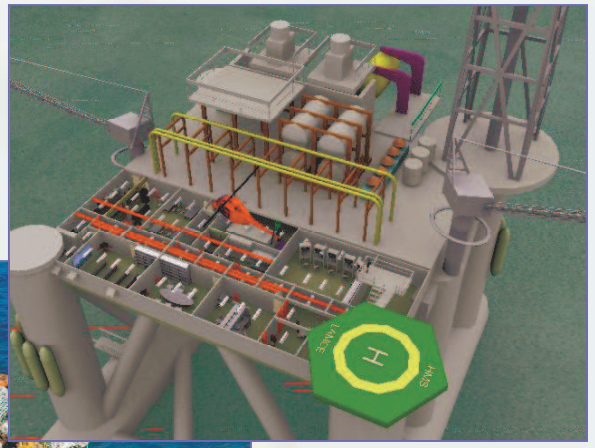
This allows to reduce drastically personnel, increasing the living spaces and providing more support to other services (i.e. fuel, weapons etc.)



Preliminary Analysis

By the support of existing cooperations it was possible to develop Computer Graphics systems for a feasibility study related to:

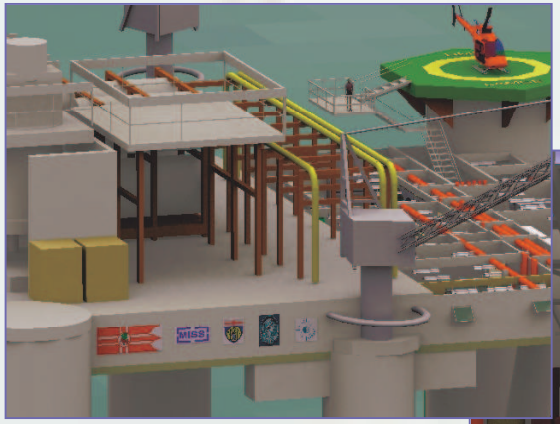
- **People Activity**
- **Platform Layout**
- **Operations & Functions**

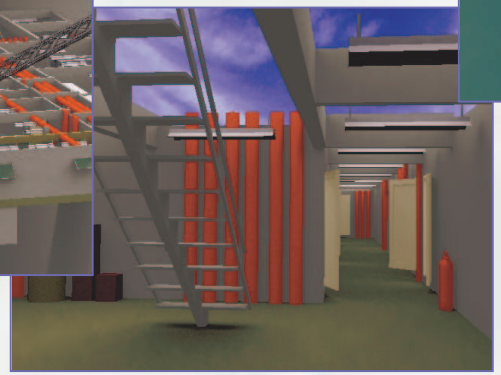


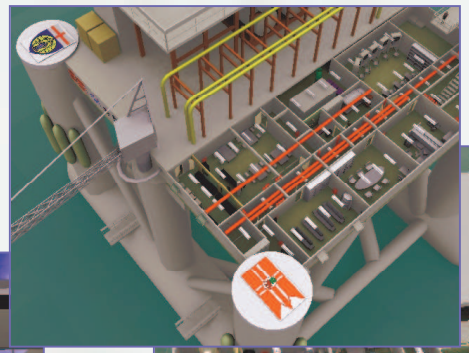
Placra Model: Oil Platform

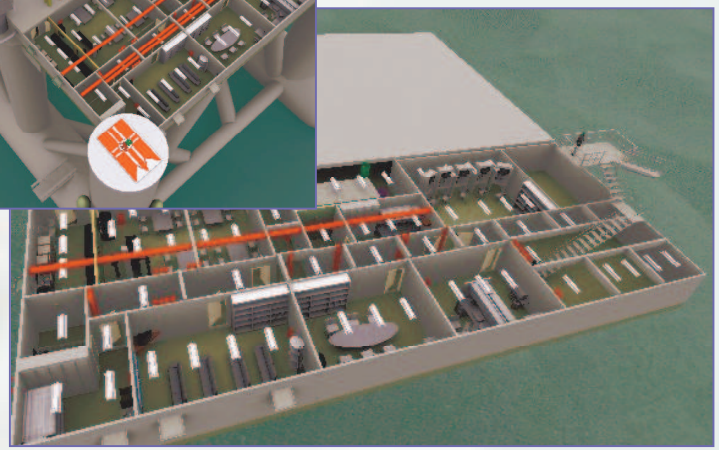
The ***Placra*** (Platform Crew Animation) model was developed in CG in order to reproduce the crew activities on Oil Platform from Petrobras. ***Placra*** simulates crew movements generated by functional requirements (3D Motion, MultiLayer and infrastructure operations)

