Virtual Reality: Basic Concept
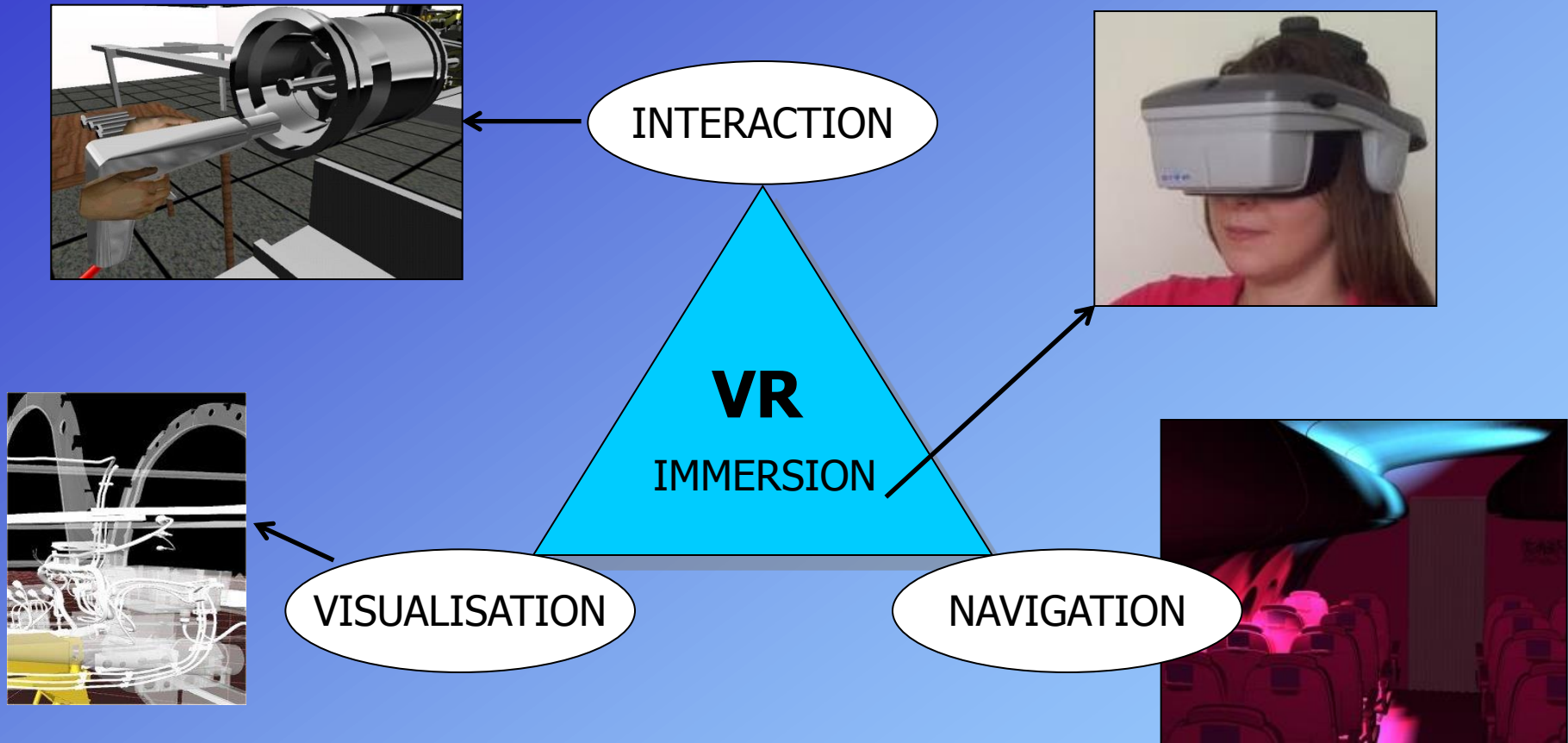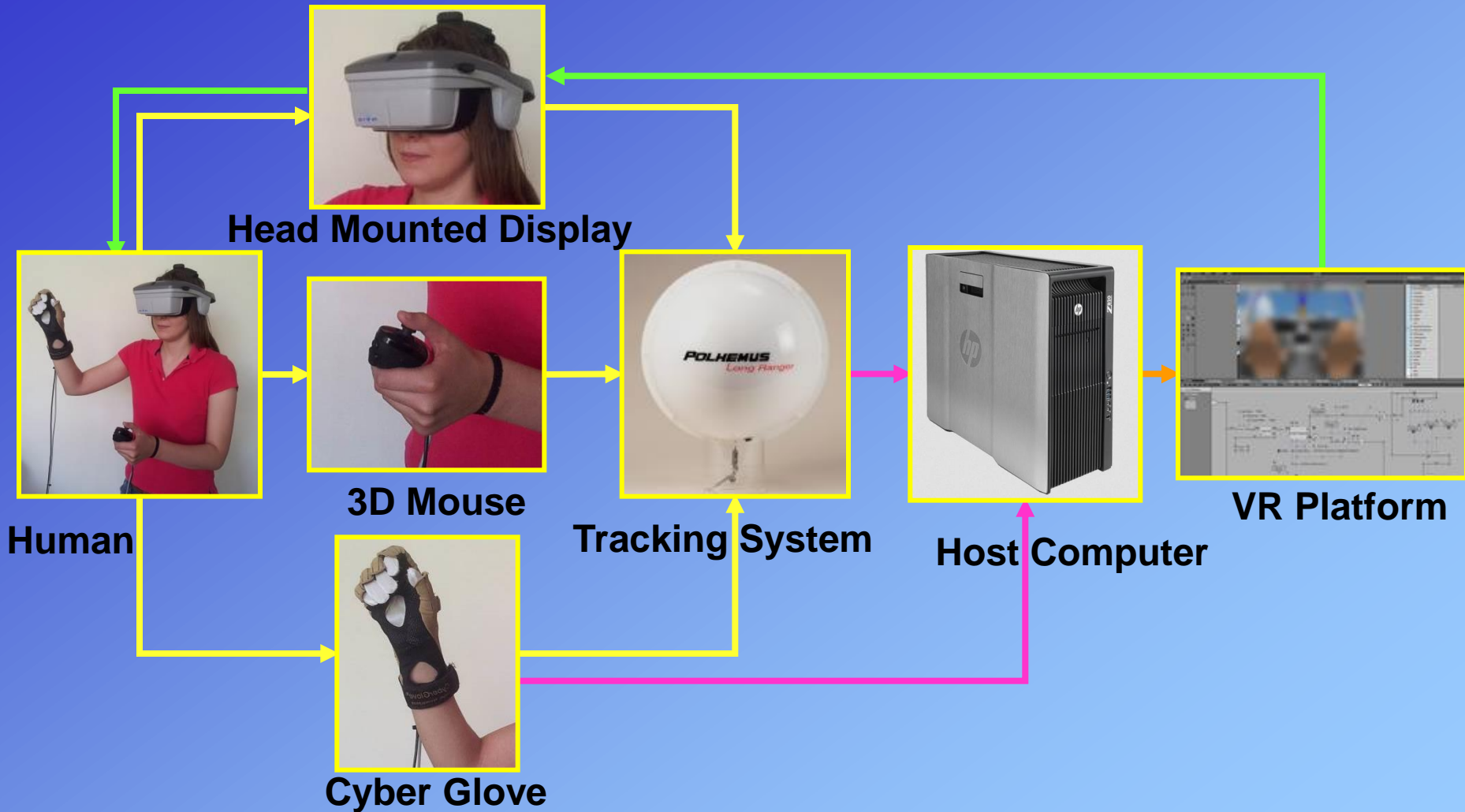

