CASSIDIAN

A Comparison: Training & Simulation vs. Games

How game technology is currently applied at CASSIDIAN

Detlef Schiron, Head of Simulation Infrastructure

08.11.2011

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Introduction

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Introduction
World of EADS

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Introduction
EADS

- Main Divisions of EADS
  - AIRBUS
  - EUROCOPTER
  - ASTRIUM
  - CASSIDIAN

- Business Data from 2010
  - ~122.000 employees worldwide
  - Main countries:
    - France, Germany, Spain, UK
  - Revenues ~45 bill. €
  - Order Backlog ~448 bill. €

Introduction
The Speaker

- Detlef Schiron
- Born in 1972, married, two children

- Computer science studies in Erlangen, Germany
- Focus on computer graphics and photorealistic image synthesis

- Started @ EADS in 1999 in the simulation department
- Since 2002 responsible for the Simulation SW & HW Infrastructure

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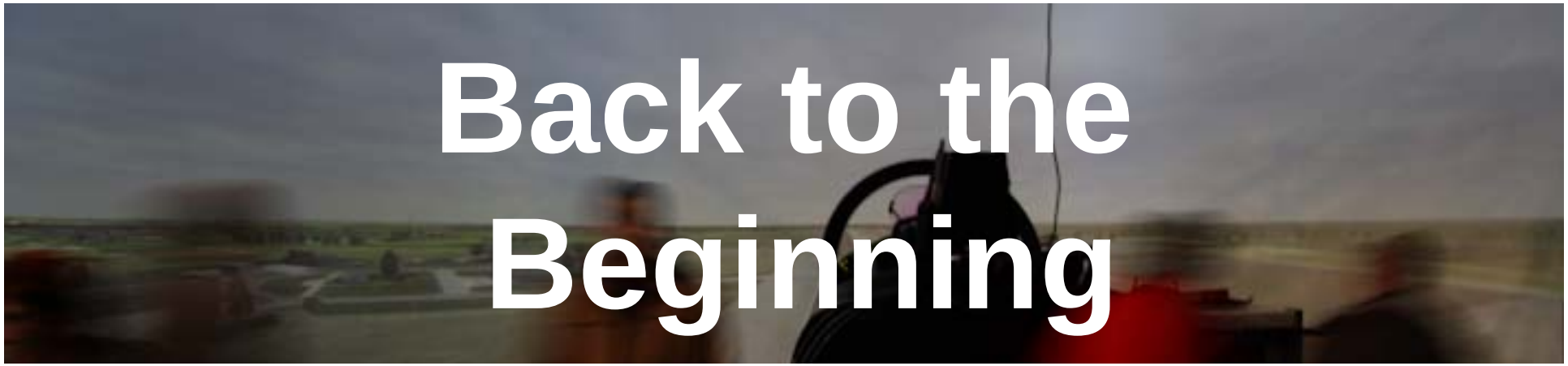
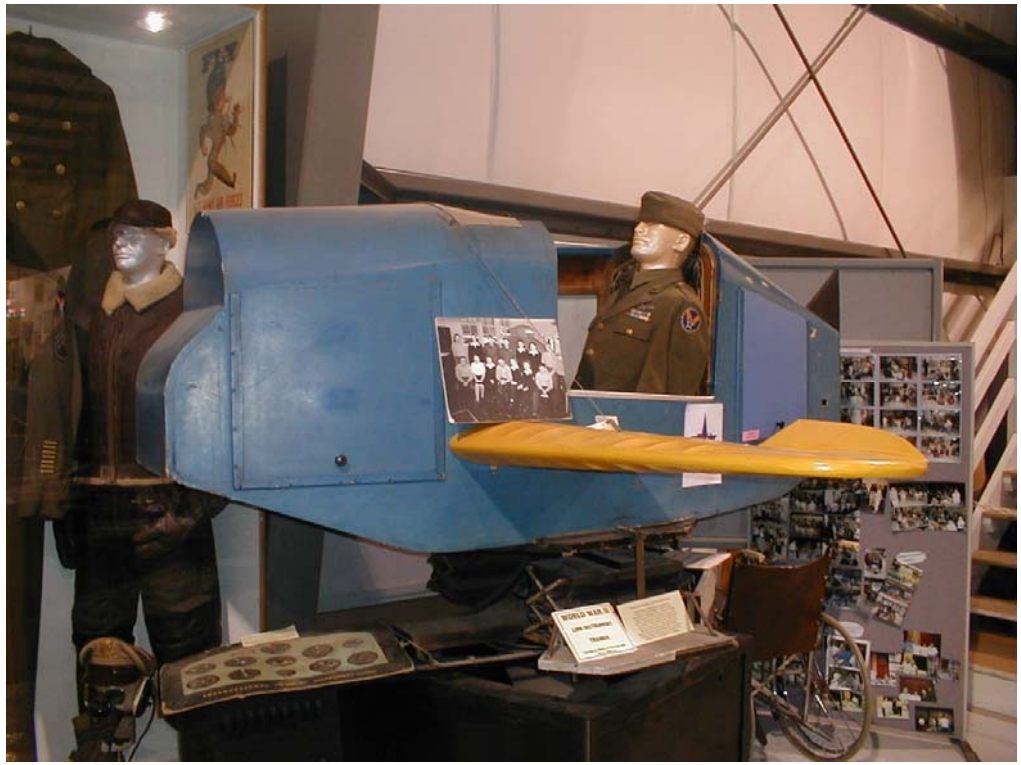
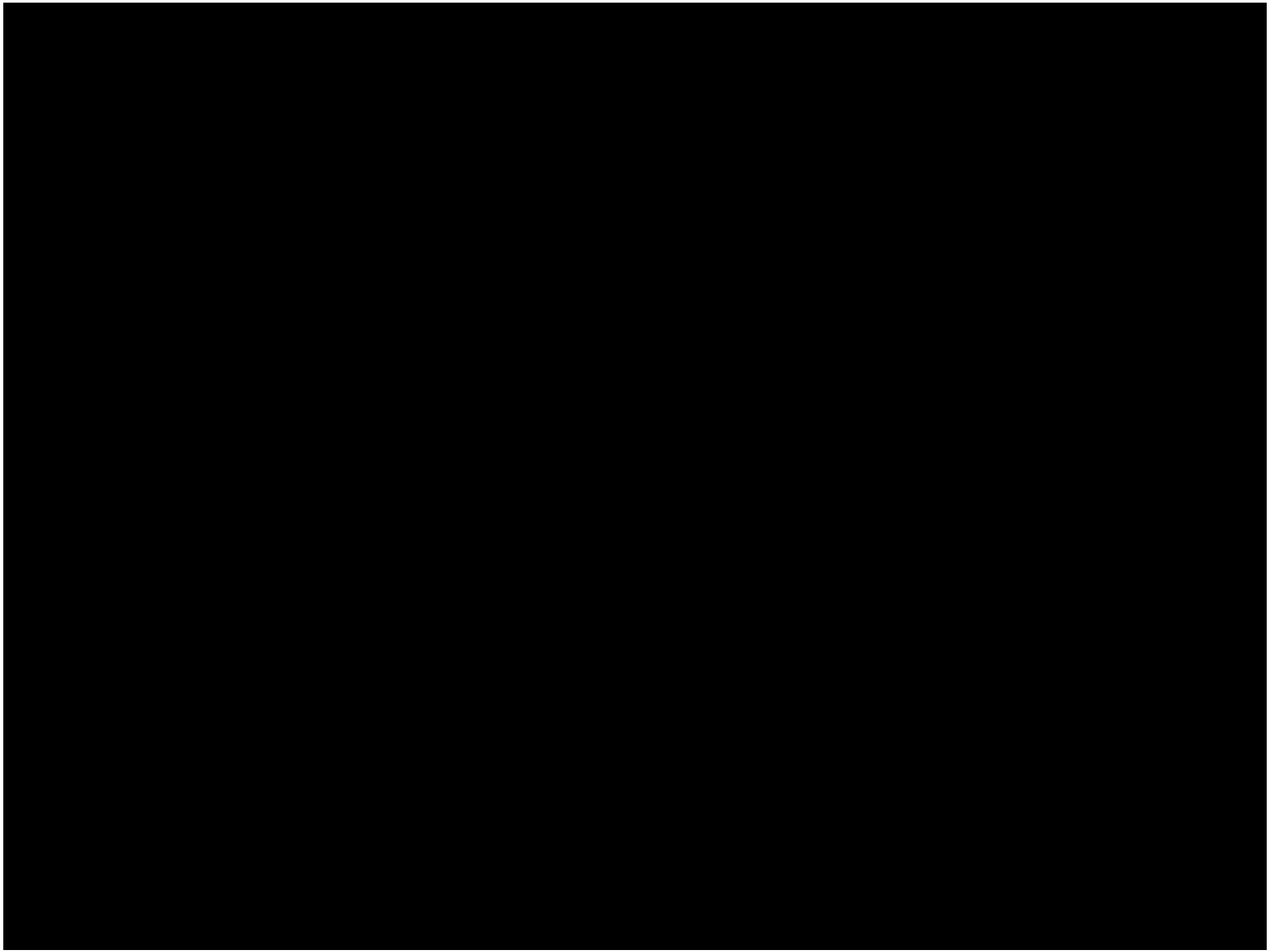


