

# VR Application Prospects in the Ship and Maritime Domain

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# Proposition

Virtual Reality offers powerful interaction capabilities.

This discusses the mapping from these capabilities to applications either existing or emerging within the Ship and Maritime domain.

Maturing VR technologies are considered according to fitness for existing and new applications.

Evidence is provided about the removal of technical and cost obstacles barring adoption of such systems among the Ship and Maritime domain.

Applications of experimental and production grades are briefly presented and discussed.

# Virtual Reality?

Jaron Lanier in 1985:

"Virtual Reality is the use of computer technology to create the effect of an *interactive* three-dimensional world in which the objects have a *sense of spatial presence*."

Articulates a coherent appeal to **diverse senses** to create a feeling of sensorial *immersion*.

***Virtual environments***: applications providing the users that sense of immersion.

# Virtual Reality History

Initially a overwhelming fascination about VR technology obfuscated in developers minds the value of simplicity, effectiveness, robustness, and price consciousness, questioning VR credibility.

Interestingly, in the beginning there were quite effective *virtual environments* that were only text based...

# Virtual environments and sensorial immersion

The centre of perception is the mind, not senses.  
And the mind can be induced into *atmospheres* by appropriate techniques.

Drama is one such technique, and well exercised has long been known for inducing the audiences (the users) into an awareness mode called ***suspension of disbelief***.

# Immersion and suspension of disbelief

How does suspension of disbelief compare to immersion?

(Is this important?)

What has been important to VR developers in the successful computer game industry?

Drama techniques are cheap on hardware, the opposite of fully immersive VR

But expensive in talent for conceiving the virtual environments

**Just assume Virtual Reality is a knowledge domain with a subject encompassing both virtual environments and the interaction computer technologies.**

# Technological maturity driven by entertainment industries

Market sizes are appealing (to say the least)

Computer games sales surpassed the movie industry (Gartner Group)

Important resources are being fed to actors in such markets, and technological achievement is impressive

Commodity 3D parts evolved to the point to compete with high-end specialised components

SGI's just announced Onyx4 Ultimate Vision computer graphics system, which is based on several ATI R300

Immersive hardware has become commodity. Even haptic devices. Inexpensive force feedback joysticks and driving wheels have been available for years.