OpenGL
VRJuggler
WXWindows
3DSMax
OpenSceneGraph
Sonix









Sistema *Similo*: Crew Mensa

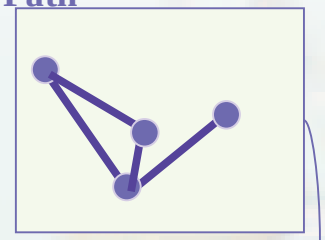
The simulator ***Similo*** (Ship MicroLogistics), is an integrated approach to M&S and CG devoted to support on-board plants and processes; in this case the study focused on the crew mensa (cook-room) in development by CETENA/Fincantieri.

Similo model the interaction among people and his behaviour in order to estimate support performance analysis (i.e. evaluation of external catering as substitute of kitchens in Fast Ferries).

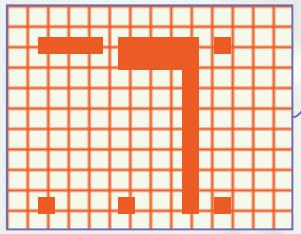
Java	Vbasic
Javascript	Maxscript
3DSMax	HTML

Conceptual Model

Path



Layout



Mensa Servers

Menu Entities

Crew Member

Crew Member

Crew Member

Crew Member

Generators

Ship Activities

Operative Shifts

Ship Layout

User Flows:
- Source
- Type
- Groups
- Frequency

People Generation

Motion to Mensa

Getting cuttlering glasses & tray

Menu' Choices Getting Dishes

Table for the Group

Group Updates

Motion to table

Lunch

Waste Collection

Individual Statistics

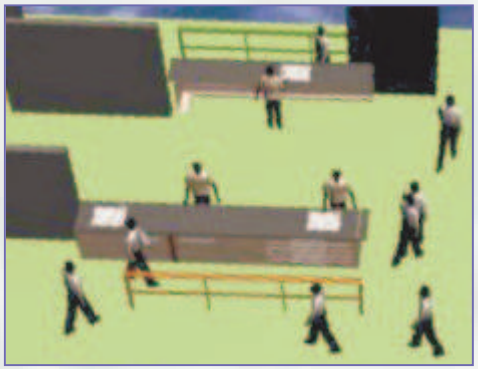
Stochastic Model based on Combined Simulation and Object Oriented Analysis e Design

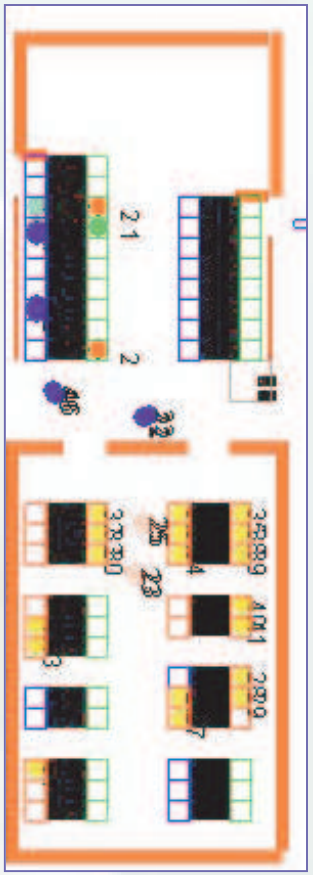
- Discrete Events: Operations and Actions
- Continuous Motion and People Interactions

People Dynamics

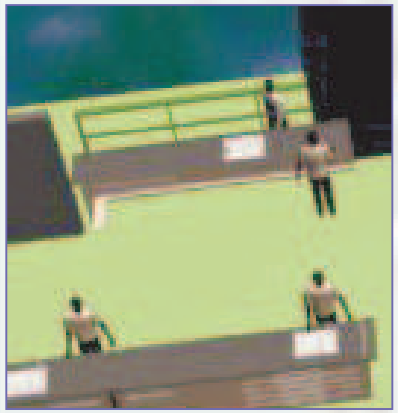
People dynamics involves the following phenomena:

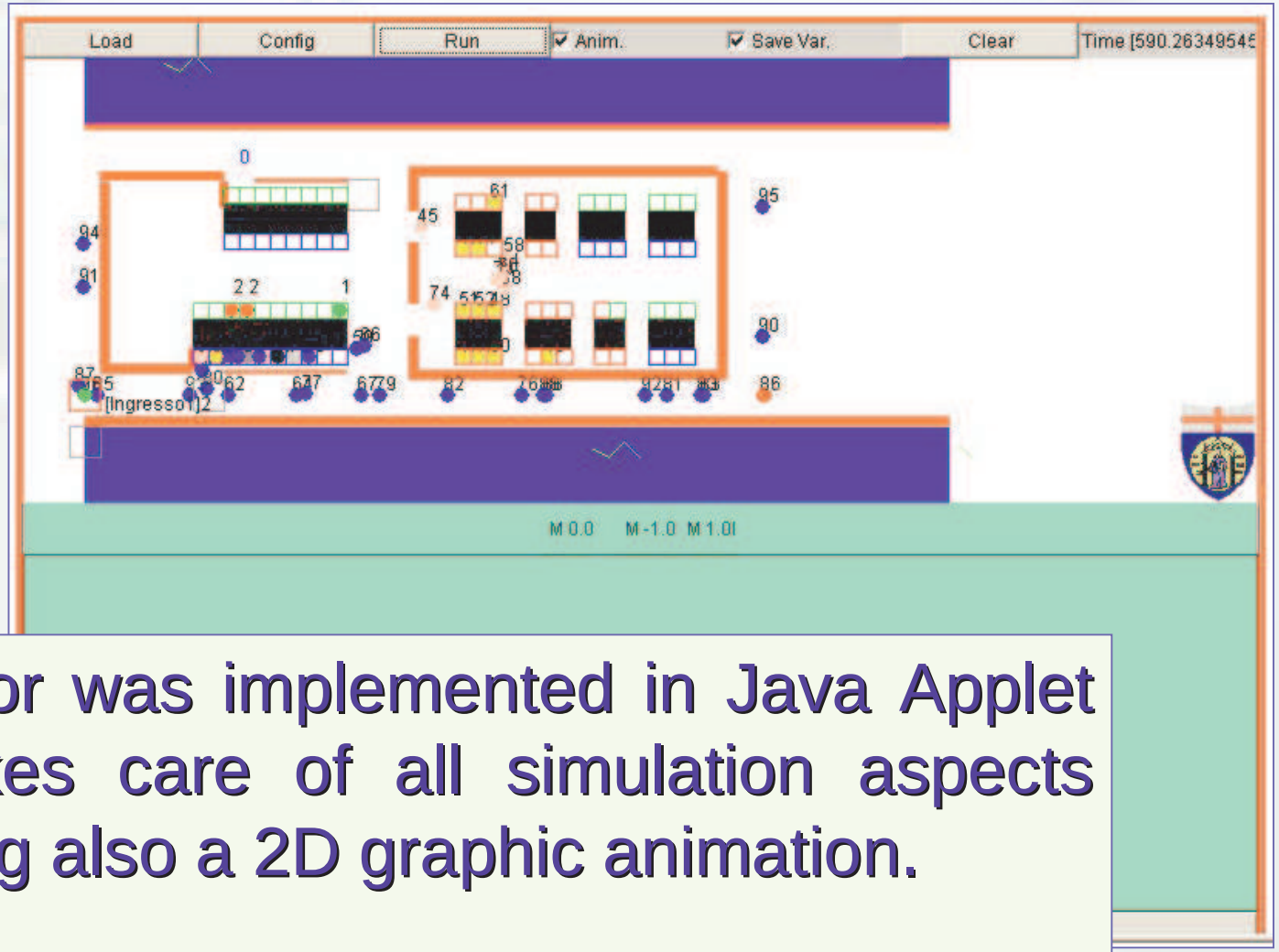
- **Personnel Grouping**
- **Dividing Group if necessary**
- **Task, Operation Locations and Reference Path**
- **Avoiding fixed and mobile Obstacles**
- **Avoiding People**





Simulator: *Similo*



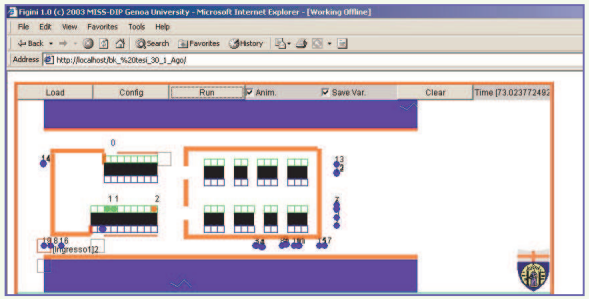


Simulator was implemented in Java Applet and takes care of all simulation aspects providing also a 2D graphic animation.