Back to the Beginning

History
Simulation : The Beginning - 1929

- The Link Trainer
  - First flight simulator in history
  - Training of flying by instruments



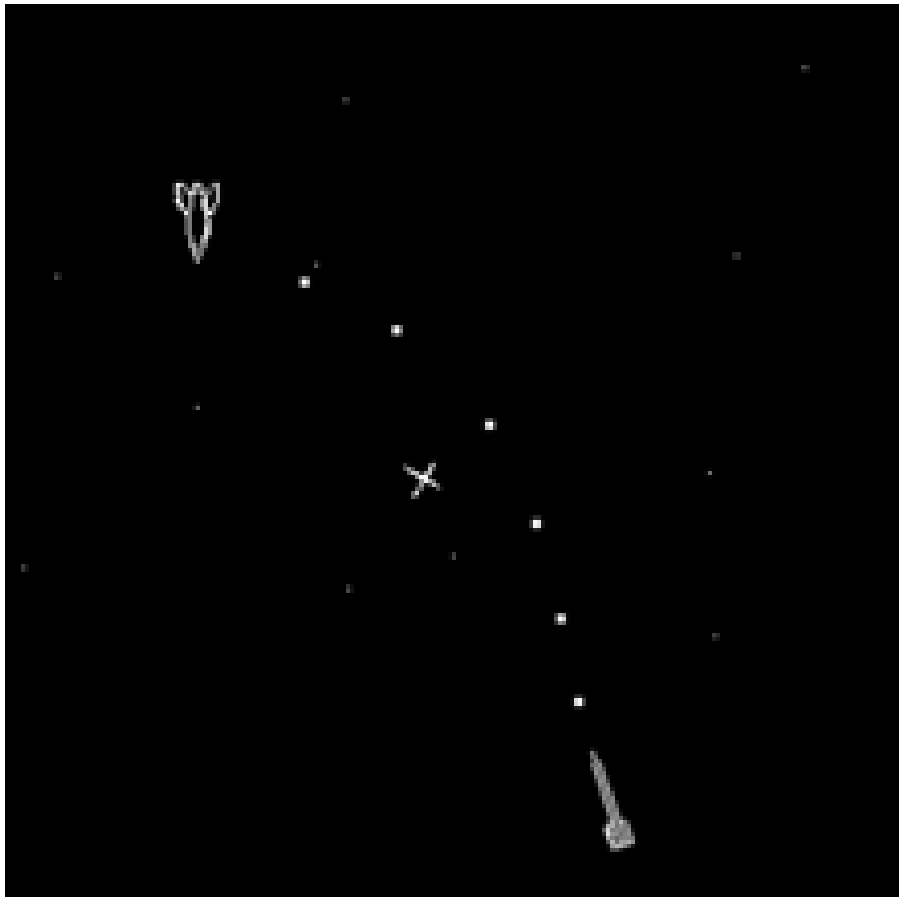


History
The first visual system for simulators – 1960s

- Model Boards

History
Computer Games - 1960s

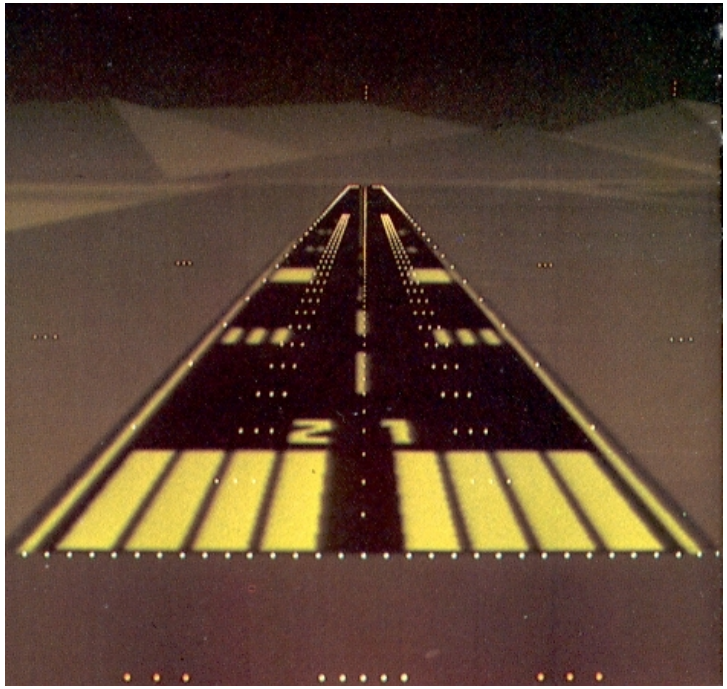
- SpaceWar!



History
1970s

- Gouraud shaded polygons
- Light points

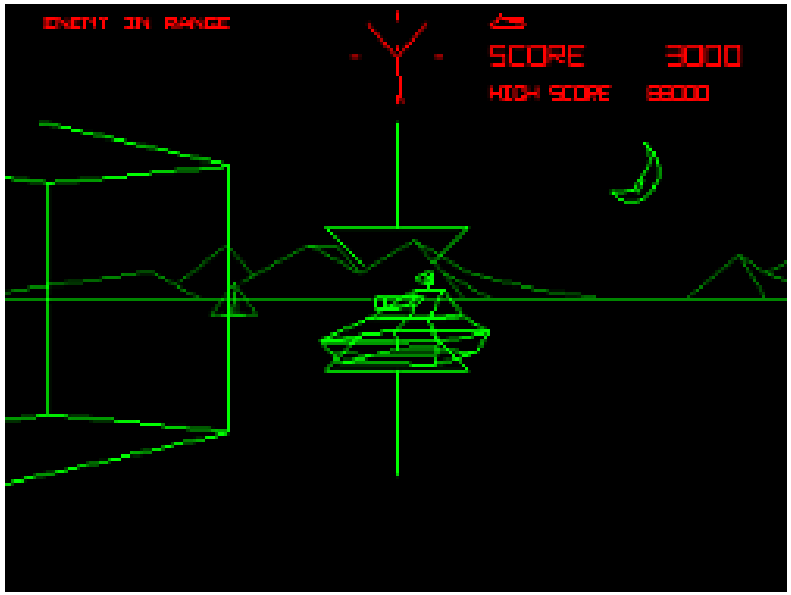
- Lines

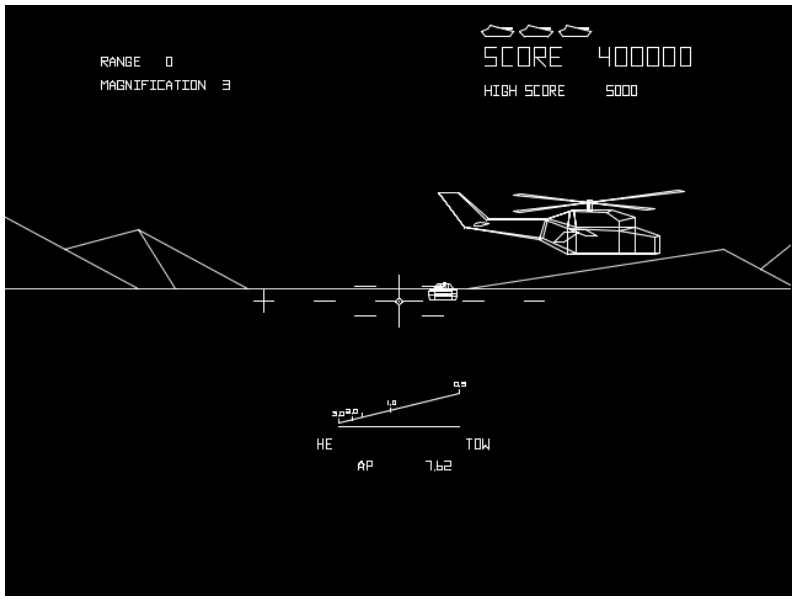


History
1980: The first serios Game: Battlezone

- „Battlezone“
- Game by Atari

- „*The Bradley Trainer*“
- Serious game for U.S. Army
- Designed for gunner training for the Bradley Fighting Vehicle