# VR strengths

Powerful interaction

Independence from location

Independence from scale

Collaborative friendly



# VR weaknesses

Cost

Complexity

Lack of specialists

Persisting image of exotic, far-fetched, fanciful

# Current application classes

Simulation training

Simulation design

Marketing and selling

Disparate scale applications

- Geographic Information Systems

- Nano-manipulation

Integrated systems for monitoring, analysis, management and control

Forensic simulation

Societal Domains

- Education and learning

- Art and creativity

- Digitally synthesised video and computer games

# VR in the Ship and Maritime domain current and prospective

Ship Design

Integrated Information Systems

Simulation training

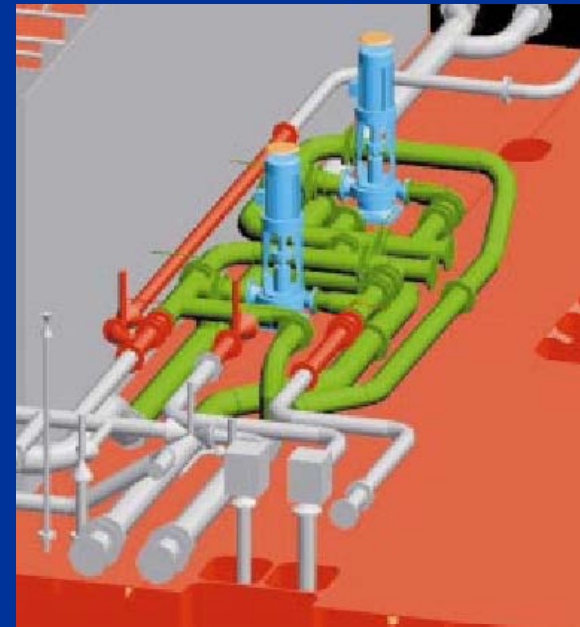
Marketing and selling

Naval Architecture forensic simulation

Augmented reality exploitation of mobile technologies

Real-time simulations embedded as shaders

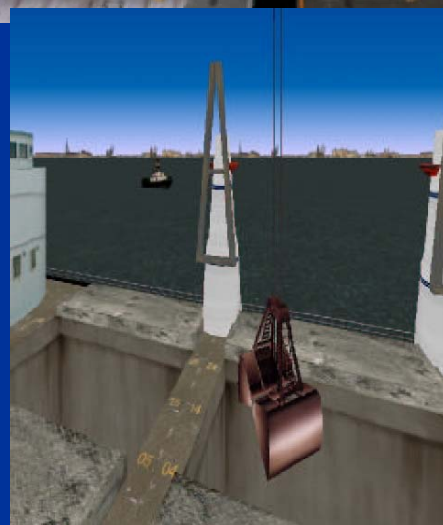
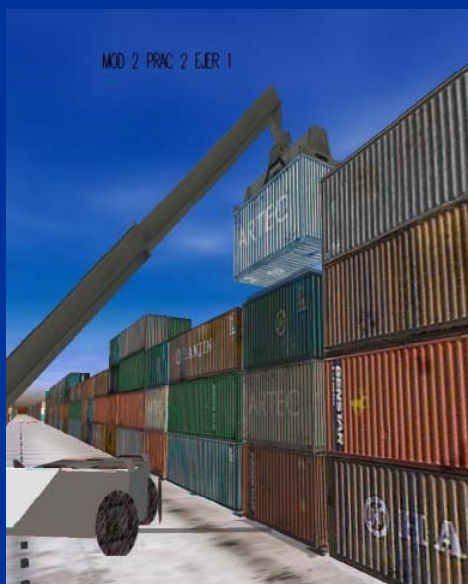
# Ship Design



# Integrated Information Systems



# Simulation training – Valencia Harbour Cargo Handling Simulator for training



# Real-time simulations embedded as shaders

Initial works have modelled simplified systems given the yet primitive hardware. Currently still restricted to 24bit and 32bit real precision.

Believable hydrodynamics where pursued before the availability of GPUs, with poor results.

Physical accuracy is now the target.

Published real-time methods solve the Navier-Stokes equations by numerical methods that exploit the power of GPUs for computing matrix algebra.