INTERACTION

VR
IMMERSION

VISUALISATION

NAVIGATION

Virtual Reality *is about creating substitutes of real-world objects, events or environments that are acceptable to humans as real or true.*

ROBOTS, AUTOMATION AND VIRTUAL REALITY IN MANUFACTURING

VR System: Basic Components

Head Mounted Display

Human

3D Mouse

Tracking System

Host Computer
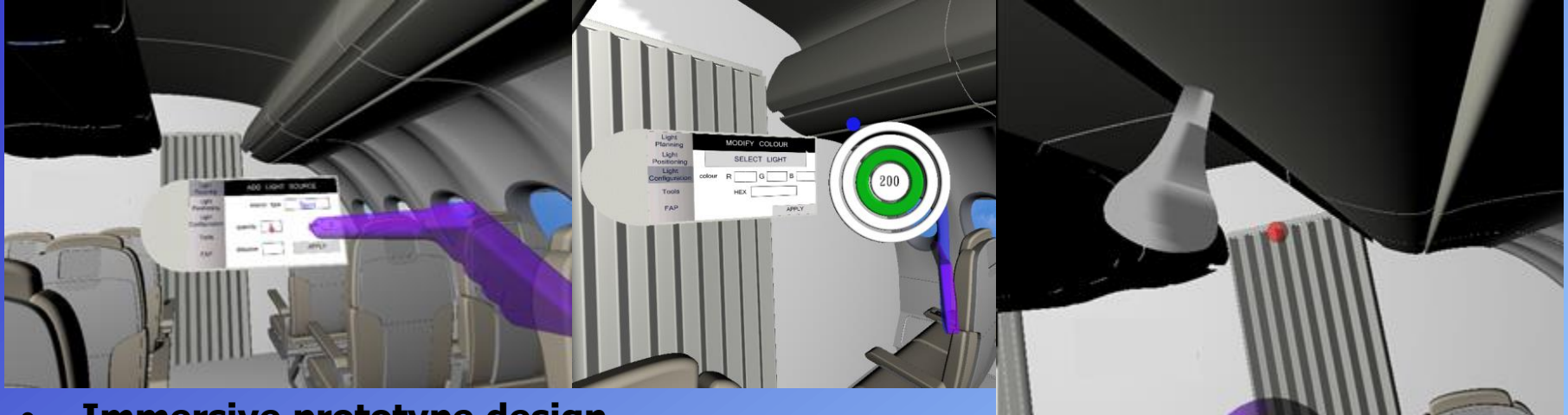
VR Platform

Cyber Glove

VR technology is the use of computers and other special hardware and software to generate a digital simulation of an alternate world or environment, which is believed as real or true by the humans.

Immersive Human-based Assembly Process Analysis
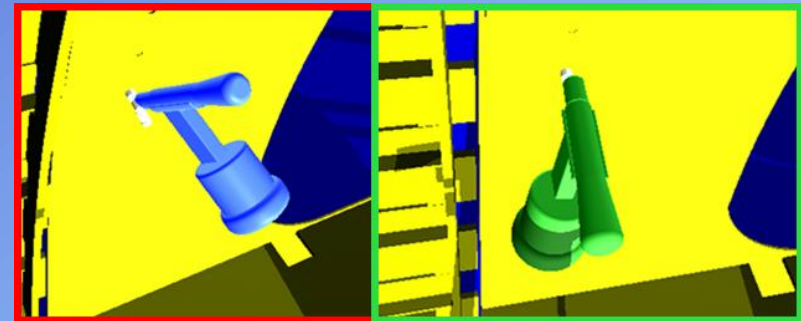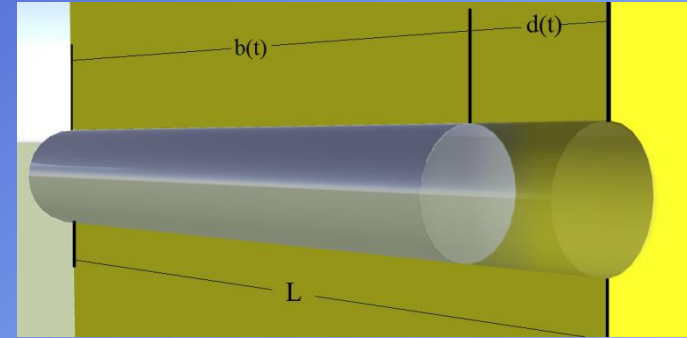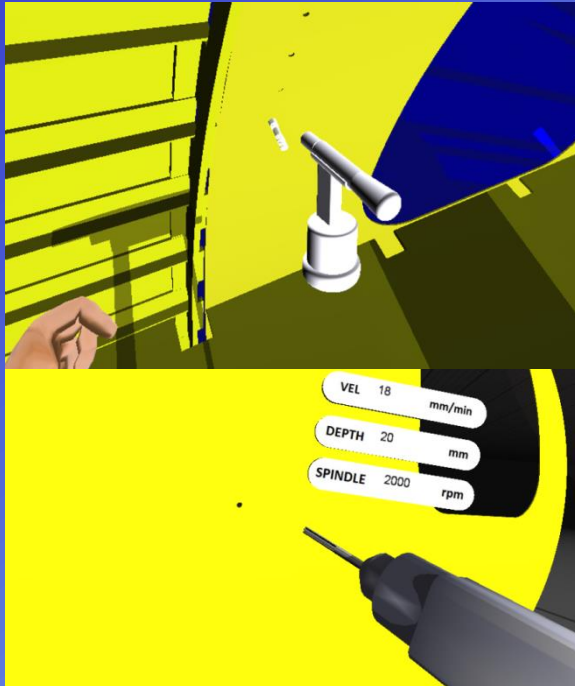
- Assembly of aircraft fuselage sections with rivets
- Human performs tasks of hole-drilling and riveting
- Simulation based on modeling of drilling process
- User controls process parameters (e.g. spindle speed, insertion velocity)
- Hole geometry is modified according to depth parameter of drilling model
- Collaborative task simulation between 2 users/operators for riveting process
- Simulation control on correct position and orientation of tools