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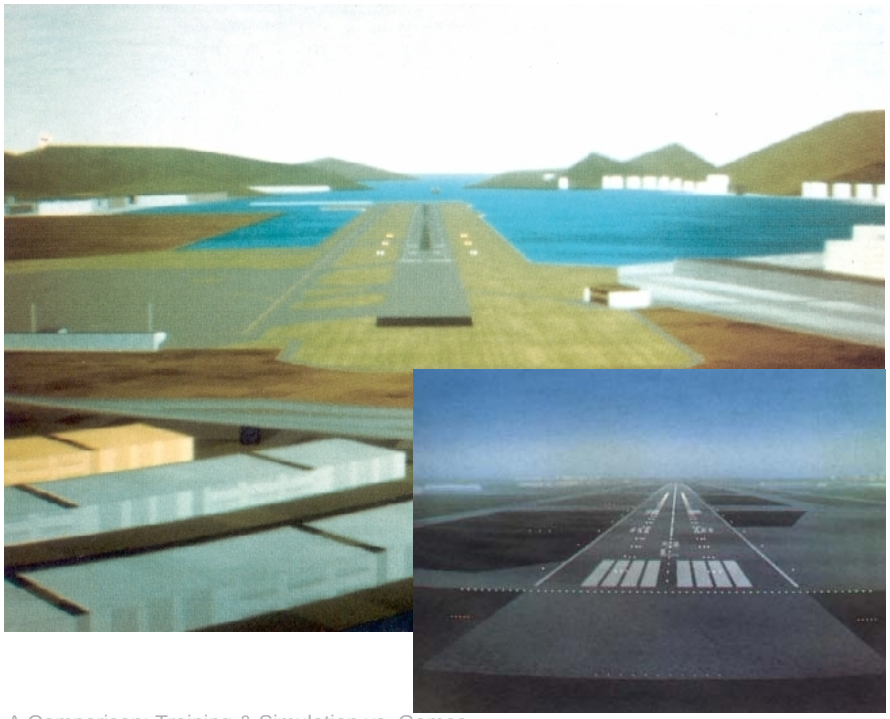
History
1980s

- Gouraud shaded polygons
- Textures
- Light points
- Atmospherical effects

- Polygons
- Lines



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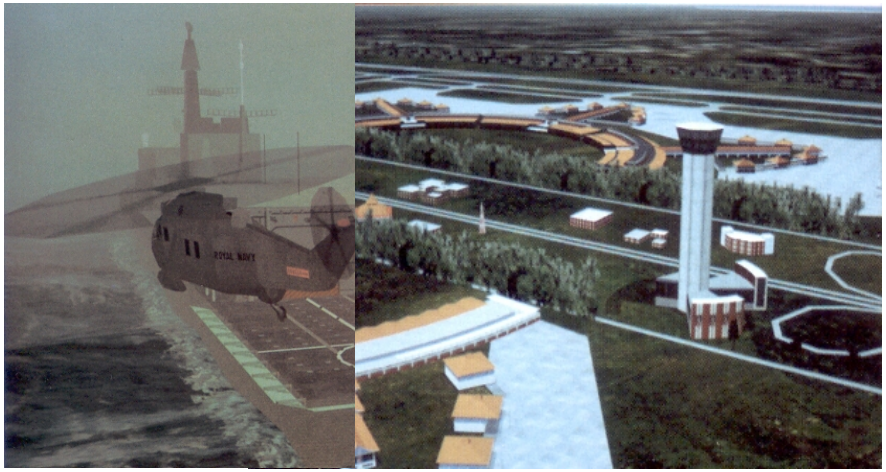
History
1990s

- Atmospheric / weather effects
- Vegetation
- Transparency levels
- Moving textures

- Gouraud shaded polygons



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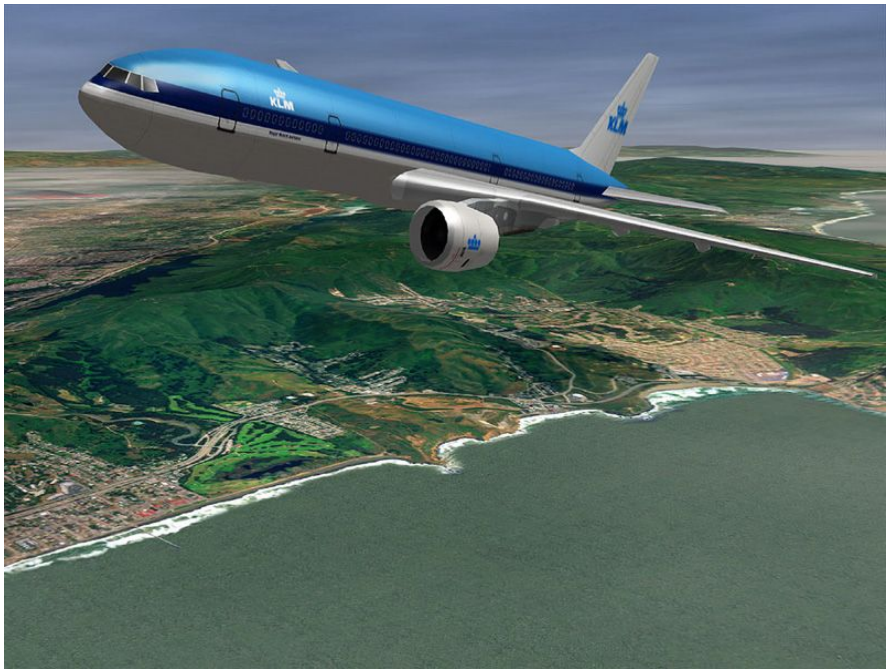
History
2000s

- Phong shading
- Whole world database
- Usage of satellite photography
- Multi layer textures
- 3D sea state

- Usage of satellite photography
- Multi layer textures



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History
2005

- Shaders

- Shaders

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History
The Present

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Simulations & Games

Simulations & Games - Similarities and Differences
Similarities

- Interactive combination of graphic, sound, I/O
- High End Visualization
- Aiming for immersion
- Embedded in a virtual environment (A.I.)
- Strong tendency for networking