# Real-time simulations embedded as shaders

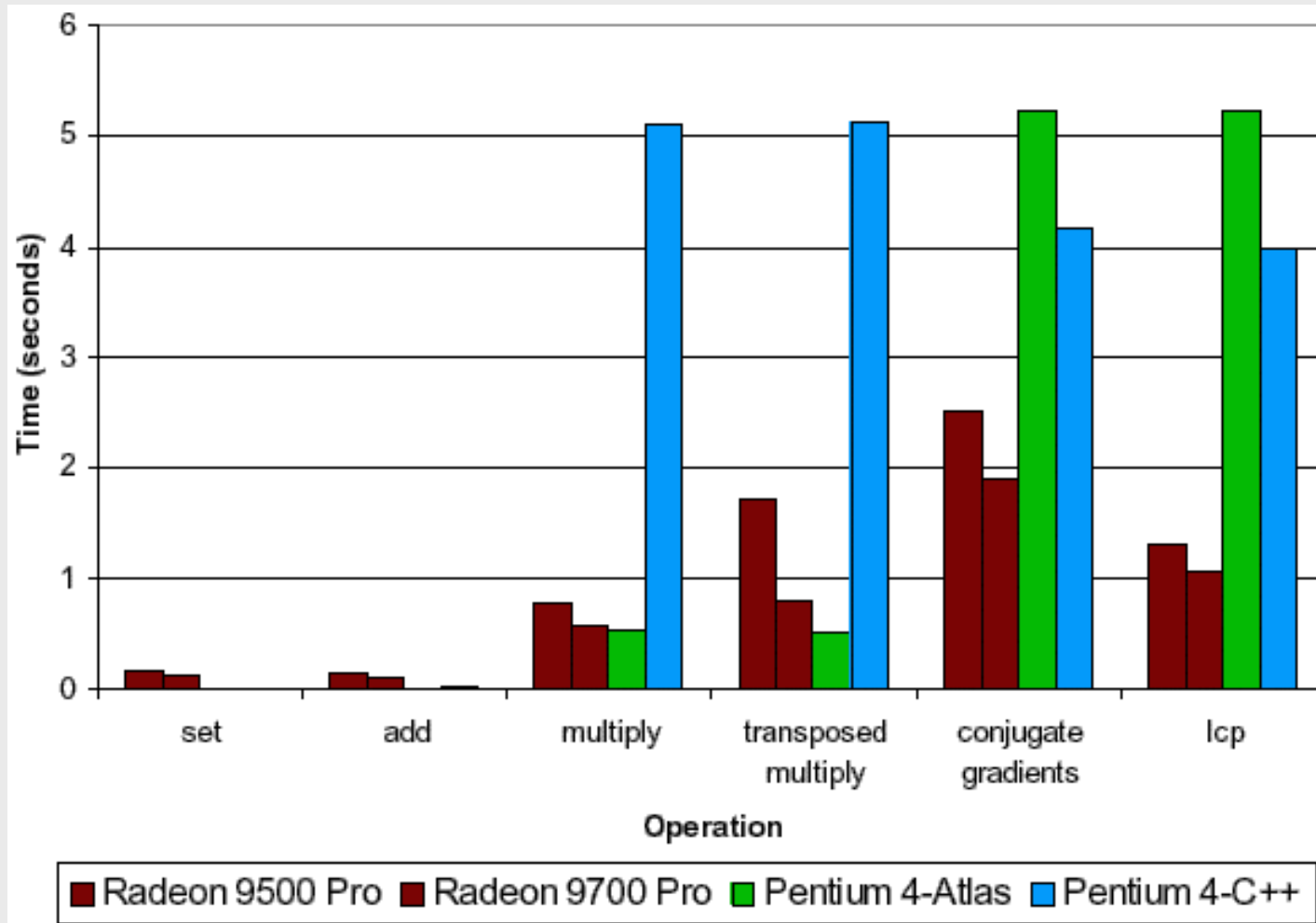
Profile of a current 3Dlabs product: P10 GPU, 512MB DDRAM, 20GB/s, 200GigaFlops, 1.2 TeraOps, 15 microseconds context switch, native virtual memory (improving programmability)

Reference: Intel Pentium4 3GHz **1GigaFlop**

However CPUs are much easier to program given  
much complete programming tool set  
generic architecture



# Real-time simulations embedded as shaders



# Real-time simulations embedded as shaders

The available computing power could allow real-time prediction of the dynamic behaviour of the vessel and eventually short-term environmental conditions

Some applications supported:

- High speed ship comfort and safety
- Control of platforms for helicopter and other aircraft for applications in the cruise shipping, military, fishing, oceanography, offshore resources, and others
- Control of working platforms in fishing, oceanography, and offshore activities
- Onboard comfort

# Augmented reality exploitation of mobile technologies

Augmented reality depends on technologies just maturing for mobile devices

Speculative short-term realisation: a head-set based on mobile communication technologies, with:

- High bandwidth communication

- Self-location

- OLED semitransparent stereo displays

- Quality 3D sound

- High capacity flash storage

- Powerful RISC CPU

- Coupled with a shading GPU

What can be done with it?