REF: L. Rentzos, G. Pintzos, K. Alexopoulos, D. Mavrikios, G. Chryssolouris, "An Analysis of Human-Based Assembly Process for Immersive and Interactive Simulation", (DET 2011), ISBN 978-960-88104-2-6, 7th International Conference on Digital Enterprise Technology, Athens, Greece, pp. 558-567 (2011)

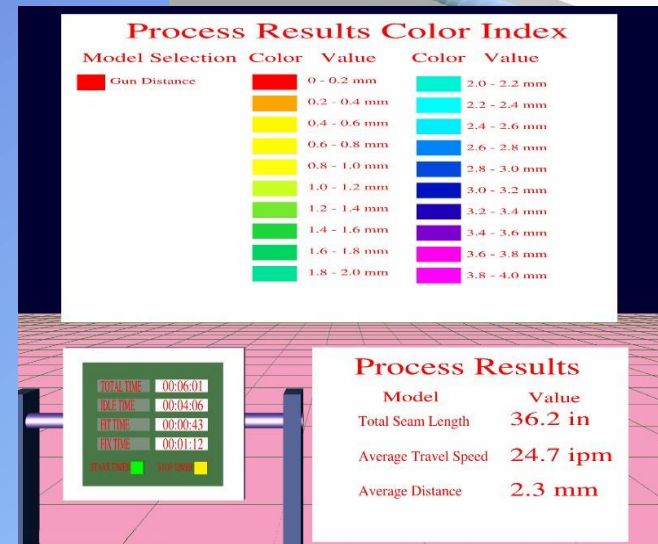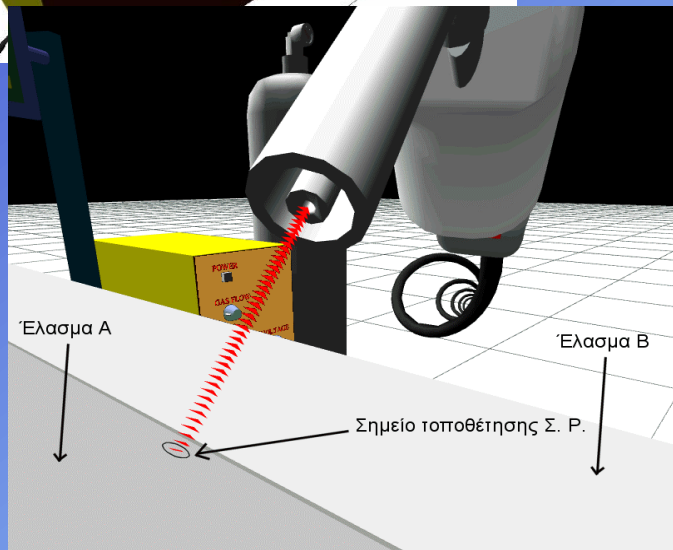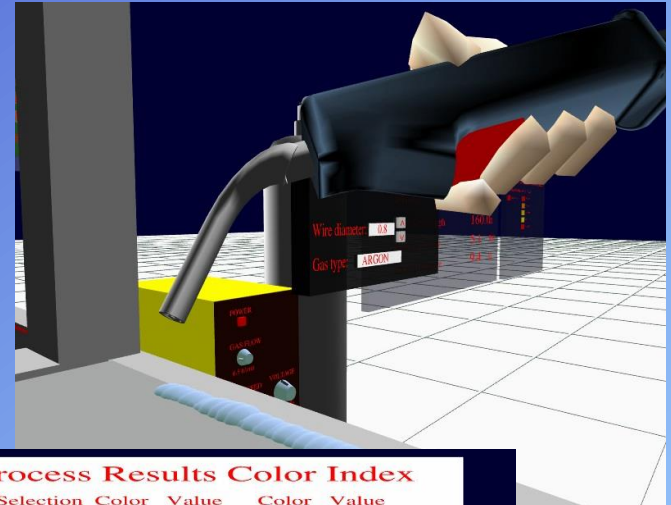## Aircraft Cabin Lighting Design and Simulation

- **Immersive prototype design**
- **Advanced interaction techniques for easy and intuitive manipulation of objects**
- **Techniques for object placement and orientation/distance control**
- **Design and evaluation of lighting:**
  - **Access and control to lighting parameters (e.g. luminous intensity and color)**
  - **Use different types of light sources (spot, point and infinite).**
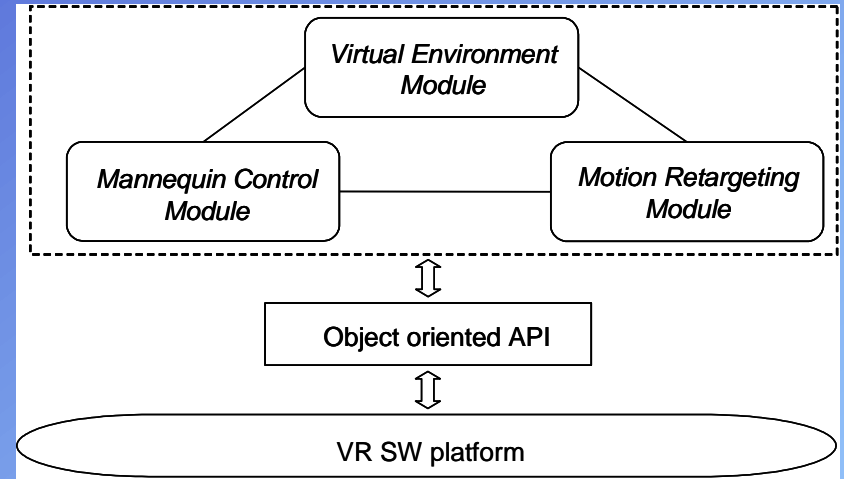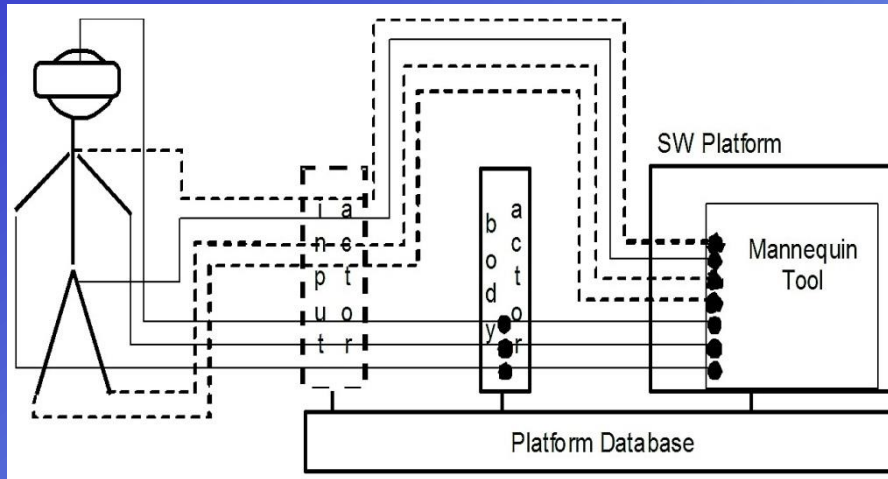 - **Simulate different lighting scenarios**