Simulations & Games - Similarities and Differences
Differences

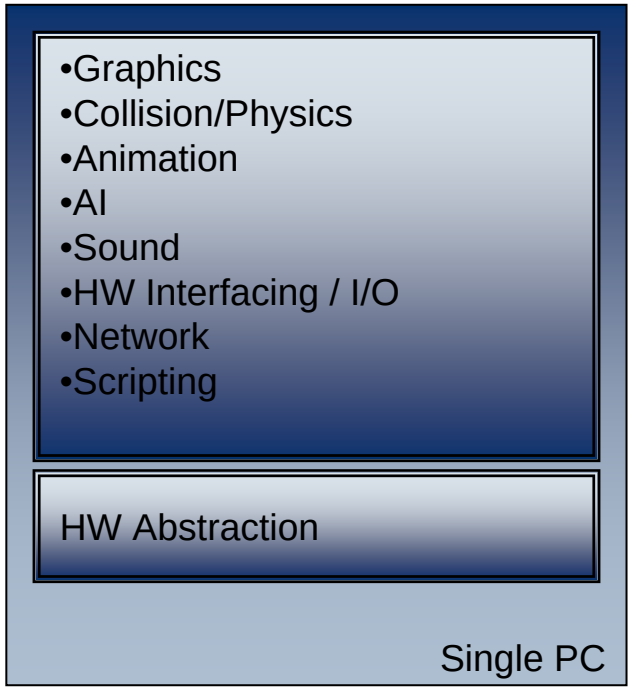
Simulator

- as realistic as possible
- for training
- interoperable
- distributed / networked (LAN/WAN)
  - using standardized (military) protocols
- analog / digital low-level I/O to a variety of sub-systems from different suppliers

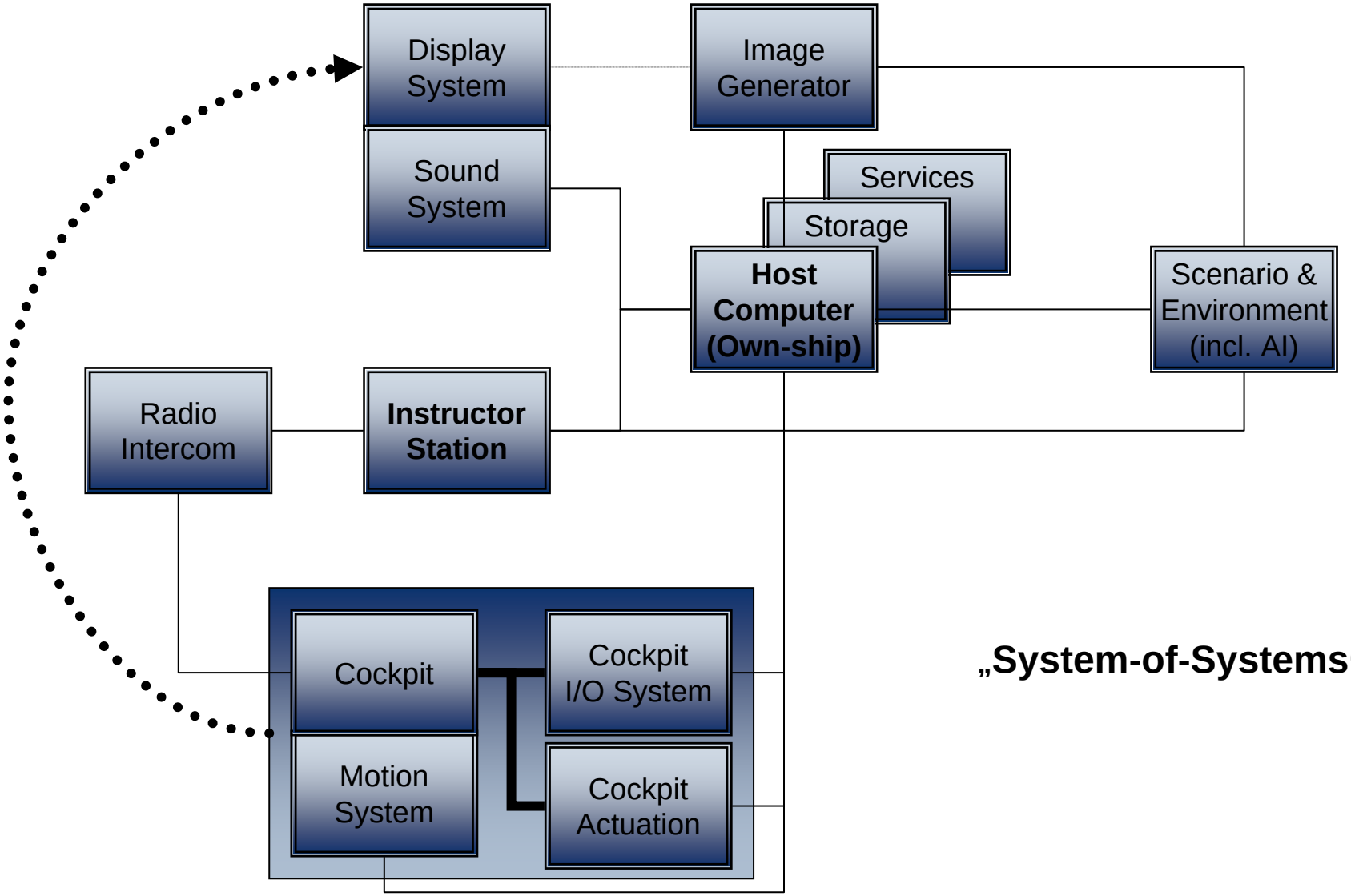
Game

- looking/feeling as realistic as possible
- for fun
- runs on a single system connected to standardized I/O equipment

Architecture of a Computer Game



Architecture of a Flight Simulator



„System-of-Systems“

Simulations & Games
Business Perspective

(Flight) Simulator

- Development costs: 5-20 M€
- (Initial) development time 2-4 years
- HW portion: 50-70%
- # of Suppliers / Partners 5-20
- # of customers 1-3
- Support phase: 10-20 years

Game

- Development costs: 20 M€
- Development time 2-3 years
- HW portion: 0%
- # of suppliers / partners 5-10
- # of customers 1-5 Million
- Support phase: 1-2 years

Trends in S&T

Trends and Challenges in Simulation and Training (1/2)

- Standardization
  - Networking (e.g. DIS/HLA)
  - Data and protocol formats (e.g. Open Flight, CDB, CIGI, SCORM)
  - Meta Languages e.g. for behaviors, tactics and complete scenarios
- Interoperability
  - Joint Training Mission
    - Air Force / Army / Navy
    - For allied and coalition forces
  - Distributed Training
- Increasing complex scenarios
  - Because of increasingly complex / powerful / flexible equipment
  - Need for more realism and/or immersion
  - Shifting of real training to simulators due to cost constraints or practicability