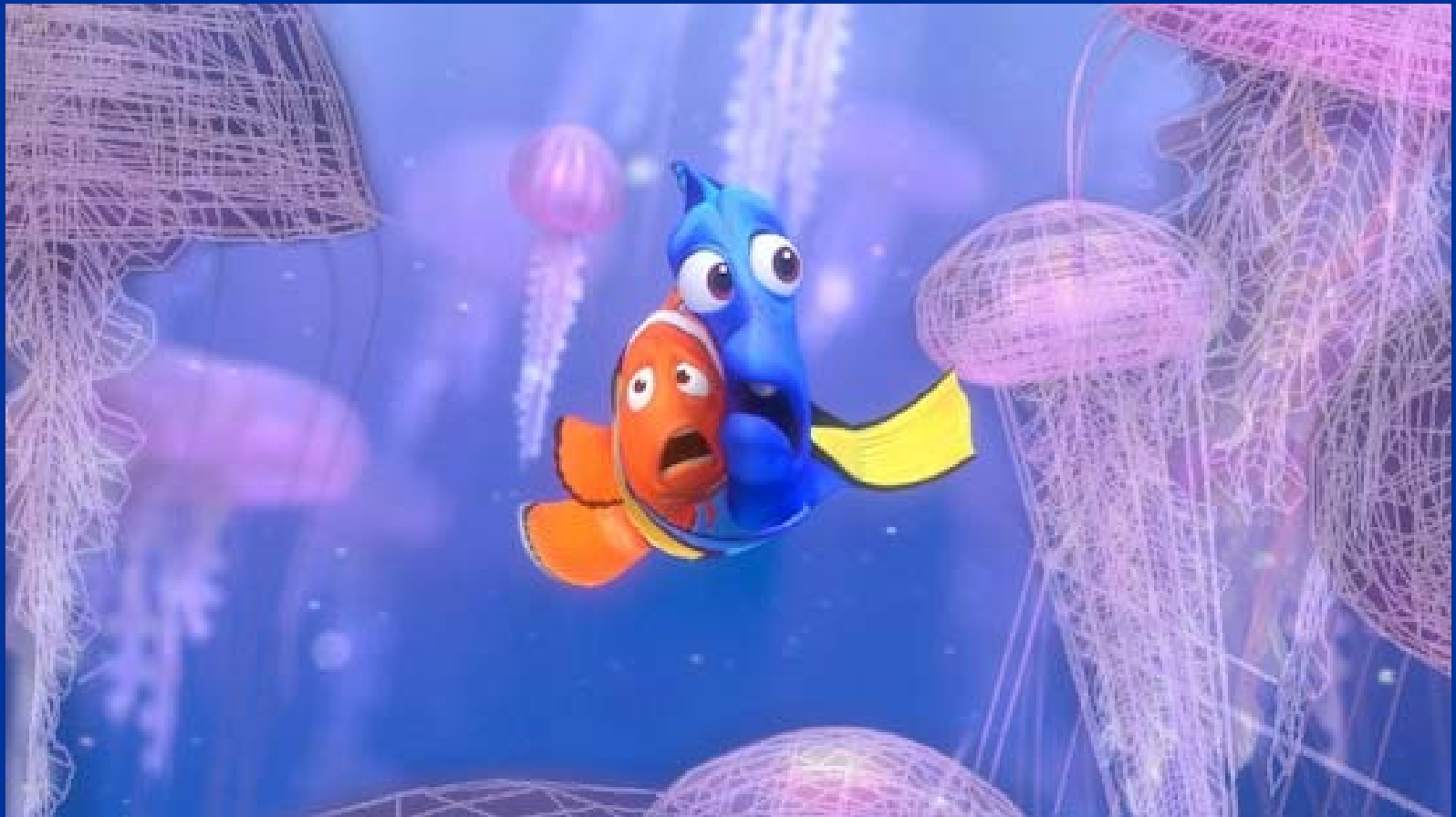
# Conclusion

The cross-pollination between Virtual Reality and the commodity markets of video games and mobile technologies is driving a surge of capable and inexpensive tools

Important technical and cost obstacles barring adoption of such systems in the Ship and Maritime domain have been effectively removed

Among other applications of experimental and production grades, physically accurate real-time simulation is appealing

Virtual Reality technology is no longer exotic. Its impressive capabilities, already pervasive in the society, are ripe for exploitation



(Pixar's Finding Nemo)

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