Immersive & Interactive Welding Simulation

REF: Mavrikios D., V. Karabatsou, D. Fragos and G. Chryssolouris, "A Prototype Virtual Reality demonstrator for immersive and interactive simulation of welding processes", International Journal of Computer Integrated Manufacturing, (Vol.19, No.3, 2006), pp.294-300.

Human-Centered Process Design Techniques

Method validation through industrial use cases

REF: Mavrikios D., V. Karabatsou, K. Alexopoulos and G. Chryssolouris, "Advanced human-centered design techniques in process design & verification: a Virtual Reality based paradigm", Proceedings (edited CD-ROM) of the 2nd VIDA International Conference "New Trends in Collaborative Product Design", Poznan-Poland, (November 2005).
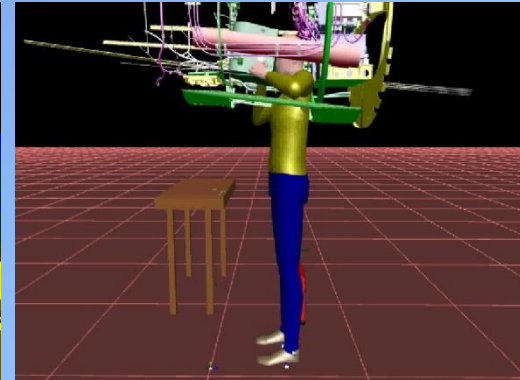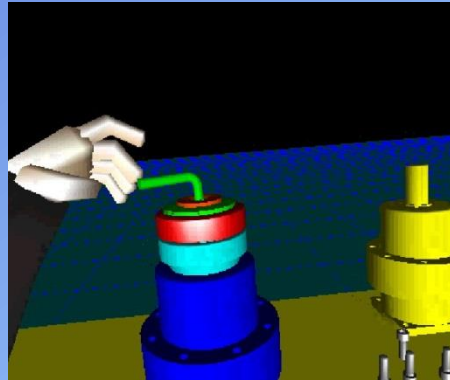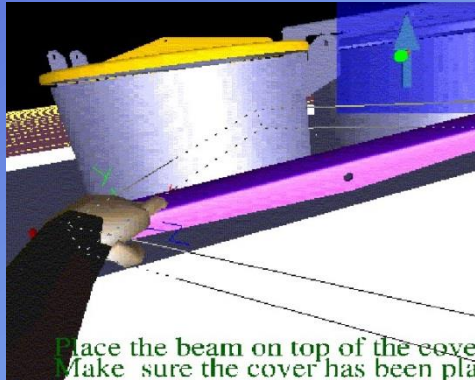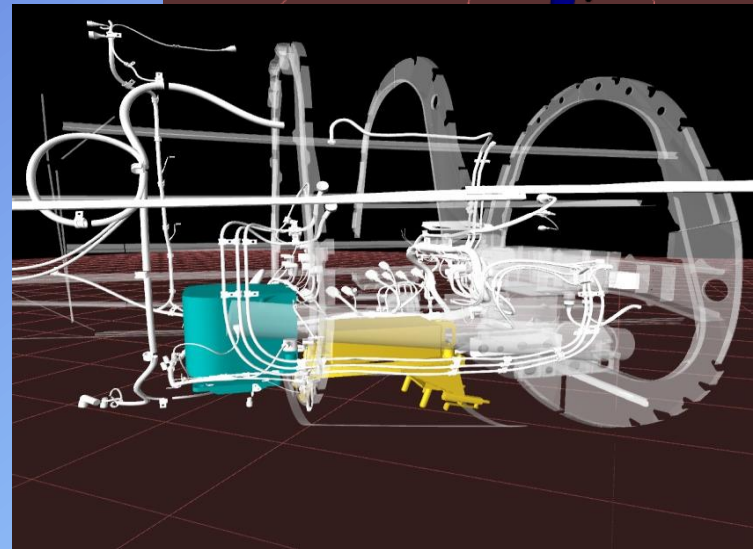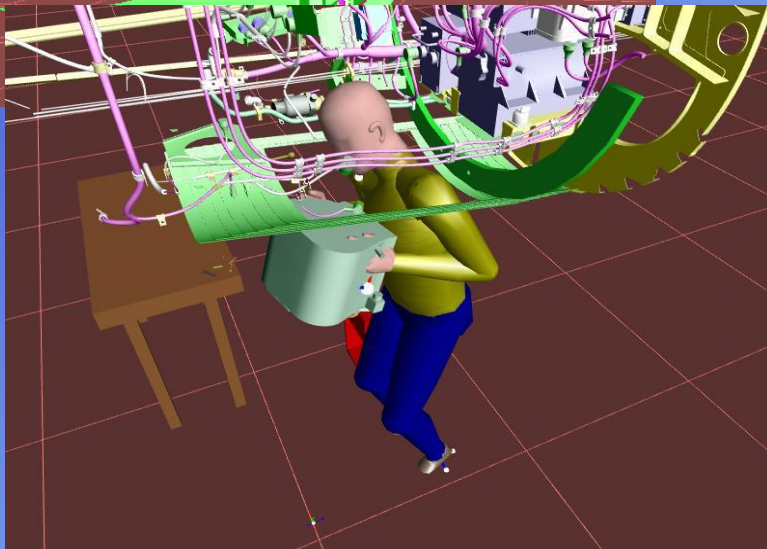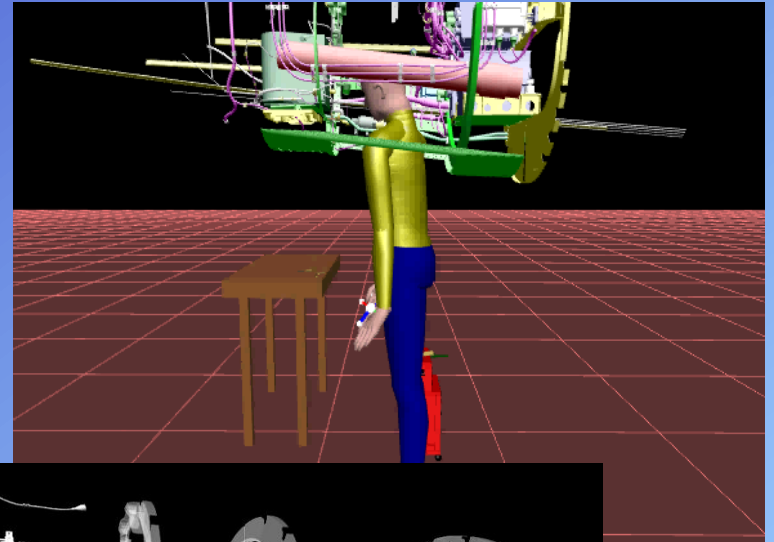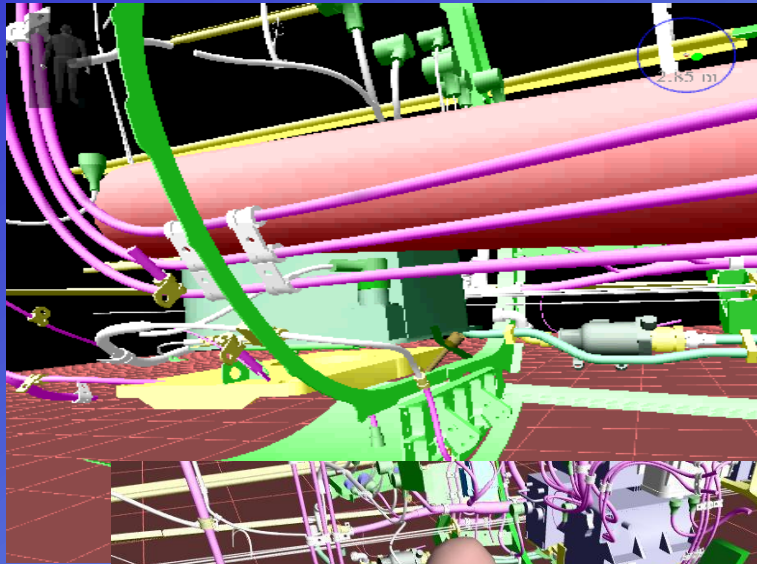
Virtual Assembly
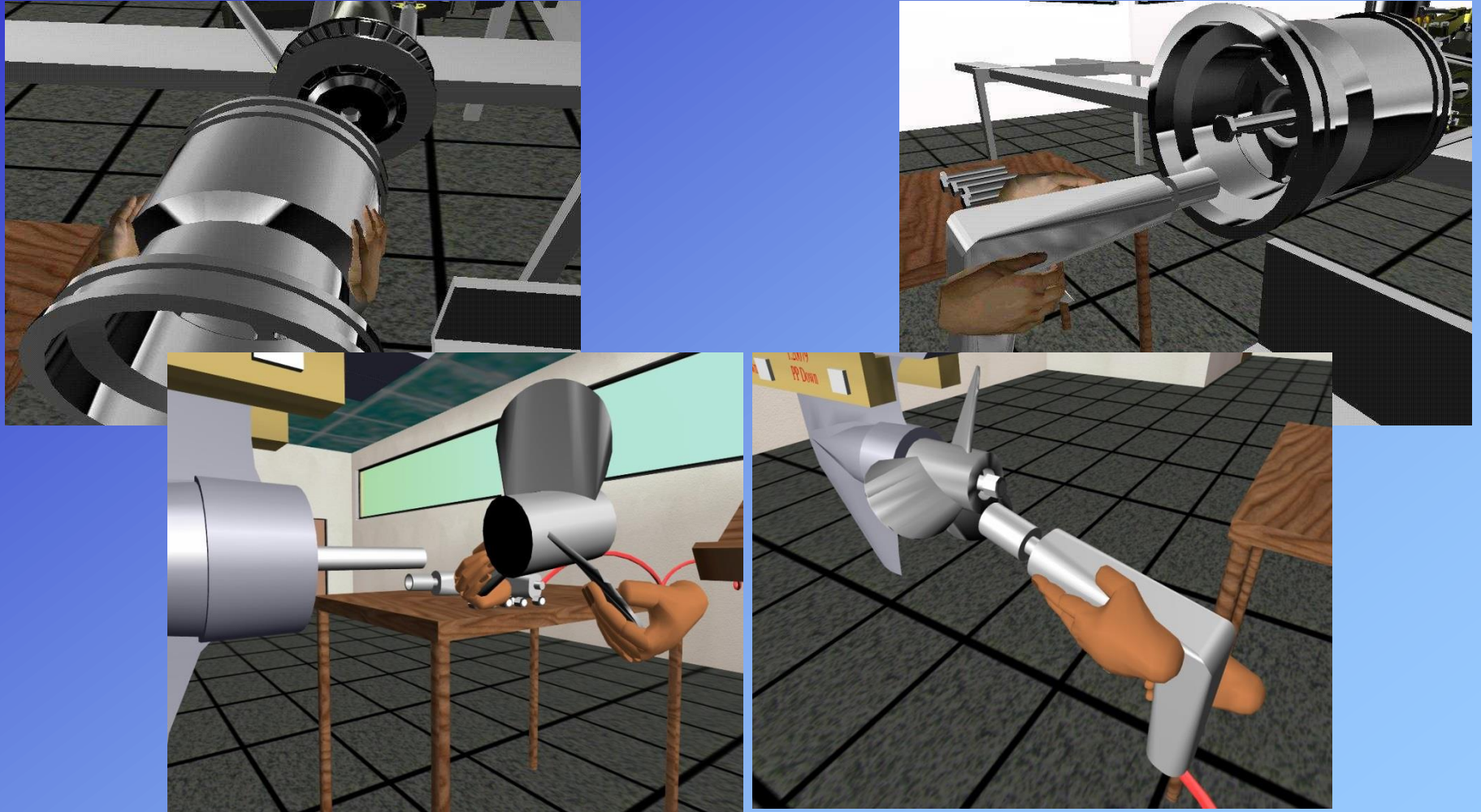
REF: Chryssolouris, G., D. Mavrikios, D. Fragos and V. Karabatsou, "Verification of human factors in manufacturing process design. A virtual experimentation approach", In: Methods and Tools for Co-operative and Integrated Design (ISBN 1-4020-1889-4), Tichkiewitch S. and Brissaud D. (eds), Kluwer Academic Publishers, (2004), pp. 463-474.