Global Architecture

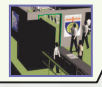
Simulator

- Java Based and Platform Independent(es.: Windows, Unix)
- Web integrated
- Highly Customizable and Modular Approach
- Integrated with 2D Fast-Time, CG 3D Post Processing and DOE/RSM Output



Postprocessor

- More Realistic Visualization
- Better “insight” on the Model
- Support for VV&A



Decision maker

- Synthetic Data and Information
- “high-level” Phenomena Perception
- Cross-check for Macro Critical Component Identification

DOE, RSM

- Parameter Analysis
- Target Function Analysis and Run
- High Computing Performance

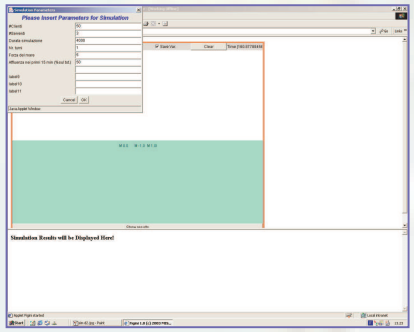
Analist

- Full Data Required (i.e.: tables and DBases)
- Compatible output with Analysis Packages

3D Post-Processing

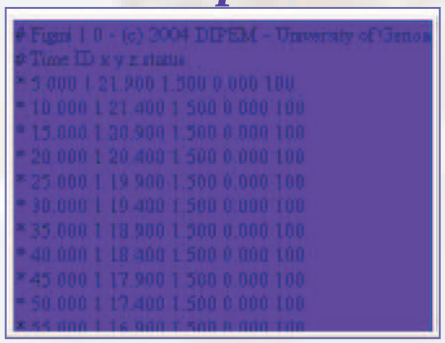
Post Processing 3D is based on:

Java Applet



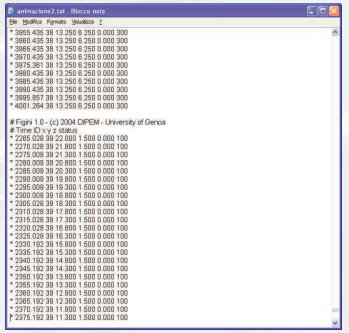
Simulator I/O

JavaScript



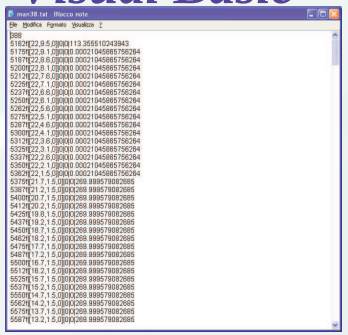
HTML

Windows API



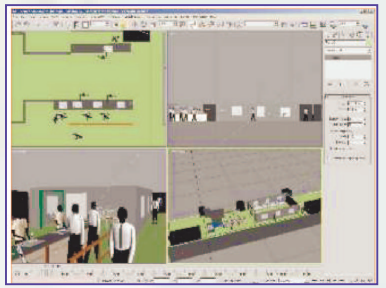
ASCII

Visual Basic

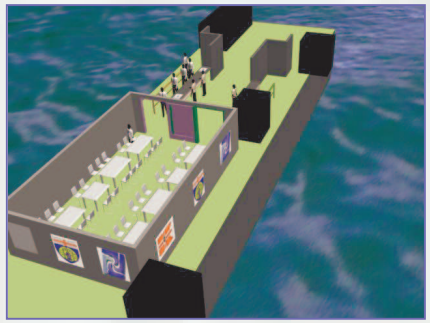


ASCII

MaxScript



3DS Max



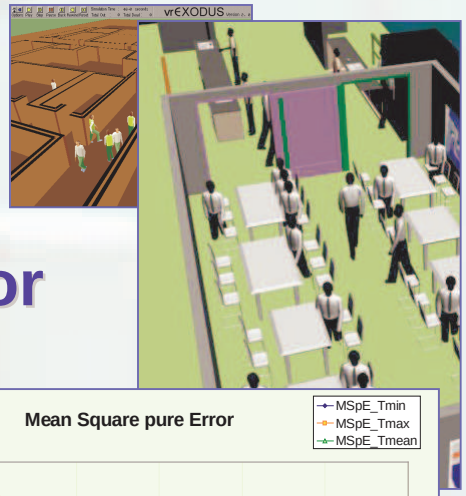
AVI/MOV

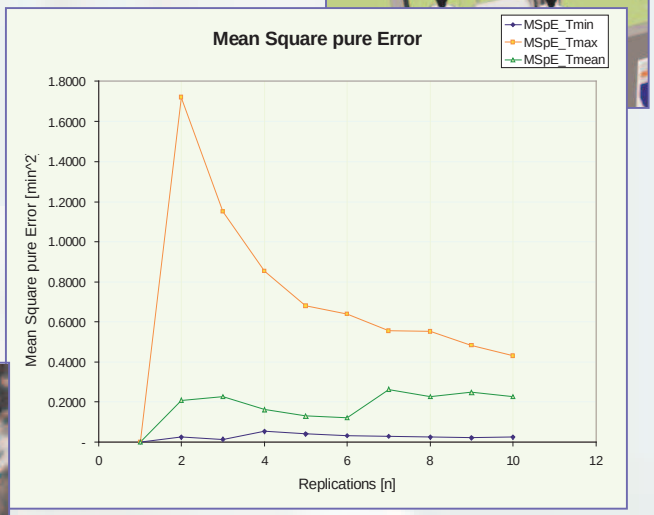
Simulation operates in Applet Java exporting data on the same HTML page; this allows remote user to generate a database for 3D rendering

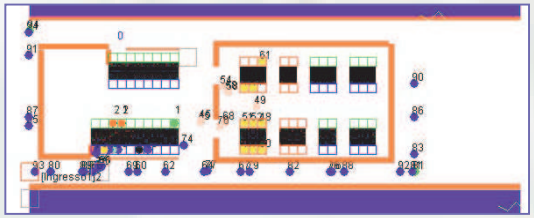
VV&A

Model VV&A was based on the following techniques:

- **Simulator White Box Tracking**
- **2D Animations Check on Simulator**
- **3D Animations Check on Post-Processor**
- **Black Box Analysis on Results**
- **MSpE Temporal Evolution**
- **Comparison with Other Models (i.e.Exodus)**
- **Comparison with Real Data**