Trends and Challenges in Simulation and Training (2/2)

- Centralization of services for all participants of networked simulation setups
  - Environment / terrain / weather server
  - Scenario server
- Rapid / automatic data base generation
- Simulation and Mission grow together
  (e.g. mission briefing, re-hearsal, de-briefing accomplished with simulation means)
- Decreasing customer budgets

Wish List

Wish List (1/2)

What would foster the use of Game Technology in Simulation & Training

- Support of typical standardized IG features
  - Large area terrains combined with complex building structures
  - Guaranteed response times (60Hz! Load balancing!)
  - Multichannel visualization and synchronization
    (timely and content-wise: weather, special effects, AI, …)
  - wind and cloud layers, storm cells, volumetric clouds
  - “calligraphic” lights for runway lighting and cultural lights
  - stars, sun, moon, time of day, time of year
  - sun set, sun rise, atmospherical effects
  - rain, snow, haze, fog, ground fog in variable strength and density
  - Height-above/of-terrain, line-of-sight

Wish List (2/2)

What would foster the use of Game Technology in Simulation & Training

- Thorough support for (military) simulation standards
- Built-in record/replay
- Scalable & tunable AI (w.r.t. number and quality)
- Seamless integration of AI players from other sources over the network
- Repeatability
- High quality sensor simulation or having interfaces to integrate them (IR, radar, electronic warfare in general)

WHY ?

Why is the defense industry so interested in game technology?

- High value for the money

- High-end visualization
- Development backed and driven by the huge game industry
- Game industry = very innovative industry

- High degree of pre-integration but still having an open architecture

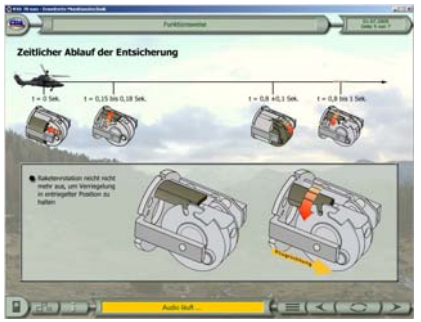
Game Technology at CASSIDIAN

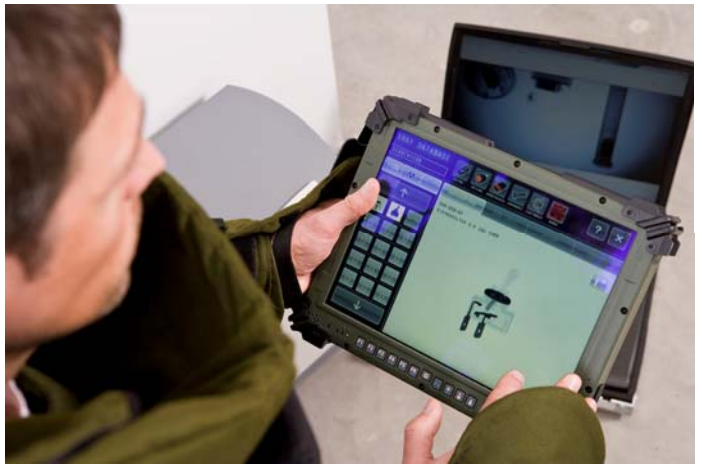
HEAT

HEAT = Holistic Explosives and Ammunition Training

- CASSIDIAN approach for comprehensive training means for personnel that is potentially in contact with explosives and ammunition:
  - Classroom Training
  - Computer based Training
  - Simulations

- Mission supporting tools





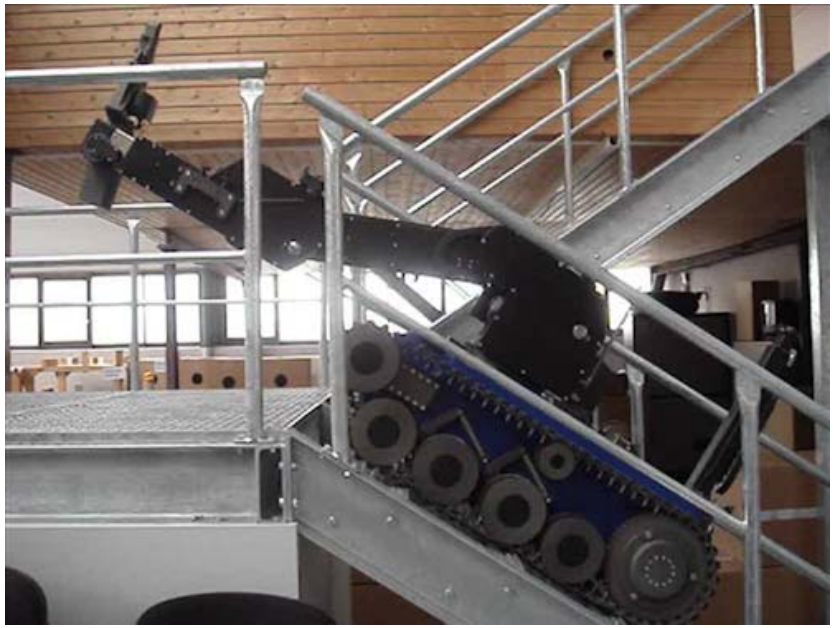
HEAT – RobotSim

- First Version from the late 1990s based on
  - SGI OpenGL Performer
  - Vortex from cmLabs
  - Linux
- 2008 a refurbished system should be developed
- The following requirements should be addressed
  - advanced state-of the art visualization
  - esp. multiple real-time shadows
  - cost effective
  - flexible & extensible architecture
  - development chain supporting tools

HEAT – RobotSim
A Game Technology based Simulation

- „Classical“ simulation industry was not able to fulfill these requirements
- Game Industry seemed to be able to do…
- After smoothing all resentments within CASSIDIAN the Havok Vision engine has been chosen, since it fulfilled the requirements best.