Virtual Maintenance

REF: Chryssolouris, G., D. Mavrikios, D. Fragos, V. Karabatsou and K. Alexopoulos, "A hybrid approach to the verification and analysis of assembly and maintenance processes using Virtual Reality and Digital Mannequin technologies", In Virtual Reality and Augmented Reality Applications in Manufacturing (ISBN 1-85233-796-6), Nee A.Y.C. and Ong S.K. (eds), Springer-Verlag, London (2004).
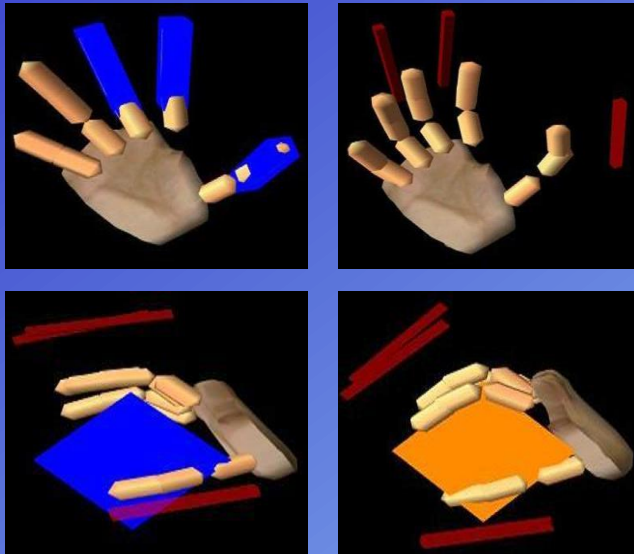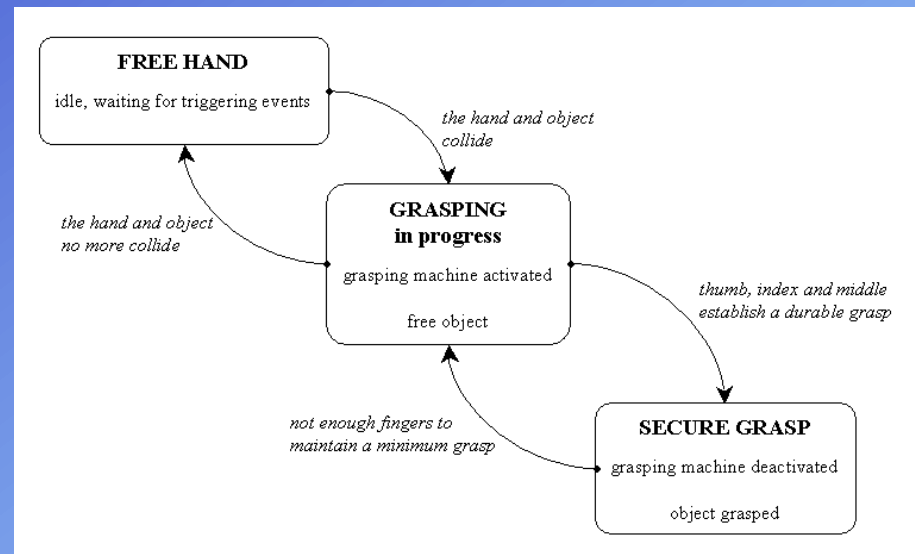
Virtual Reality & Human Simulation in Manufacturing
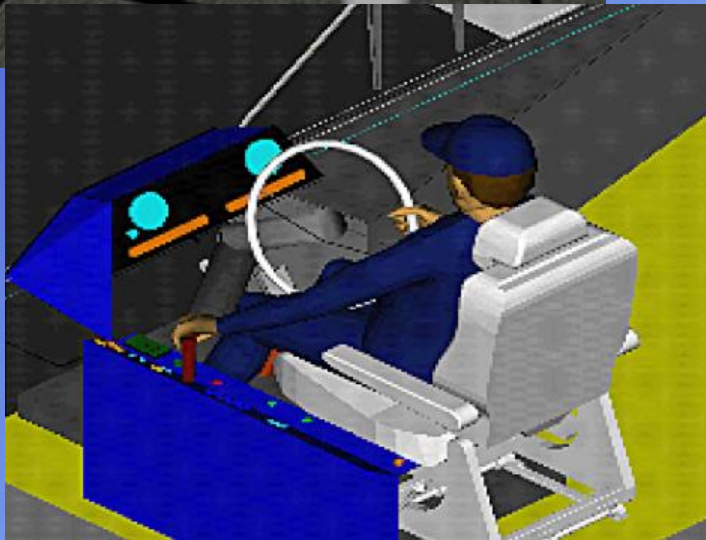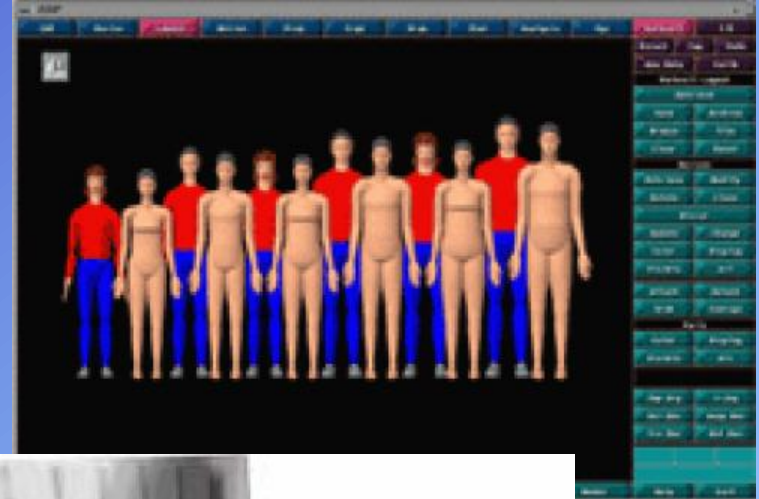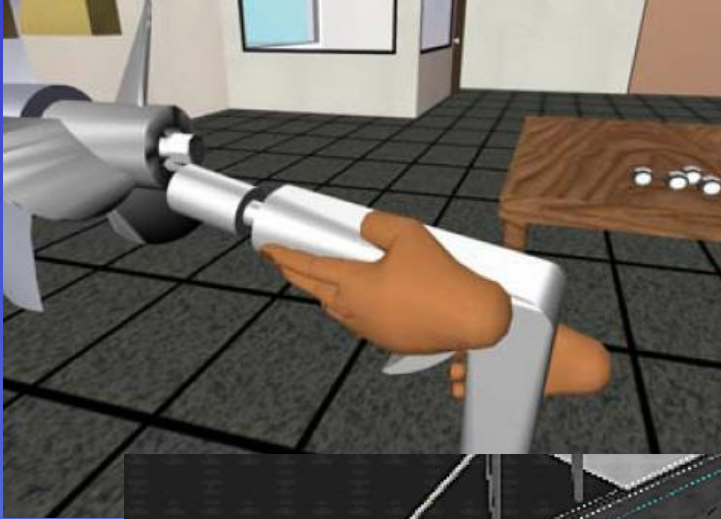
REF: Chryssolouris, G., V. Karabatsou and G. Kapetanaki, "Virtual Reality and Human Simulation for Manufacturing", CIRP Journal of Manufacturing Systems, (Vol. 32, No.6, 2003).
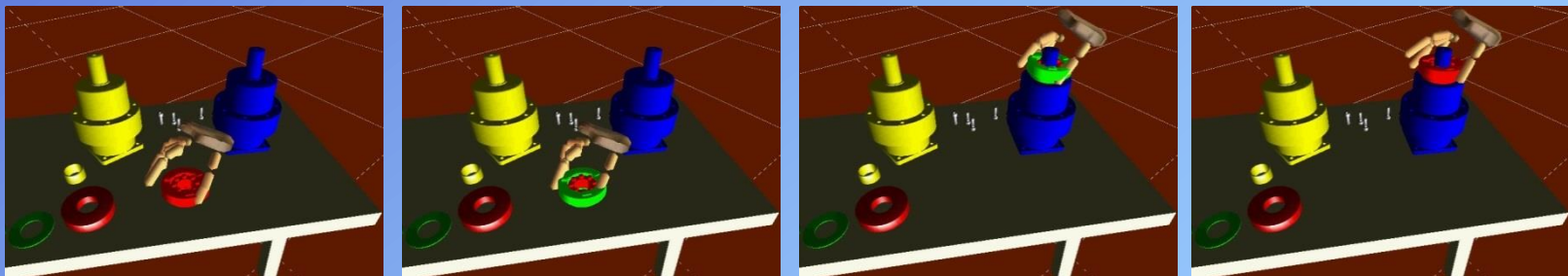
Development of Advanced Grasping Technique