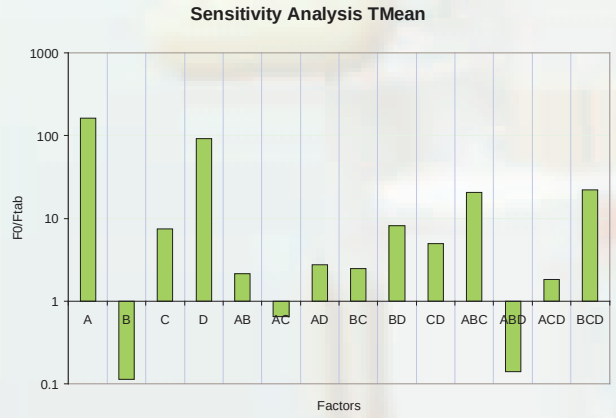


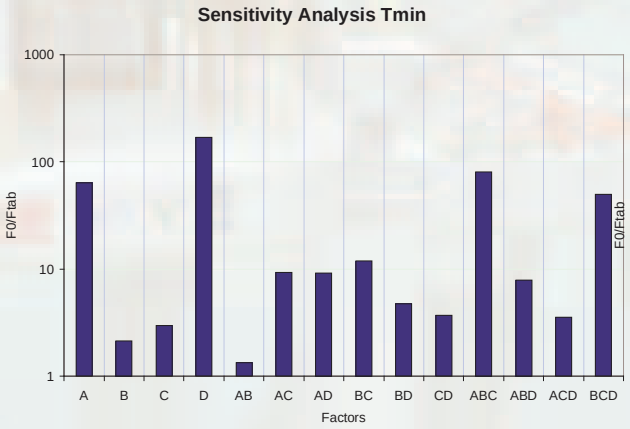


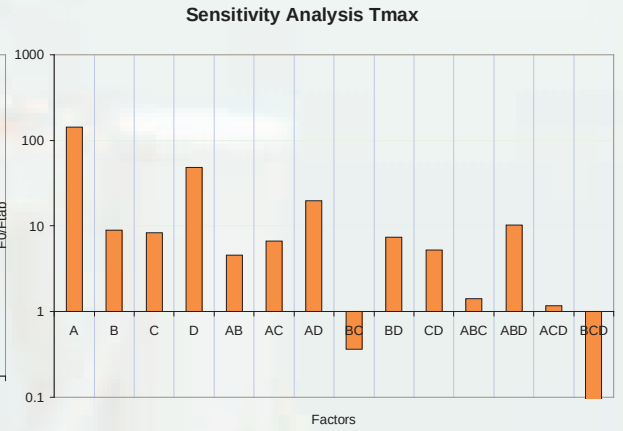


Sensitivity Analysis

Sensitivity Analysis allowed to correlate factors and parameters with target functions





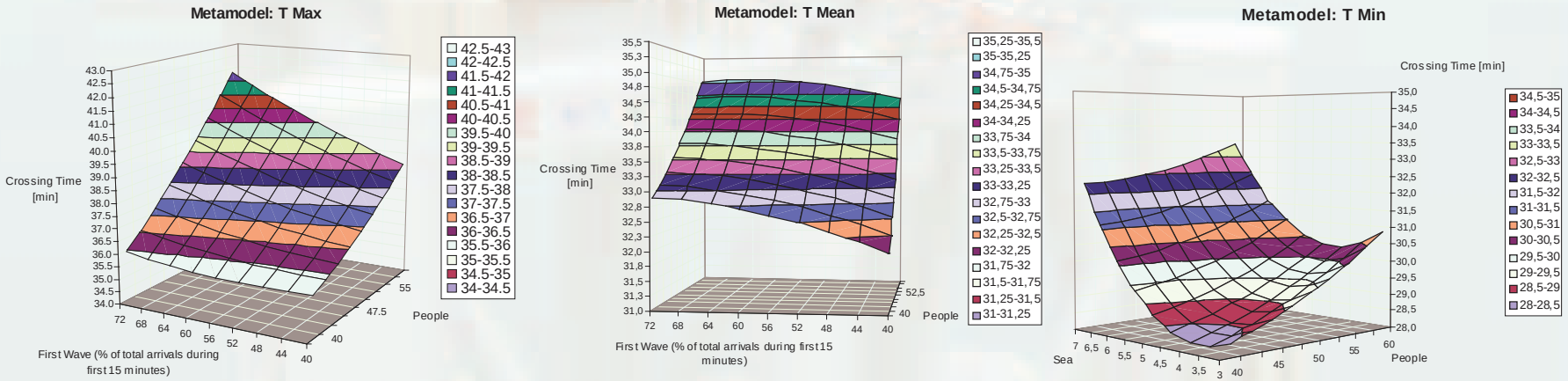


The experimental analysis was focusing on lead times (average, minimum, maximum) by a Composite Central Design 2^4

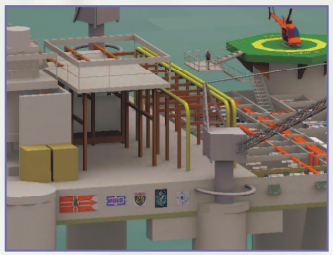
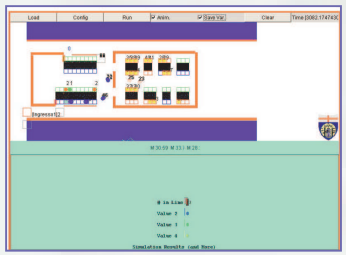
Level	Low	Mean	High
A (Crew)	40	50	60
B (Servers)	1	2	3
C (Initial Arrival Rate)	30	50	70
D (Sea Factor)	3	5	7

Response Surface Methodology & SBDVP

By RSM methodology it was possible to support Virtual Prototype of new mensa



Metamodels based on sul CCD (Central Composite Design) have been statistical validated

Conclusions

- It was possible to verify the effectiveness of the proposed approach on Complex Cases
- The Case study allowed to evaluate the costs/benefits related to this application area
- Similo simulator is a good reference for the development of new SBDVP tools for Cook-Rooms in vessels and other on-board processes