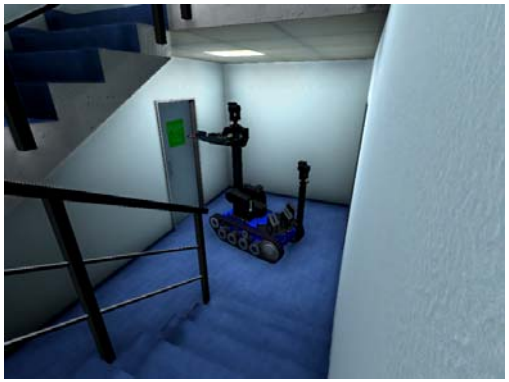
- The product could be released in-time, in-cost and in-quality



HEAT – RobotSim
How it was done…

- Vehicle was exactly modeled
- Track model was simplified
- Gripper is full functional
- Strong Cooperation with manufacturer
- Physical model had to be iteratively improved by tuning the physical parameters to match reality
  - friction coefficients
  - actuator torques
  - stiffness / compliance of manipulator parts
  - damping parameters
  - safety clutch models
  - gripper force propagation
  - parameters of numerical solvers

HEAT – RobotSim Impressions



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HEAT - Conclusion

- The usage of the Havok Vision engine allowed to realize completely different products
  - to be developed by the same people
  - re-using the same assets
  - in different configurations of the engine

- Lessons Learnt:

  - Game technology can make a significant added value to simulation and training by
    - Saving development time and costs
    - Increasing the quality of the training products
  - But
    - It is not a silver bullet
    - It has to be carefully selected
    - It has to solve a problem or shortcoming that you actually have

FAC/FO Training
Definitions

- The Forward Air Controller (FAC) is a qualified soldier who, from a forward ground or airborne position, controls aircraft in close air support of ground troops

  a.k.a. JTAC = Joint Terminal Attack Controller

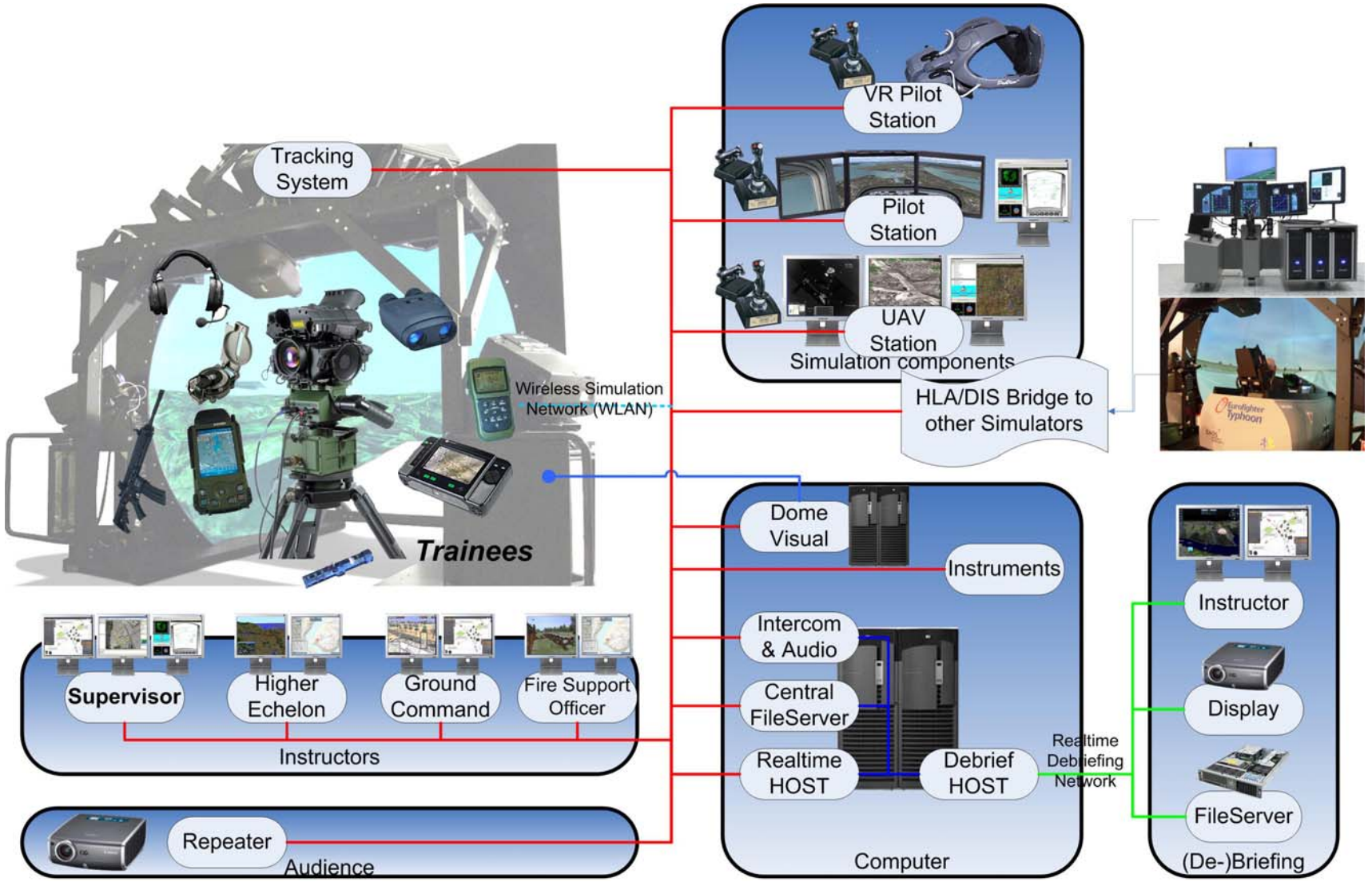
- The Forward Observer (FO) is an observer operating with front line troops and trained to direct and adjust ground or naval gunfire and pass back battlefield information.