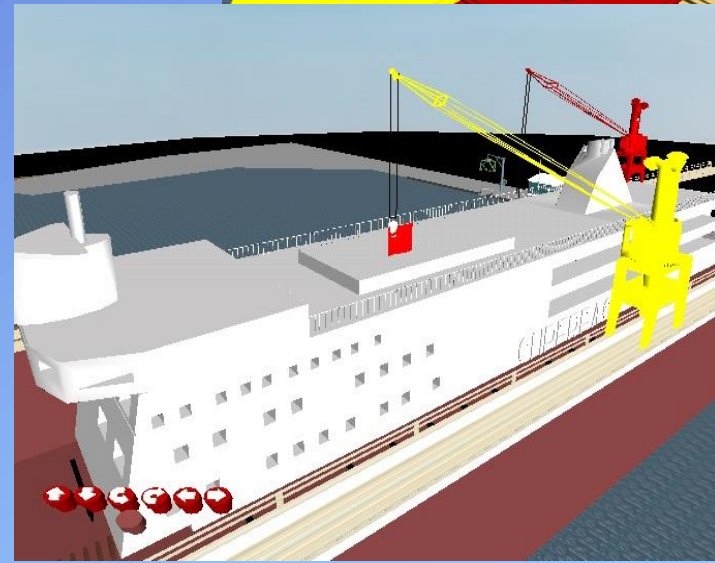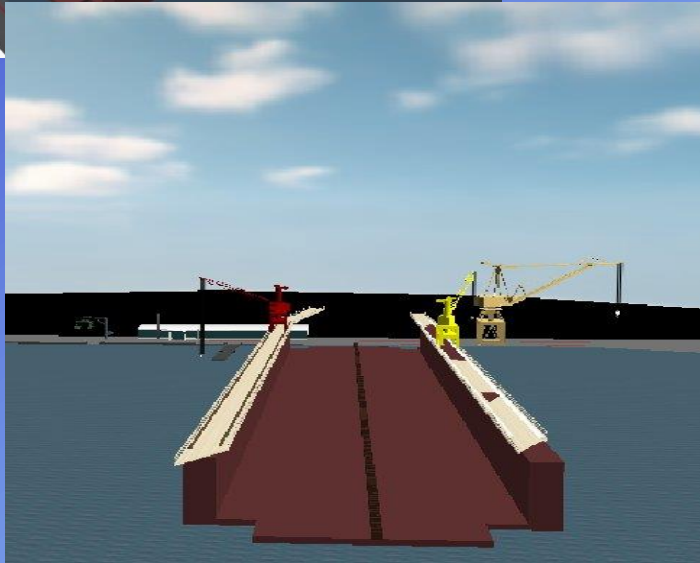**Support mechanisms**
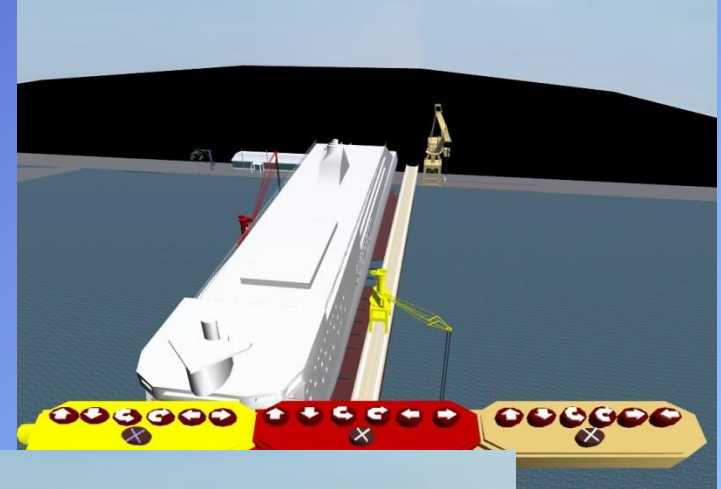
Grasping algorithm – State diagram