- FAC/FO Team a.k.a. Joint Fires Support Team

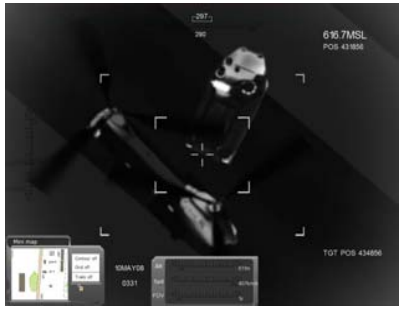
FAC/FO Training Requirements

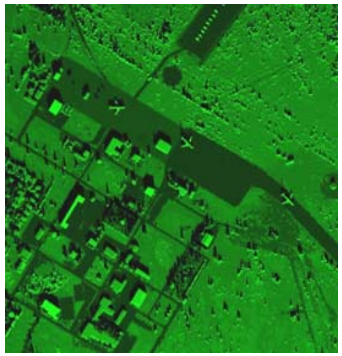
- A FAC/FO training system shall fulfill the following operational requirements:
  - Allow heavy fire from a variety of effectors from sea, air and land
  - Conduct training with simulated instruments and with instructors as role players
  - Offer during- and after- action review capability
  - Show a realistic picture of the enemy and the combat environment
  - Cost efficient / COTS based solution

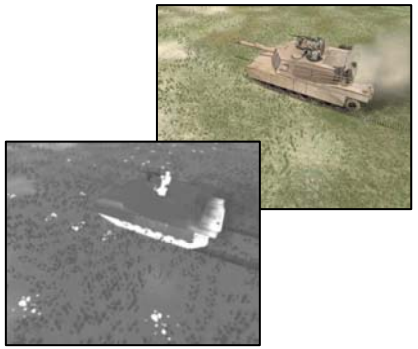
FAC/FO Training
System Overview

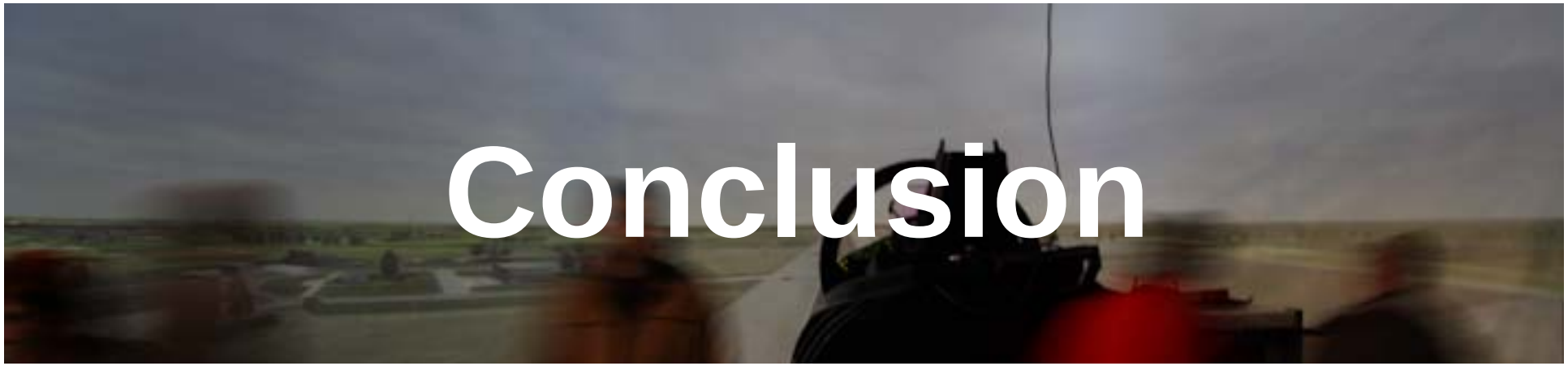


FAC/FO Training
Sensor Impressions









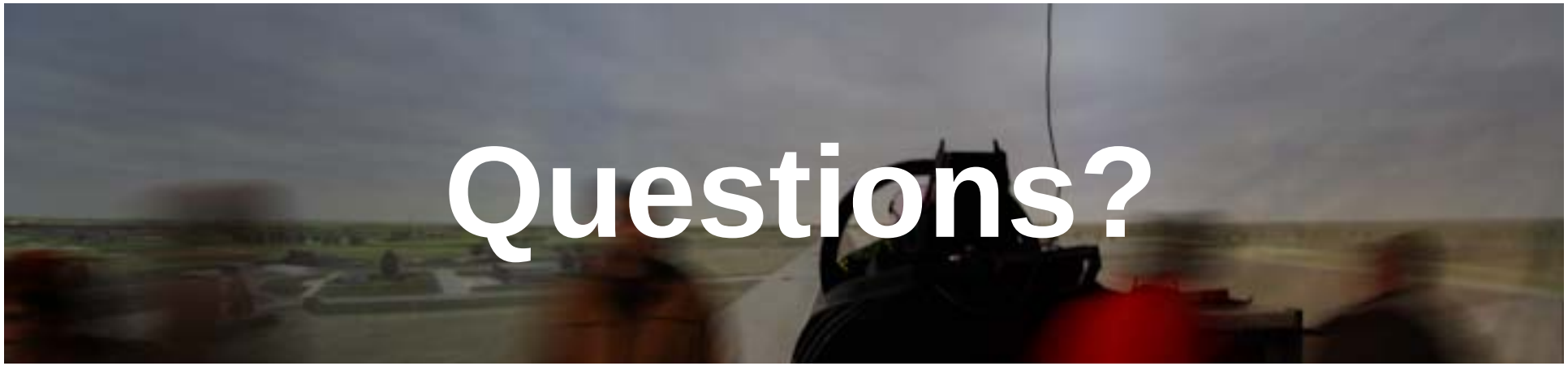
Conclusion

Conclusion

- Today's soldiers have grown up with computer games. They expect the same visual quality in multi-million $ simulators as they know it from the games they play at home.
- Fulfilling this request would bring an reasonable increase in acceptance and engagement.
- Engagement means involvement which will dramatically increases the training success.

- Training success is the service for what our customers in the end pay for.

You can support us!



Thank you for your attention!

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