Virtual assembly task execution using the developed grasping technique

REF: Pappas, M., D. Fragos, K. Alexopoulos and V. Karabatsou, "Development of a three-finger grasping technique on a VR glove", Proceedings of the 2nd Virtual Concept Conference, Biarritz-France, (November 2003), pp. 279-283.
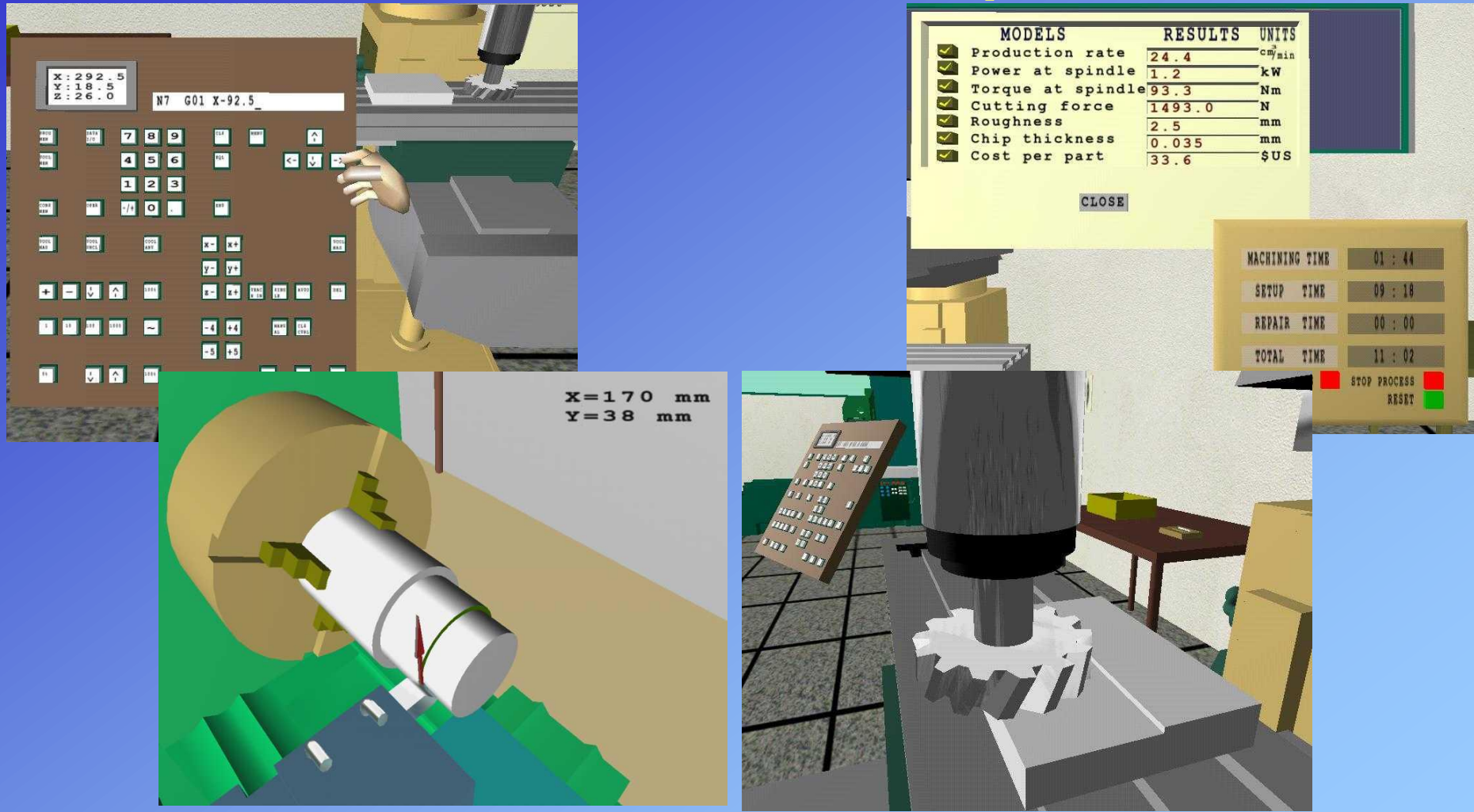
Virtual Shipbuilding
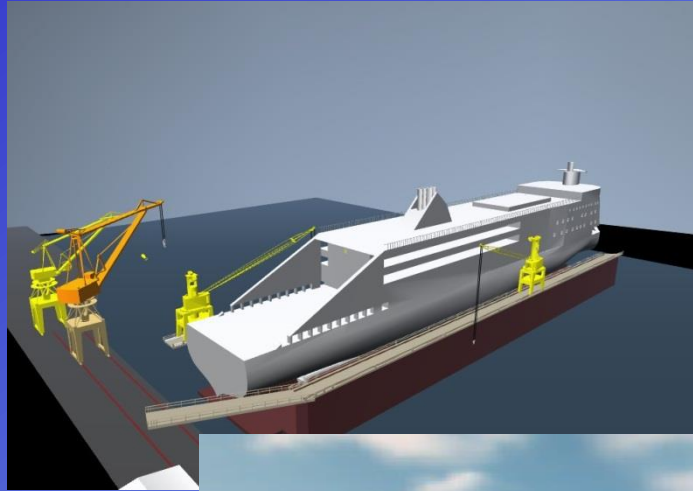
REF: Chryssolouris, G., V. Karabatsou, K. Alexopoulos, D. Fragos and P. Stavropoulos, "Virtual Reality Applications in Shipbuilding: A Ship Docking Case Study", Proceedings of the 8th International Marine Design Conference, Athens, Greece, (May 2003), pp. 543-549.

Virtual Machine Shop

REF: Chryssolouris, G., D. Mavrikios, D. Fragos, V. Karabatsou and K. Pistiolis, "A Novel Virtual Experimentation Approach to Planning and Training for Manufacturing Processes-The Virtual Machine Shop", International Journal of Computer Integrated Manufacturing, (Vol.15, No.3, 2002), pp. 214-221.

Verification of Human-Related Factors in Assembly